Background pattern

Description automatically generated with low confidence

**Year 10 – Teacher Booklet B (Triple)**

Key Stage 4 Science:

**Atomic Structure (PHY)**

Graphical user interface, text, application

Description automatically generated

Diagram, schematic

Description automatically generated

Shape

Description automatically generated with medium confidenceShape

Description automatically generated with medium confidenceShape

Description automatically generated with medium confidenceShape

Description automatically generated with medium confidence



Icon

Description automatically generated with low confidenceIcon

Description automatically generatedIcon

Description automatically generatedLogo

Description automatically generatedA picture containing icon

Description automatically generatedIcon

Description automatically generated with low confidenceIcon

Description automatically generated with medium confidenceIcon

Description automatically generated

**This booklet is for use in your Science lessons. Please look after it in the same way you would your exercise book and ensure that your presentation is always PROUD.**

**Ensure that your booklet is returned to your class book box at the end of the lesson.**

**Lesson Breakdown**

Lesson 1: 4.4.1.1 / 4.4.1.2 The structure of an atom / mass number & atomic number

Lesson 2: 4.4.1.2 Isotopes

Lesson 3: 4.4.1.3 The development of the model of the atom

Lesson 4: 4.4.1.3 The scattering experiment

Lesson 5: 4.4.2.1 Radioactive decay

Lesson 6: 4.4.2.1 Uses of radiation & **4.4.3.3 Uses of nuclear radiation**

Lesson 7: 4.4.2.2 Nuclear equations

Lesson 8: 4.4.2.3 Half-lives and the random nature of radioactive decay & **4.4.3.2 different half-lives of radioactive isotopes**

Lesson 9 (HT only): 4.4.2.3 New decline expressed as a ratio

Lesson 10: 4.4.2.4 Radioactive contamination

**Lesson 11: 4.4.3.1 Background radiation**

**Lesson 12: 4.4.4.1 Nuclear fission**

**Lesson 13: 4.4.4.2 Nuclear fusion**

**Keystone words**

1. Atomic

2. Radioactive

3. Decay

4. Nuclear

5. Contamination

6. Irradiation

**Lesson 7: Teacher notes**

**AQA content**

Graphical user interface, text, application, email

Description automatically generated

**Chunking**

1. Nuclear equations
2. Alpha decay
3. Beta decay

**Key direct and explicit teacher explanations:**

1. Nuclear reactions can change the number of each type of particle in the nucleus.

In alpha decay, which emits alpha particles composed of 2 protons and 2 neutrons, the mass of the nucleus decreases (because protons and neutrons have a mass of 1). The charge of the nucleus also changes because protons are positively charged.

Alpha particles are fast moving electrons that are emitted from the nucleus (not the shells / energy levels). This electron is made when a neutron divides into a proton and a neutron. Protons and neutrons have the same mass so the mass of the nucleus does not change. However, its charge does change.

The emission of gamma rays does not change the mass or charge of the nucleus because gamma rays do not have mass or charge.

1. Alpha particles are composed of two protons and two neutrons. The mass of the alpha particle is 4; when an alpha particle is emitted from the nucleus, its mass decreases by 4 (the mass number will decrease by 4). The loss of two protons also reduces the atomic number by 2.

**Model balancing of equations).**

1. Beta particles are composed of an electron. Electrons have a minute mass; the atomic mass does not change when alpha particles are emitted.

The atomic number increases by 1. This is because the electron that is emitted is made when a neutron decays into a proton and an electron. The atomic number tells us the number of protons in the nucleus; the atomic number must increase by 1 when a beta particle is made.

**Model balancing equations.**

**Teacher notes (e.g. key questions, examples, non-examples, explanations)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lesson 7: Nuclear equations**

**Objective: By the end of this lesson, you will be able to represent nuclear reactions using nuclear equations.**

**Skills Drill / Retrieval**

|  |  |  |
| --- | --- | --- |
| Answer | | PA / SA |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

**Connect**

**Table

Description automatically generated**

Table

Description automatically generated

1. **Blocked practice – Alpha decay**

Each of these elements is undergoing alpha decay. An alpha particle is made of 2 neutrons and 2 protons. He often show this as He (because helium also contains 2 protons and 2 neutrons).

Fill in the gaps for atomic mass and proton number for each of the elements marked X.

Text, letter

Description automatically generated

6 and 3

24 and 12

201 and 71

42 and 20

145 and 56

18 and 86

204 and 90

204 and 82

181 and 77

181 and 73

1. **Blocked practice – Beta decay**

These elements are going through beta decay. A beta particle is a high energy electron. This has a mass of -1.

Fil in the gaps for atomic mass and atomic number for each element marked as X.

A picture containing diagram

Description automatically generated

Complete the nuclear equations for the decays below. The first two have been done for you as an example.

1. Americium- 241 decays by alpha emission.
2. Carbon – 14 decays by beta emission.
3. Bismuth – 211 decays by alpha emission
4. Polonium – 204 decays by alpha emission
5. Radon – 224 decays by alpha emission
6. Uranium – 235 decays by alpha emission
7. Neptunium – 237 decays by alpha emission
8. Strontium – 90 decays by beta emission
9. Phosphorus – 32 decays by beta emission
10. Nickel – 63 decays by beta emission
11. Lead – 209 decays by beta emission
12. Hydrogen – 3 decays by beta emission

Text, letter

Description automatically generated

Table

Description automatically generated

Table

Description automatically generated

**Radioactive Decay**

**1.** Atoms of uranium-238 decay to produce another radioactive atom called thorium-234. Thorium-234 can then go on to decay by emitting beta radiation.  
(i) What does beta radiation consist of?................................................................................**(1)**

(ii) Thorium-234 decays to form protactinium-234. What differences are there between the nucleus of a protactinium-234 atom and the nucleus of a thorium-234 atom?  
............................................................................................................................................

..........................................................................................................................................**(2)**

**2.** (technetium) is produced by the radioactive decay of (molybdenum). What type of decay is this and what change occurs in the nucleus of a molybdenum atom when this happens?  
......................................................................................................................................................

.....................................................................................................................................................

...................................................................................................................................................**(2)**

3. Potassium-40 decays to give argon-40.

(i) What is the atomic number of potassium?.................................................................**(1)**

(ii) What is the atomic number of argon?........................................................................**(1)**

(iii) What must happen to one of the protons?................................................................**(1)**

(iv) Write an equation to show this decay.

.........................................................................................................................................**(2)**

4. The isotope protactinium-234 emits beta radiation.

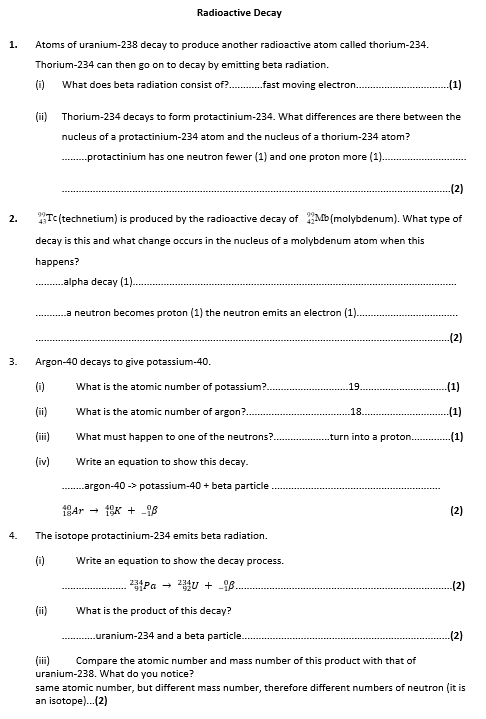
(i) Write an equation to show the decay process.

.........................................................................................................................................**(2)**

(ii) What is the product of this decay?

.........................................................................................................................................**(2)**

**Lesson 8: Teacher notes**



**AQA content**

Radioactive decay is random.

The half-life of a radioactive isotope is the time it takes for the number of nuclei of the isotope in a sample to halve, or the time it takes for the count rate (or activity) from a sample containing the isotope to fall to half its initial level.

**Students should be able to** explain the concept of half-life and how it is related to the random nature of radioactive decay.

**Students should be able to** determine the half-life of a radioactive isotope from given information.

**Triple only:** Radioactive isotopes have a very wide range of half-life values.

**Students should be able to explain why the hazards associated with radioactive material differ according to the half-life involved.**

**Chunking**

* What is a half-life?
* Determining half-life from graphs
* Half-life from tabulated data
* Related calculations

**Key direct and explicit teacher explanations:**

**Teacher notes (e.g. key questions, examples, non-examples, explanations)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lesson 8: Half-lives**

**Objective: By the end of this lesson, you will be able to determine the half-life of a radioactive substance using given information.**

**Skills Drill / Retrieval**

|  |  |  |
| --- | --- | --- |
| Answer | | PA / SA |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

**Connect**

We can use probability theory to predict the likelihood of something happening. For example, an unbiased coin has 2 sides. If we spin the coin the probability of it landing on heads is 50% or 0.5. The probability of it landing on tails is 50% or 0.5.

If we spin the coin twice, we can calculate the probability of it landing on heads both times:

0.5 x 0.5 = 0.25 (or 25%)

Radioactivity also follows probability theory. Scientists calculate probabilities of nuclei decaying in a certain amount of time.

If there is a 50% probability of a radioactive nucleus decaying in 3 hours:

1. How many would decay in 6 hours if we start with 10,000 nuclei?

**Answer:** (Probability of decay in 3 hours + Probability of decay in 6 hours) x 10,000

(0.5 + 0.25) x 1000 = 7,500 nuclei decay

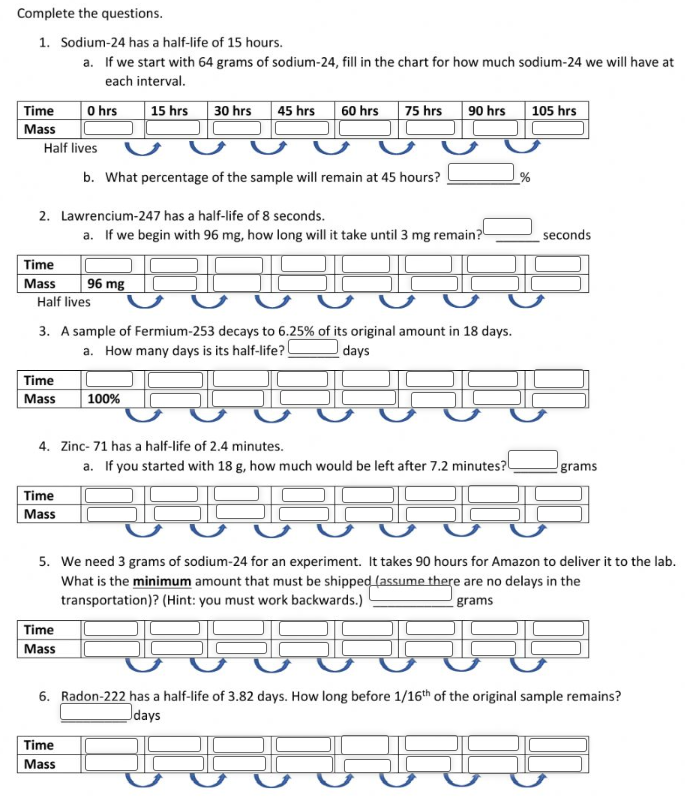
b. How many nuclei would have decayed after 3 half-lives?

(o.5 + 0.25 + 0.125) x 10,000 = 8750

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ c. How many nuclei would not have decayed?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

10,000 – 8750 = 1,250



15.28 days

192g

2.25g

4.5 days

40s

12.5%

![Chart

Description automatically generated](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDmRXhpZgAATU0AKgAAAAgABAE7AAIAAAAJAAAISodpAAQAAAABAAAIVJydAAEAAAASAAAQzOocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAEZlcm5hbmRhAAAABZADAAIAAAAUAAAQopAEAAIAAAAUAAAQtpKRAAIAAAADMzgAAJKSAAIAAAADMzgAAOocAAcAAAgMAAAIlgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAADIwMTk6MDI6MTIgMTA6MTg6MTEAMjAxOTowMjoxMiAxMDoxODoxMQAAAEYAZQByAG4AYQBuAGQAYQAAAP/hCxtodHRwOi8vbnMuYWRvYmUuY29tL3hhcC8xLjAvADw/eHBhY2tldCBiZWdpbj0n77u/JyBpZD0nVzVNME1wQ2VoaUh6cmVTek5UY3prYzlkJz8+DQo8eDp4bXBtZXRhIHhtbG5zOng9ImFkb2JlOm5zOm1ldGEvIj48cmRmOlJERiB4bWxuczpyZGY9Imh0dHA6Ly93d3cudzMub3JnLzE5OTkvMDIvMjItcmRmLXN5bnRheC1ucyMiPjxyZGY6RGVzY3JpcHRpb24gcmRmOmFib3V0PSJ1dWlkOmZhZjViZGQ1LWJhM2QtMTFkYS1hZDMxLWQzM2Q3NTE4MmYxYiIgeG1sbnM6ZGM9Imh0dHA6Ly9wdXJsLm9yZy9kYy9lbGVtZW50cy8xLjEvIi8+PHJkZjpEZXNjcmlwdGlvbiByZGY6YWJvdXQ9InV1aWQ6ZmFmNWJkZDUtYmEzZC0xMWRhLWFkMzEtZDMzZDc1MTgyZjFiIiB4bWxuczp4bXA9Imh0dHA6Ly9ucy5hZG9iZS5jb20veGFwLzEuMC8iPjx4bXA6Q3JlYXRlRGF0ZT4yMDE5LTAyLTEyVDEwOjE4OjExLjM4MjwveG1wOkNyZWF0ZURhdGU+PC9yZGY6RGVzY3JpcHRpb24+PHJkZjpEZXNjcmlwdGlvbiByZGY6YWJvdXQ9InV1aWQ6ZmFmNWJkZDUtYmEzZC0xMWRhLWFkMzEtZDMzZDc1MTgyZjFiIiB4bWxuczpkYz0iaHR0cDovL3B1cmwub3JnL2RjL2VsZW1lbnRzLzEuMS8iPjxkYzpjcmVhdG9yPjxyZGY6U2VxIHhtbG5zOnJkZj0iaHR0cDovL3d3dy53My5vcmcvMTk5OS8wMi8yMi1yZGYtc3ludGF4LW5zIyI+PHJkZjpsaT5GZXJuYW5kYTwvcmRmOmxpPjwvcmRmOlNlcT4NCgkJCTwvZGM6Y3JlYXRvcj48L3JkZjpEZXNjcmlwdGlvbj48L3JkZjpSREY+PC94OnhtcG1ldGE+DQogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgIDw/eHBhY2tldCBlbmQ9J3cnPz7/2wBDAAcFBQYFBAcGBQYIBwcIChELCgkJChUPEAwRGBUaGRgVGBcbHichGx0lHRcYIi4iJSgpKywrGiAvMy8qMicqKyr/2wBDAQcICAoJChQLCxQqHBgcKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKir/wAARCAGtAjsDASIAAhEBAxEB/8QAHwAAAQUBAQEBAQEAAAAAAAAAAAECAwQFBgcICQoL/8QAtRAAAgEDAwIEAwUFBAQAAAF9AQIDAAQRBRIhMUEGE1FhByJxFDKBkaEII0KxwRVS0fAkM2JyggkKFhcYGRolJicoKSo0NTY3ODk6Q0RFRkdISUpTVFVWV1hZWmNkZWZnaGlqc3R1dnd4eXqDhIWGh4iJipKTlJWWl5iZmqKjpKWmp6ipqrKztLW2t7i5usLDxMXGx8jJytLT1NXW19jZ2uHi4+Tl5ufo6erx8vP09fb3+Pn6/8QAHwEAAwEBAQEBAQEBAQAAAAAAAAECAwQFBgcICQoL/8QAtREAAgECBAQDBAcFBAQAAQJ3AAECAxEEBSExBhJBUQdhcRMiMoEIFEKRobHBCSMzUvAVYnLRChYkNOEl8RcYGRomJygpKjU2Nzg5OkNERUZHSElKU1RVVldYWVpjZGVmZ2hpanN0dXZ3eHl6goOEhYaHiImKkpOUlZaXmJmaoqOkpaanqKmqsrO0tba3uLm6wsPExcbHyMnK0tPU1dbX2Nna4uPk5ebn6Onq8vP09fb3+Pn6/9oADAMBAAIRAxEAPwD6RooooAKKKKACiiigAooooAKKKKAK0mo2UN7HZzXlvHdSjMcDSqHceoXOTSzajZW93Fa3F5bxXE/+qheVVeT/AHVJyfwrzbxl4Y0XVb3UtG0KxjvPE+qXEVxcag+Hk0pRt2ymQ8pgJ8iA5J6DG4ih4i03T9R0X4panrNvC2o6fIws7mRQZLZYrKKSExt1X52LDHUk0AesTajZW93Fa3F5bxXE/wDqoXlVXk/3VJyfwqxXi+pWNrq/hP4kav4itYf7XslzbzyIPNtfLsYZYth6r+8ZmGO5Nd14q8W6j4T8Cya+2lJe/ZbNZ50a48k7uMrjafWgDrqK5Hw142uPFfhmz13StHLWl2Pl3XShlbdtKkY4IYEVrvqWrouW0UYyB/x9r3OPSgDXorHbUtXTbnRR8xwP9LX/AApW1LV1Kg6KMscD/S19M+ntQBr0VjNqmrJKkbaKN0mdv+lr2/ClOpauJAn9ijJBI/0te2Pb3oA2KKx/7S1fzAn9ijcRn/j7X/ClGpauZCn9ijIAJ/0te+fb2oA16KyBqWrmQp/YoyACf9LXvn29qih1rU57i4gj0bMluwWQfal4JUMO3oRQBuUVkLqWrszAaKMqcH/S19M+nvSLqWruCV0UYBI/4+17HHpQBsUVjrqWrupK6KMZI/4+17HHpQmpau6Bl0UYIyP9LX/CgDYorFj1bVZbZJ00UGN0Dg/a16EZ9KcdT1ZYjIdFG0Lu/wCPten5UAbFFZD6lq8aFm0UYAyf9LX/AApH1LV0XLaKMZA/4+17nHpQBsUVh3OtanaCIzaNjzZFiXF0pyzcDtUjalq6soOijLHA/wBLX0z6e1AGxRWO2paurKDooyxwP9LX0z6e1KdS1cSBP7FG4gkf6WvbHt70Aa9FZB1LVxIE/sUZIJH+lr2x7e9NGqasZjF/Yo3hQxH2tehJHp7UAbNFZH9pauXK/wBijIAJ/wBLX/D2oGpauzMo0UZU4P8Apa/4UAa9FZA1HV2LAaKPlOD/AKWv+FC6lq7Zxoo4OD/pa/4UAa9FYltrGqXUPmw6MCu5k5u1HKsVPb1BqRdS1d1yuijH/X2v+FAGvRWQupau6Bl0UYIyP9LX/Ck/tPVvK8z+xRt27v8Aj7Xp+VAGxRWPLqmrQxNI+igKoyf9LX/ClbUtXUZOijqB/wAfa9zj0oA16KyG1LV1xnRRycD/AEtf8KDqOrqVB0UfMcD/AEtf8KANeisg6lq6sqnRRljgf6Wv+FRvrGqR3UVu2jDzJVZkH2teQuM9vcUAbdFZH9pauJAn9ijJBI/0te2Pb3oGpauXK/2KMgA/8fa/4e1AGvRWONS1cyFP7FG4AE/6WvfPt7Uo1LV2LAaKPlOD/pa/X0oA16Kxk1TVpHkVdFGY22t/pa9cA+noRTl1HV2GRoo6kf8AH2vb8KANeisdNS1d1yuijGSP+Ptexx6UJqWryIGXRRgjI/0tf8KANiisV9X1VLVrhtFHlqm8n7WvTGfSkj1jVJLRblNGBiZBID9rXpjPpQBt0VjvqWrohdtFGAMn/S1/wobUtXRctooxkD/j7XucelAGxRWQ2paui5bRRjIH/H2vc49KbJqurRtGr6KMyNtX/S164J9PY0AbNFY7alq6soOijLHA/wBLX0z6e1KdS1cSBP7FGSCR/pa9se3vQBr0VjnUtXEgT+xRkgkf6WvbHt70f2lq/mFP7FGQM/8AH2v+FAGxRWdp+pzXV7PaXdmbWaFFfHmhwQ2ccj/dNaNABRRRQAUUUUAFFFFABRRRQAUUUUAcjc/C/wAK3ep3moSWt8l1eyma4eHVruISOeM7UlA6ADgcAYq7qvgTw3resJqmqaYs90uzcTLIqS7DlPMQMFkwem4HFdDRQBz2q+BPDet6ymqappiz3S7Nx811SXYcr5iBgsmD03A4rI+M/wDyRnxL/wBeZ/8AQhXcVw/xn/5Iz4l/68z/AOhCgDH8CSN4d8Ua54Q8tFSR4dbsVLkAxTFRIo46LKD/AN916NctP5S5ij/1if8ALQ/3h/s15r8Q459Am8KeO02LHpEsdtqJXPNpNtUk+u19pA9zXpM5naFSDEQXTBGf7woAWdp90X7qP/Wf89D6H/ZomafzYP3cf3z/AMtD/dP+zSTfaN0X+r/1nv6Gib7R5kH+r++fX+6aAI52n/tC0/dx5+f/AJaH0+lSs0/2yP8AdR/6tv8AlofVf9mop/P/ALQtf9Xn58dfSpG+0fbI/wDV58tvX1WgALT/AGxf3Uf+rP8Ay0PqP9mlVp/tkn7qP/Vr/wAtD6t/s0h+0fbF/wBXnyz6+ooX7R9sk/1f+rX19WoAVWn+2Sfuo/8AVr/y0Pq3+zWfpjTf25rOI4yfOiz854/dL7VfX7R9rk/1f3F9fVqz9M8/+3NZx5efOiz1/wCeS0AaMLT+bP8Auo/vj/lof7q/7NFu0/lN+7j/ANY//LQ/3j/s0kP2jzZ/9X/rB6/3Vot/tHln/V/ff1/vGgAt2n8pv3Uf+sf/AJaH+8f9mi2af7LHiOP7o/5aH/4mi3+0eUf9X99/X+8aLb7R9ljx5f3fegCCxaf+w7fEcePsy/8ALQ/3R7VLK0/9nP8Au48eUf8AlofT/dqKx8/+w7bHl4+zL6/3RUsv2j+zn/1ePKPr6UAPumn+yyZij+7/AM9D/wDE0ly0/lDMUf8ArE/5aH+8P9mi5+0fZZM+X933ouPtHlDPl/6xPX+8KAKGvNN5dhujjH+nw4xITzu+laEzT+bB+6j/ANYf+Wh/ut/s1na75/l2G7y/+P8AhxjPXdWhN9o82D/V/wCsPr/dagAmafzYP3Uf+sP/AC0P91v9mlZp/tkf7qP/AFbf8tD6r/s0k32jzYP9X/rD6/3Wob7R9rj/ANX/AKtvX1WgBWaf7ZH+6j/1bf8ALQ+q/wCzUatP/asn7uPPkJ/y0P8Aeb2p7faPtkf+r/1bevqtRr9o/tWT/V58hPX+81AEytcfaX/dR/cX/lofU/7NJE0/nTfuo/vD/lofQf7NA+0faX/1f3F9fU0kX2jzpv8AV/eHr6CgB0bXHmS/uo/v/wDPQ/3R/s0kLT4k/dR/fP8Ay0P/AMTSx/aPMl/1f3/f+6KSH7R8/wDq/vn1oAp6G0/9mnbHGR9on6yEf8tn9quwNceSP3UfU/8ALQ+v+7VLRPP/ALNO3y8faJ+uf+ez1cg+0eSMeX1Pr60ALbtP9mjxFH9wf8tD6f7tR7p/7O/1cePK/wCeh9P92nwfaPs0ePL+4PX0pn+kf2d/yzx5Xv6UAF+0/wDZ8+Y48bD/AMtD6f7tSTNP5Y/dx/fX/lof7w/2aiv/ALR/Z8+fLx5Z9fSpJvtHlj/V/fX1/vCgAmaf5P3Uf3x/y0P/AMTSyNceZF+6j+//AM9D/dP+zSTfaPk/1f3x60sn2jzIv9X9/wB/7poASRp/Oh/dR/eP/LQ+h/2ap3TT/wDCQafmOPPlTYHmH/Y9qtyfaPOh/wBX94+voap3Xn/8JBp+fLz5U2Ov+xQBdZp/tkf7qP7jf8tD6r/s0qtcfaX/AHUf3F/5aH1P+zTW+0fa4/8AV52N6+q0q/aPtL/6v7i+vqaABWn+2Sfuo/8AVp/y0Pq3+zSxtceZL+6j+/8A89D/AHR/s01ftH2yT/V/6tfX1alj+0eZL/q/v+/90UARWjT/AGm9xHH/AK8Z/eH/AJ5p7VNC1xsP7qP77f8ALQ/3j/s1Daef9pvceX/rxnr/AM80qWH7RsP+r++3r/eNABbNP5RxFH/rH/5aH+8f9mi1af7LHiKP7v8Az0P/AMTSW/2jyjjy/wDWP6/3jRa/aPssePL+770AVrlp/wDhHZv3cePsrc+Yf7n0pLNp/wDhGoMRx4+yLz5h/ufSlufP/wCEem/1ePsrev8Acptn5/8AwjcGPLx9kX1/uUAXLlp/ssn7qP7v/PQ//E0XDT+UP3Uf+sT/AJaH+8P9mkuftH2WT/V/d96Lj7R5Q/1f+sT1/vCgBbhp/KH7qP76f8tD/eH+zUV40/n2eY4/9fx+8P8Acb2qS4+0eUP9X99PX+8KivPP8+zz5f8Ar/f+41AEszT+bB+7j++f+Wh/ut/s0rNP9sj/AHUf+rb/AJaH1X/ZpJvtHmwZ8v8A1h9f7rUN9o+1x/6v7jevqtACs0/2yP8AdR/6tv8AlofVf9mgNP8AbG/dR/cH/LQ+p/2aRvtH2yP/AFf+rb19VoH2j7Y3+r/1Y9fU0AUrMufFeoeYqqfs0PCnP8T+1bFY9lv/AOErv/M25+zQ/d+r1sUAFFFFABRRRQAUUUUAFFFFABRRRQAUVTu9XsLHUbGwu7qOK71B2S1hJ+aUqhdsD2UEk9OnqKz9T8aeHtH1P+z9S1OKC4GzeGVisW44XewG1M9txGaANyuH+M//ACRnxL/15n/0IVt6n408PaPqg0/U9Uit7n5NysGKx7zhd7AbUyem4jNYnxn/AOSM+Jf+vM/+hCgDX1fRv7f8Ey6ReyR/Z761W3fEZyAwAyPm6jOaxvhxqN9f/D+ztL+ZDqOkTf2XeqVJIlgcJknPOVCtnvurqITP/ZNr8sf3Yv4j6r7VwekyXHhf4v63oUwRbTxCI9XscsQvnKVS4QccscK/0oA9DmW43RfvY/8AWf8APM+h/wBqlmW48yD97H98/wDLM/3T/tUk5uN0Xyx/6z+8fQ+1LMbjzYPlj/1h/iP90+1AEU6z/wBoWn7yPPz/APLM+n+9UjLcfbI/3kf+rb/lmfVf9qo5zP8A2hafLHn5/wCI+n0qRjcfbI/lj/1bfxH1X2oACtx9sX97H/qz/wAsz6j/AGqFW4+2SfvY/wDVr/yzPq3+1QTP9sX5Y/8AVn+I+o9qFNx9sk+WP/Vr/EfVvagAVbj7XJ+9j+4v/LM+rf7VZ+mLP/bms4kjz50Wf3Z5/dL71oqbj7ZJ8sf+rX+I+re1Z+mGb+3NZwsefOiz8x/55L7UAX4VuPNn/eR/fH/LM/3V/wBqi3W48tv3sf33/wCWZ/vH/aohNx5s/wAsf3x/Ef7q+1Fubjy2+WP77/xH+8fagAt1uPKb97H/AKx/+WZ/vH/aotluPsseJY/uj/lmf/iqLc3HlN8sf+sf+I/3j7UWxuPsseFj+6P4j/hQBBYrP/YdtiSPH2Zf+WZ/uj/aqWVZ/wCzn/eR48o/8sz6f71RWJn/ALDt8LHj7Ov8R/uj2qWUz/2c/wAsePKP8R9PpQA66W4+yyZlj+7/AM8z/wDFUXK3HlDMsf8ArE/5Zn+8P9qi6Nx9lkysf3f7x/wouTceUMrH/rE/iP8AeHtQBQ15Z/LsN0kZ/wBPhxhCOd31q/Mtx5sH72P/AFh/5Zn+63+1VDXjP5dhuWP/AI/4cYY9d30rQmNx5sHyx/6w/wAR/ut7UAJMtx5sH7yP/WH/AJZn+63+1Qy3H2yP97H/AKtv+WZ9V/2qJjP5sHyx/wCsP8R/ut7UrG4+2R/LH/q2/iPqvtQAjLcfbI/3sf8Aq2/5Zn1X/aqNVuP7Vk/eR58hP+WZ/vN/tVKxuPtkfyx/6tv4j6r7VEpn/taT5Y8+Qn8R/vN7UATKtx9pf97H9xf+WZ9T/tUkS3HnTfvY/vD/AJZn0H+1Sqbj7S/yx/cX+I+p9qSI3HnTfLH94fxH0HtQAsa3HmS/vY/v/wDPM/3R/tUkK3GH/ex/fP8AyzP/AMVSxm48yX5Y/v8A94/3R7UkJuMSfLH98/xH/CgCnoaz/wBmnbJGB9on6xn/AJ6v71cgW48kfvY+p/5Zn1/3qp6GZ/7NO1Y8faJ+rH/nq/tVyA3Hkj5Y+p/iPr9KAFt1uPs8eJY/uD/lmfT/AHqj23H9nf6yPHlf88z6f71SW5uPs0fyx/cH8R9PpUebj+zvux/6r+8fT6UAJfrcf2fPmSP/AFZ/5Zn0/wB6pJluPLH72P76/wDLM/3h/tUy/M/9nz5WP/Vn+I+n0p8xuPLHyx/fX+I/3h7UAEy3HyfvY/vj/lmf/iqWRbjzIv3sf3/+eZ/un/apJjcfJ8sf3x/Ef8KWQ3HmRfLH9/8AvH+6fagBJFuPOh/ex/eP/LM+h/2qp3Sz/wDCQafmSPPlTYPln/Y96uSG486H5Y/vH+I+h9qp3Rn/AOEg0/Kx58qbHzH/AGPagC2y3H2yP97H9xv+WZ9V/wBqnKtx9pf97H9xf+WZ9T/tUjG4+2R/LH9xv4j6r7Uqm4+0v8sf3F/iPqfagBqrcfbJP3sf+rX/AJZn1b/ap0a3HmS/vY/v/wDPM/3R/tU1TcfbJPlj/wBWv8R9W9qdGbjzJflj+/8A3j/dHtQBDaLP9pvsSR/68Z/dn/nmn+1U0K3Gw/vY/vt/yzP94/7VQ2hn+03uFj/14z8x/wCeae1TQm42H5Y/vt/Ef7x9qAG2y3HlHEkf+sf/AJZn+8f9qi1W4+yx4lj+7/zzP/xVFsbjyjhY/wDWP/Ef7x9qLU3H2WPCx/d/vH/CgCtcrP8A8I9N+8jx9lbjyz/c+tNs1n/4RqDEkePsi8eWf7n1p1yZ/wDhHZsrHj7K38R/ufSm2Zn/AOEagwsePsi/xH+59KALdytx9lk/ex/d/wCeZ/8AiqLhbjyh+9j/ANYn/LM/3h/tUXJuPssnyx/d/vH/AAouDceUPlj/ANYn8R/vD2oALhbjyh+9j++n/LM/3h/tVFeLP59nmSP/AF/H7s/3G/2qmuDceUPlj++n8R/vD2qG8M/n2eVj/wBf/eP9xvagCWZbjzYP3sf3z/yzP91v9qhluPtcf72P/Vt/yzPqv+1RMbjzYPlj++f4j/db2pWNx9sj+WP/AFbfxH1X2oARluPtkf72P/Vt/wAsz6r/ALVAW4+2N+9j+4P+WZ9T/tUrG4+2R/LH/q2/iPqvtSA3H2xvlj+4P4j6n2oApWYceK7/AMxlY/ZoeVXH8T+5rYrHs9//AAleoeYFB+zQ/dOf4nrYoAKKKKACiiigAooooAKKKKACiiigDg/FGkWEHxO8G6rHbKL651GaOSc5LFFsbjCjPQd8DAzz1ri/Hc/mX3jrfrlppUSmFZtEuFUyawFgQgqxO5RIP3Q2A8p65r2yS3hlkiklijd4WLRMyglCQQSD2OCRx2JqKbTrG5vIru4s7eW5g/1UzxKzx/7rEZH4UAeSaxqun2vhv4m2OtyxW2p6kS9pZTOBNMJLGFIVRerHzAVGP4ga2vi7Bqq/BPVt11bqiaaouY5IGeR3yucOHAH4qa9Bm06yuLyK7uLO3luYP9VM8Ss8f+6xGR+Fch8Z/wDkjPiX/rzP/oQoA6KGO+/sq1/0m3xtix/o7eo/264r4uWWoWWi6d4wt3hluvC96l7tjgIZ4CQky/fPBU5P+7XcwrP/AGTa/vI/uxf8sz6r/tU7U7Nr3T5bW6MUsE+I5EMZwysQCPvehoAiimuL60s7u1vbWWC4CyxSLbthlZcg/f6EGppY7/zIM3Nv984/0dv7p/264v4Xz3Fv4bfw1PcK114av5NNfeh3NGuTC/XoY2XH0NdzMs/mwfvY/vn/AJZn+6f9qgCrPHffb7XNzb5+fB+zt6f79StHf/bI/wDSbfOxv+XdvVf9uidZ/wC0LT95Hn5/+WZ9PrUjLP8AbI/3sf8Aq3/5Zn1X/aoAjMd/9sX/AEm3z5Z/5d29R/t0LHf/AGyT/SbfPlr/AMu7erf7dSFZ/ti/vY/9Wf8AlmfUf7VKqz/bJP3sf+rX/lmfVv8AaoAiWO/+1yf6Tb52L/y7t6t/t1Q01L3+29Y23EAbzo9xMDEH90vT5+P1rUVZ/tkn72P/AFa/8sz6t/tVn6Ys39uaziSMHzos/Ief3S+9AFuKO/8ANnxc2/3xn/R2/ur/ALdEEd/5bYubf77/APLu394/7dSQrP5s/wC9j++P+WZ/ur/tUW6z+U37yP77/wDLM/3j/tUAR28d/wCU2Lm3++//AC7t/eP+3SW0d/8AZY8XNvjaOtu3/wAXUtus/lN+9j/1j/8ALM/3j/tUWyz/AGWPEkf3R/yzP/xVAFSxjvv7Et9txbhfs64Bt2zjaO++pJY7/wDs9s3Nvjyjx9nb0/36LFZ/7Dt8SR4+zL/yzP8AdHvUsqz/ANnP+8jx5R/5Zn0/3qAG3Md/9lkzc2+Mdrdv/i6LmO/8oZubf76f8u7f3h/t1JdLP9lkzLH93/nmf/iqLlZ/KGZY/wDWJ/yzP94f7VAGZriXoSw33EB/06HGIGGDu/36vyx3/mwZubf75x/o7f3T/t1U15ZvLsN0kZ/0+HGEP9761oTLP5sH72P/AFh/5Zn+63+1QBFNHf8AmwZubf75x/o7f3W/26Gjv/tcf+k2+djf8u7eq/7dSTLP5sH72P8A1h/5Zn+63+1Sss/2yP8Aex/6tv8AlmfVf9qgCJo7/wC1x/6Tb52N/wAu7eq/7dRrHff2pJ/pNvnyU5+zt/eb/bqyyz/bI/3sf+rb/lmfVf8AaqJVn/tWT97HnyE/5Zn+83vQAqx3/wBpf/SbbOxf+XdvU/7dJHHf+dNi5t/vDP8Ao7eg/wBuplWf7S/72P7i/wDLM+p/2qSJZ/Om/ex/eH/LM+g/2qAI447/AMyX/Sbb73/Pu390f7dJDHf4fFzb/fP/AC7t/wDF1NGtx5kv72P7/wDzzP8AdH+1SQrPh/3sf3z/AMsz/wDFUAZ+iJenTTsuLcD7RPwYGPPmvn+OrkEd/wCSMXNt1P8Ay7t6/wC/VfQ1nOmHbJGB9on6xn/ns/vVyBZ/JH72Pqf+WZ9f96gCOCO/+zx4ubbG0f8ALu3p/v1H5d9/Z/8Ax82+PK6fZ29P9+rNus/2aP8Aex/cH/LM+n+9Ue2f+zv9ZHjyv+eZ9P8AeoAivo777BPuubcjYc4t2Hb/AH6kmjv/ACxm5tvvr/y7t/eH+3S36z/2fPmSPGw/8sz6f71STLP5Y/ex/fX/AJZn+8P9qgCGaO/+TNzbffH/AC7t/wDF0skd/wCZF/pNt97/AJ92/un/AG6kmWf5P3sf3x/yzP8A8VSyLceZF+9j+/8A88z/AHT/ALVAEMkd/wCdD/pNv944/wBHb0P+3VS6S9/t+wzcW+7ypsHyGwPudt9aEiz+dD+9j+8f+WZ9D/tVTuln/wCEg0/MkefKmwfLP+x70ATtHf8A2tP9Jts7G/5d29V/26VY7/7Q/wDpNtnYv/Lu3qf9upGWf7ZH+9j+43/LM+q/7VKq3H2l/wB7H9xf+WZ9T/tUAQrHf/bJP9Jt87F/5d29W/26WOO/8yXFzbff5/0dv7o/26eqz/bJP3sf+rT/AJZn1b/ap0az+ZL+9j+//wA8z/dH+1QBVtY777Te4ubfPnjObduf3af7dSwx3+w4ubb77f8ALu394/7dJaLP9pvcSR/68Z/dn/nmnvU0Kz7D+9j++3/LM/3j/tUAQ28d/wCUcXNv99/+Xdv7x/26LaO/+yx4ubcDb3t2/wDi6ktln8o4lj/1j/8ALM/3j/tUWqz/AGWPEsf3f+eZ/wDiqAKVyl9/wj82bi32/ZWyPIbONnrvptol7/wjcGLi3C/ZFwDA2cbPXfU1ys//AAjs37yPH2VuPLP9z60lms//AAjUGJI8fZF48s/3PrQBNcx3/wBlkzc2+Nv/AD7t/wDF0XEd/wCUM3Nv99P+Xdv7w/26kuVn+yyfvY/u/wDPM/8AxVLcLP5Q/ex/6xP+WZ/vD/aoAiuI7/yhm5t/vp/y7t/eH+3UV3HfefZ5ubc/vuMW7cfI3+3Vq4Wfyh+9j++n/LM/3h/tVFeLP59nmSP/AF/H7s/3G96ACaO/82DNzb/fOP8AR2/un/boaO/+1x/6Tb52N/y7t6r/ALdSTLP5sH7yP75/5Zn+63+1Sss/2yP97H/q2/5Zn1X/AGqAImjv/tcf+k2+djf8u7eq/wC3QI7/AO1t/pNvnYP+XdvU/wC3UrLP9sj/AHsf+rb/AJZn1X/apAs/2xv3sf3B/wAsz6n/AGqAKNgJV8VagJ3R2+zQ8ohUdX7EmtmsezDjxXf+Yysfs0PKjH8T+9bFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABXD/Gf/AJIz4l/68z/6EK7iuH+M/wDyRnxL/wBeZ/8AQhQB00MT/wBk2v8ApEn3Yuy+q+1WLmF/KX/SJP8AWJ2X+8Paq8ML/wBk2v8ApEn3Yuy+q+1T3EL+UP8ASJf9YnZf7w9qAPPNYgfwp8btM1MTOmn+KohYXL4Xi7iBMJPGPmQsg+leiTQv5sH+kSf6w9l/un2rlPih4bu/EHga4g06eT+0rV1vLBsLlZ4vnTGB1ONv/Aq1/D+rJ4l8N6NrNrcSeXfQpMANvyEoSV6dQcj8KAL88T/2haf6RJ/H2X0+lStC/wBsj/0iT/Vt2X1X2qKeF/7QtP8ASJP4+y+n0qRoX+2R/wCkS/6tuy+q+1AAYn+2L/pEn+rPZfUe1KsL/bJP9Ik/1a9l9W9qQwv9sX/SJf8AVnsvqPahYX+2Sf6RL/q17L6t7UAKsL/bJP8ASJP9WvZfVvas/TInOuayPPkGJouQF5/dL7VoLC/2uT/SJf8AVr2X1b2rO0yJzrmsjz5BiaLkBef3S+1AGjDC/mz/AOkSffHZf7q+1Jbwv5Tf6RJ99+y/3j7UQwv5s/8ApEv3x2X+6vtRbwv5Tf6RJ99+y/3j7UAFvC/lN/pEn337L/ePtRbQv9lj/wBIk+6Oy/4UW8L+U3+kSf6x+y/3j7UW0L/ZY/8ASJPujsv+FAEFjE/9h25+0SD/AEdeML/dHtUssT/2c/8ApEn+qPZfT6VFYxP/AGHbn7RIP9GXjC/3R7VLLC/9nP8A6RJ/qjxhfT6UAPuoX+yyf6RJ930X/CkuYX8of6RJ/rE7L/eHtRdQv9lk/wBIlPy+i/4UXML+UP8ASJD+8Tsv94e1AFDXonCWGZ5D/p8I5C8fN9K0JoX82D/SJP8AWHsv91vas/XonEdhmeQ/6fCOQvHzfSr80L+bB/pEv+sPZf7re1ABNC/nQf6RJ/rD2X+63tStC/2yP/SJP9W3ZfVfakmhfzYP9Ik/1h7L/db2pWhf7ZH/AKRL/q27L6r7UADQv9sj/wBIk/1bdl9V9qiWJ/7Wk/0iT/UJzhf7ze1StC/2yP8A0iX/AFbdl9V9qiWF/wC1ZP8ASJP9QnOF/vN7UATLC/2l/wDSJPuL2X1PtSRQv503+kSfeHZfQe1KsL/aX/0iX7i9l9T7UkUL+dN/pEv3h2X0HtQAscL+ZL/pEn3/AEX+6PakhhfEn+kSffPZf8KWOF/Ml/0iX7/ov90e1JDC+H/0iT757L/hQBT0OJzppxPIP9In4AX/AJ6v7Vct4X8kf6RJ1PZfX6VT0OJzppxPIP8ASJ+AF/57P7VcghfyR/pEvU9l9fpQAtvC/wBmj/0iT7g7L6fSo/Jf+zv+PiT/AFXovp9Kkt4X+zR/6RL9wdl9PpUfkv8A2d/x8Sf6rphfT6UAF/C40+f/AEiQ/Iey+n0qSaF/LH+kSffXsv8AeHtUd/C40+f/AEiQ/IeML6fSnzQv5Y/0iT769l/vD2oAJoX/AHf+kSffHZf8KWSF/Mi/0iT7/ov90+1JNC/yf6RL98dl/wAKWSF/Mi/0iX7/AKL/AHT7UAJJC/nQ/wCkSfePZfQ+1U7qJ/8AhINPHnyf6qbnC8fc9quSQv50P+kS/ePZfQ+1U7qJ/wDhINPHnyf6qbnC8fc9qALjQv8AbI/9Ik+43ZfVfalWF/tL/wCkSfcXsvqfamtC/wBsj/0iX7jdl9V9qcsL/aX/ANIl+4vZfU+1ACLC/wBsk/0iT/Vr2X1b2pY4X8yX/SJPv+i/3R7U1YX+2Sf6RL/q17L6t7U6OF/Ml/0iX7/ov90e1AENpE/2m+/0iT/Xjsv/ADzT2qaGF9h/0iT77dl/vH2qG0hf7Te/6RIP347Lz+7T2qaGF9h/0iX77dl/vH2oAS2hfyj/AKRJ/rH7L/ePtSWsL/ZY/wDSJPu+i/4UW0L+Uf8ASJf9Y/Zf7x9qLWFzax/6RIPl9F/woArXMT/8I7MfPk/49W4wv9z6UlnE/wDwjUB8+QD7IvGF/ufSluYn/wCEemP2iT/j1bjC/wBz6U2zif8A4RqA+fIB9kXjC/3PpQBbuYX+yyf6RJ930X/CluIX8of6RJ/rE7L/AHh7UlzC/wBlk/0iT7vov+FFxC/lD/SJf9YnZf7w9qAFuIX8of6RJ99Oy/3h7VDeRP59n/pEh/f+i/3G9qluIX8of6RL99Oy/wB4e1RXkLiez/0iQ/v/AEXj5G9qAJZoX82D/SJPvnsv91valaF/tkf+kSf6tuy+q+1JNC/mwf6RJ989l/ut7UrQv9sj/wBIl/1bdl9V9qABoX+2R/6RJ/q27L6r7UCF/tjf6RJ9wdl9T7UjQv8AbI/9Il+43ZfVfagQv9sb/SJfuDsvqfagClZqV8V6gGdnP2aHlsf3n9K2Kx7NSviu/DOzn7NDy2P7z+lbFABRRRQAUUUUAFFFFABRRRQAUUUUAcvqfjWOx8c6P4agsbiZ7+Z457ooyxQYgeVQGIw7HZ0HQcnHAOdrfj++s9cvLTRdKtdQh06VYblJL4RXE8hRZGjt49pEjKjoSCy5JwK1PEum3d54r8I3VrA0kNjqE0ty4IxGptJkBP8AwJlH41w3iXwVcjUfFltB4SGsXHiKQS2Gq7ogtg5iVPnZmDpsdfMBQEnOOooA6TXPH2padcazc6ZokV7pHh/aNTne7McwJjWV/Kj2ENsjdWOWXPQdKPjHIkvwU8RyRsGR7LcrDoQWXBrF1XRvEmnWfivw9p2j3GqDxN80OpiWNYoGkto4JTMGYMMbC42q2c4q58YtHt4vgzrJ8y53WeniJAtzIiMAVHzIrBW/EGgDtobdP7JtTmT7sX/LVvVferFxboIh80n+sT/lq394e9ZEPh6w/su2b/SclYs/6XL3I/2qnn8OaesYI+0/fUf8fcv94f7VAGhPboGi+aT/AFn/AD1b0PvXnfw/T+wPFmveB7hnCWF4dQ0394wzaXAZtoGf4JNyk+9dpN4c08NFj7Ty+P8Aj7l9D/tVwPxF0Sx8L+JvDPi+Pz1t47saZqTG5kz9nm4Vi27ICPg8HvQB6TPbp/aFoMyc7/8Alq3p9aka3T7ZH80n+rb/AJat6r71mTeHrAX1so+04bfn/S5fT/eqRvDmn/ao1/0nBRj/AMfcvqv+1QBfNun2xRuk/wBWf+Wreo96VbdPtknzSf6tf+Wrere9Z58O6f8AalX/AEnGwn/j7l9R/tUL4c0/7U6/6TgIp/4+5fVv9qgDQW3T7XJ80n+rX/lq3q3vWfpkCHXNZBMnE0X/AC0b/nkvvQvhzT/tTr/pOAin/j7l9W/2qo6foNjJrGrRt9o2xSxhcXUgPMank7uevegDeht082f5pPvj/lq391fekt7dPKbmT77/APLVv7x96oReHNPMswP2nh8D/S5f7o/2qIPDuntGxP2n77D/AI+5f7x/2qAL9vbp5TfNJ/rH/wCWrf3j70W1uhtY+ZPuj/lq3+NUIPDuntGSftP32H/H3L/eP+1Rb+HdPa2Qn7Tkr/z9y/8AxVAFixt0Oh25zJ/x7L/y0b+6PepZbdP7Oc5k/wBUf+Wren1rMs/D9g+jQSN9p3NArHF3KBnb6bqkk8O6eLBmH2nPlk/8fcvp/vUAaN1boLWT5pPu/wDPVv8AGi5t0EQ+aT/WJ/y1b+8PeqFx4c09bdyPtOQP+fuX/wCKouPDunrGCPtP31H/AB9y/wB4f7VABr0CLHYYMnN/COZGP8X1rQmt082D5pP9Yf8Alq391vesLWtBsYEsvL+0fPexId11IeCeercfWrsvhzTxJCB9p5cg/wCly/3T/tUAX5rdPNg+aT/WH/lq391vela3T7ZH80n+rb/lq3qvvWfL4d08SwgfaeXwf9Ll/un/AGqG8Oaf9qRf9JwUY/8AH3L6r/tUAaDW6fbI/mk/1bf8tW9V96iW3T+1ZBmT/UJ/y1b+83vVRvDmn/akX/ScFGP/AB9y+q/7VMXw9Yf2lIn+k4EKn/j7l9W/2vagDUW3T7S/zSfcX/lq3qfekit086b5pPvD/lq3oPeqA8Oaf9ocf6VgKp/4+5fU/wC1SR+HNPMsoP2nhhj/AEuX0H+1QBox2yeZL80n3/8Anq390e9JDbp8/wA0n3z/AMtW/wAaoR+HNPLy/wDH1w2P+PuX0H+1RF4c0878/aeHI/4+5f8A4qgB+hwI2mEkyf8AHxP0kYf8tn96uQW6GEfNJ1P/AC1b1+tYuj6BYzaeXf7Rnz5l4upBwJWA6N7Vbg8Oae0QJ+09T/y9y+v+9QBoW9uhto/mk+4P+Wren1qP7On9nZ3Sf6r/AJ6t6fWqcHhzT2t4yftOSo/5e5fT/epn/CO6f9g3f6Tny8/8fcvp/vUAX7+3QafOd0n+rP8Ay1b0+tSTW6eWPmk++v8Ay1b+8Pesy98O6eljMy/achCRm7lP/s1Pl8OaeEGPtP3lH/H3L6j/AGqAL81unycyffH/AC1b/Glkt08yL5pPv/8APVv7p96z5vDmnjZj7Ty4H/H3L/8AFUSeHNPEkWPtXLc/6XL6H/aoAvyW6edD80n3j/y1b0PvVO6gQeINPGZOYpv+Wjf7HvUcnhzTxNEB9p5Y5/0uX0P+1VW50CxXXLGIfaNrxyk5upM8bcc7uOtAG01un2yP5pPuN/y1b1X3pVt0+0v80n3F/wCWrep96zm8Oaf9qRf9JwUY/wDH3L6r/tUo8Oaf9ocf6VgKp/4+5fU/7VAF5bdPtknzSf6tP+Wrere9Ojt08yX5pPv/APPVv7o96zl8Oaf9qkX/AEnART/x9y+rf7VLH4c08vLn7Tw2P+PuX0H+1QBatLdDc3vzScTj/lq3/PNPepobdNh+aT77f8tW/vH3rKtvD1g1xeA/acJMAMXcv/PND/e96li8OaeUOftX3m/5e5fU/wC1QBetrdDEfmk/1j/8tW/vH3otbdDax/NJ93/nq3+NULfw5p7Rkn7T99h/x9y/3j/tUW/hzT2tkJ+05I7Xcv8A8VQBNc26f8I7Mcyf8erf8tG/ufWks7dD4agOZM/ZFP8ArG/ufWqVx4fsV0KWUfaNwtiw/wBKlxnb6bsUlroFi/h+GU/aN5tVY4upAM7c9N2KANi5t0+yyfNJ93/nq3+NFxbp5Q+aT/WJ/wAtW/vD3qhceHNPW2cj7TkD/n7l/wDiqJ/DmnrGCPtP31H/AB9y/wB4f7VAGhcW6eUPmk++n/LVv7w96ivLdBPZ8ycz/wDPVv7je9VJ/DmnrGCPtP31H/H3L/eH+1Ud14esEmtAv2nDTYObuU/wMf73tQBpzW6CWD5pPvn/AJat/db3pWt0+2R/NJ/q2/5at6r71ny+HdPEkIH2nl8H/S5f7p/2qG8Oaf8AakX/AEnBRj/x9y+q/wC1QBoNbp9sj+aT/Vt/y1b1X3pBbp9sb5pPuD/lq3qfeqDeHNP+1Iv+k4KMf+PuX1X/AGqB4c0/7Uy/6TjYD/x9y+p/2qAHWaBPFd+F3EfZofvMT/E/rWxWFpVnDY+JtQit9+z7PCfnkZznL92JNbtABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABXD/ABn/AOSM+Jf+vM/+hCu4rh/jP/yRnxL/ANeZ/wDQhQB00NtD/ZNr+6X7sXb3WrFxbQeUuIl/1idv9oVVh+yf2Ta/6nO2L09Vqe4+x+UMeR/rE9P7woAfNbQbov3S/wCs9PY1k+L/AAxZ+J/DF5olxGgS+ieINj7jFG2t+DYP4VpzfY90WPI+/wC3oaJvsnmQY8j759P7poA5bwBqy+I/B+gXt1GPtixPb3it1E8XySZ/4EpP4iusa2h+2R/ul/1bdvda818OpD4b+Net6AwjGn6un9tWXTashGydfqWAbHoa9Hb7J9sj/wBRjy29PVaAHm2h+2L+6XHlnt7ihbaD7ZJ+6X/Vr292ph+yfbF/1GPLPp6ihfsf2yT/AFGPLX09WoAettB9sk/dL/q17e7Vn6ZbxHXNZBjXAmixx0/dLV1fsf2uT/UY2L6erVn6b9l/tzWN3k486LbnH/PJaANOG2h82f8AdL98dv8AZWi3tofKb90v337f7RpkX2TzZ/8AUffHp/dWi3+yeU2fI++/p/eNAD7e2h8pv3S/6x+3+0aS2toTax5iX7o7U23+yeU2fJ++/p/eNFt9k+yx58nO0elAEVjbwnQ7cmNc/Zl7f7IqWW2h/s5z5S58o9vaoLH7J/Ydvnyc/Z164/uipZfsn9nN/qc+UfT0oAluraAWsmIl+76UXNtCIhiJf9Ynb/aFMuvsn2WTHkdPai5+yeUMeR/rE9P7woApa9bwrHYbY1Gb+EHj/arQmtoPNg/dL/rD2/2WrN137LssNnk/8f0OcY6bqvzfY/Ng/wBR9856f3TQA+a2h82D90v+sPb/AGWoa2g+2R/ul/1bdvdaZN9k82DHkffOen91qG+x/a4/9RjY3p6rQA9raD7ZH+6X/Vt291qNbaH+1ZB5a48hO3+01K32P7XH/qMeW3p6rUa/ZP7Vk/1OPJT0/vNQBYW2g+0v+6X7i9vc0kVtB5037pfvDt7Cmr9j+0v/AKjGxfT1NJF9j86b/UfeHp6CgCSO2g8yX90v3/T/AGRSQ20OH/dL989qbH9j8yX/AFH3vb+6KSH7Hh8+R98+lAFbQ7eFtMJaNSftE/b/AKbPV2C2g8kZiXqe3vVDRPsv9mnf5OftE/XH/PV6uQfY/JGfI6n09aAH29tAbaPMS/cHb2qP7ND/AGdnylz5Xp7Utv8AY/s8efI+4PT0pn+if2d/yxz5Xt6UAOv7aEafOREv3D29qkmtofLH7pfvr2/2hUF99k/s+fHk52HGMelSTfZPLH+o++vp/eFADpraD5P3S/fHalktoPMi/dL9/wBP9k0yb7H8mPI++PSiT7H5kX+o+97f3TQA6S2g86H90v3j29jVO6t4R4g08CNcGKbIx/uVZk+x+dD/AKj7x9PQ1Tuvsv8AwkGn48nb5U2emP4KAL7W0P2yP90v3G7e60q20H2l/wB0v3F7e5qNvsn2uP8A1GNjenqtKv2P7S/+o+4vp6mgBy20P2yT90v+rXt7tSx20HmS/ul+/wCn+yKjX7J9sk/1GNi+nq1LH9j8yX/Uff8Ab+6KAGWltCbm9zGvE4xx/wBM0qaG2g2H90v327f7RqvafZPtN7nyf9eMdP8AnmlSw/Y9hz5H329P7xoAdbW0JiOYl/1j9v8AaNFrbQm1jzEv3fSmW/2TyjnyP9Y/p/eNFr9k+yx58jO32oAgubeH/hHZj5a5+ytzj/YpLO3hPhqAmNc/ZFOcf7FJc/ZP+Eemx5O77K3pn7lNs/sv/CNwZ8nd9kX0znZQBeubaH7LJ+6X7vpRcW0PlD90v+sTt/tCmXP2T7LJjyM7fai4+yeUMeR99PT+8KAH3FtD5Q/dL99O3+0KivLeET2eI15n9P8AYanXH2TyhjyPvp6f3hUV59k8+zx5P+v56f3GoAnmtofNgxEv3z2/2WpWtoPtkf7pf9W3b3WmTfZPNgx5H3z6f3Wob7H9rj/1GNjenqtAD2toPtkf7pf9W3b3WgW0P2xv3S/cHb3NMb7H9sj/ANRjY3p6rQPsn2xv9RjYPT1NAFSzRY/Fd+EUKPs0PA/3nrYrGsfL/wCEq1Dydu37ND93p1etmgAooooAKKKKACiiigAooooAKKKKACiuL8R3+vW3xG8KQR3MEGjXV5NE8MeTJcEWkz5cnAVQVGFGcnBJGMVQ8Z+JdSk1rTbbQLryLKz1uxttSmTkzPJKoNup7AKwZz/tKv8AewAeh1w/xn/5Iz4l/wCvM/8AoQrF1+91q/j8aa/p+u3unt4WkaOzs4ivkS+Vbxzv5qlTv3lyvUYAGOatfGDWIJvgtrG5Jle805ZUCwOygEqcFwNo/EigDtobmD+ybUedH92L+Meq1Yubq3MS/v4/9Yn8Y/vCqUOoQf2VajE2dsX/ACwf1HtVi41G3MYwJvvp/wAu7/3h7UASz3VuWi/fx/6z++PQ0TXUHmwfv4/vn+Mf3TUU2o25aLib7/8Az7v6H2ol1G3MkHE3Dn/l3f8Aun2oA4P4szLpsnhzxbZOjS+H7/zbgq2WNpJiOcD/AICQf+A16Abu3a6iZZ4iDG3Iceq1la8tlrVm+m3SzGC8t5reQfZ3+66bTxj3rnPhX4ke+8H2ljqvmnU9FMul3oETt+8hKqD07rtP40AdybqD7Yp8+PHln+MeooW6t/tkn7+P/Vr/ABj1aoTqEH2xTibGw/8ALu/qPalXUbf7XIcTfcX/AJd39W9qAJVurf7ZJ+/j/wBWv8Y9WrP0y4hGuayTNGAZosHcOf3S1bXUbf7XIcTfcX/l3f1b2rP02+hXW9YYiXDTRkYgc/8ALJfbigDVhuoPNn/fx/fH8Y/urRb3UHlN+/j++/8AGP7xqKLULcSz8TcuP+Xd/wC6vtSW+owCNuJvvv8A8u7/AN4+1AEtvdQeU37+P/WP/GP7xotrmAWsf7+P7o/jFRW+owCJuJvvv/y7v/ePtRbahALWMETfdH/Lu/8AhQA2xuYBoduDNGD9mXjcP7oqWW5g/s5x50efKP8AGPSqtjqEC6JbqRNkW6jiB/7o9qll1CD+z2GJs+Uf+Xd/T6UAWLq6gNrJieP7v98UlzdQGIYnj/1ifxj+8KjudRtzayACb7v/AD7v/hSXGoQGIYE330/5d3/vD2oAq69cQtHYbZozi/hJww4G6tCa6g82D9/H/rD/ABj+61ZeuX0DpYbRLxfQk5gccbvcVfl1G3MsHE3Dn/l3f+6fagCSa6g82D9/H/rD/GP7rUrXVv8AbI/38f8Aq2/jHqtQy6hAZYOJuHP/AC7v/db2pW1G3+1xnE33G/5d39V9qAJWuoPtkf7+P/Vt/GPVajW5g/tWQ+dHjyE53j+81I2o2/2uM4m+43/Lu/qvtUa6hB/akhxNjyUH+of+83tQBaW6g+0v+/j+4v8AGPU0kV1B5037+P7w/jHoKjGo2/2lzib7i/8ALvJ6n2pI9Rt/Om4m+8P+Xd/Qe1AE0d1b+ZL+/j+//fH90UkN1Bh/38f3z/GKjj1G38yXib73/PvJ/dHtSQ6jbgPxN98/8u7/AOFAEGh3MC6aQ00YP2ifqw/57PV2C6gEI/fx9T/GPWs7RL+BNNIYTZ+0TniBz1lc+lW4NRtxCMibqf8Al3k9fpQBNb3UAto8zx/cH8Y9Kj+0wf2djzo8+V/fHpSQajbi3jBE33R/y7yen0qP+0IP7PxibPlY/wCPd/T6UAS39zAdPnAmjPyH+MelSTXUHlj9/H99f4x/eFVr7UIG0+cATZKHrA/p9Kkm1GAxjib76/8ALvJ/eHtQBJNdQfJ+/j++P4xSyXVv5kX7+P7/APfH901DNqNudnE33x/y7v8A4Usmo2/mRcTfe/595P7p9qAJJLqDzof38f3j/GPQ1TurmA+INPImjwIpsncOPuVPJqNv50PE33j/AMu7+h9qp3V/AdfsGAmwsU2f3D/7HbFAGi11B9sj/fx/cb+Meq0q3Vv9pf8Afx/cX+MepqFtRt/taHE33G/5d39V9qVdRt/tD8TfcX/l3k9T7UASLdQfbJP38f8Aq1/jHq1LHdW/mS/v4/v/AN8f3RUK6hb/AGuQ4m+4v/Lu/q3tSx6jb+ZLxN9//n3k/uj2oAS0uYBc3uZo+Zxj5x/zzSpobqDYf38f32/jH941UtdQgFzekibmcEfuH/55p7VNDqNuEPE332/5d5P7x9qAJLa6gERzPH/rH/jH940Wt1ALWPM8f3f74qK31C3ERyJvvv8A8u7/AN4+1Jbajbi1jBE33f8An3f/AAoAjubmA+HZh50efsrDG4f3KSzuYB4agBmjz9kUY3D+5UdzfwHw/MuJsm1Yf6h8fc9cUlpfwDw5ApE2RaKP9Q+PueuKANC5uoPssn7+P7v98UXF1B5Q/fx/6xP4x/eFRXOo25tZBib7v/Pu/wDhRcajbmIcTffT/l3f+8PagCW4uoDEP38f30/jH94VFeXMBns8TR8T8/OP7jUXGo25iGBN99P+Xd/7w9qiu9QgM9ngTcTZP7h/7je1AFma6g82D9/H98/xj+61K11B9sj/AH8f+rb+Meq1DNqMBlgwJuHP/Lu/90+1K2o2/wBrjOJvuN/y7v6r7UAStdQfbI/38f8Aq2/jHqtAuoPtjfv4/uD+MepqJtRt/tcZxN9xv+Xd/Vfagajb/a2OJvuD/l3f1PtQBWs3STxXqBjZWH2aHlTn+J62KxbCZJ/FWoPHux9mhHzIVPV+xFbVABRRRQAUUUUAFFFFABRRRQAUUUUAZOraEuq61omoNOYzpFzJcKgXPm7oZIsZzx/rM/hXO+I/hH4S8RXS3cuj2UV217Hd3FwLcM1wFcM6MfR+QT713FFAHE6t8OzfSapbWGsy6dpOsqi6hYxW6sZAsaxEI5+5ujRVPB6ZGKj+MiLH8FfEaIoVVssKB2G5a7quH+M//JGfEv8A15n/ANCFAHTQ3Cf2Ta/LJ92L/lk3qvtVi5uE8ofLJ/rE/wCWTf3h7VXhlf8Asm1/cSfdi7r6r71YuJn8pf8AR5P9Yndf7w96AEnuE3RfLJ/rP+eTeh9qWa4TzYPlk/1h/wCWTf3T7UTzPui/0eT/AFnqvofeiaZ/Ng/0eT757r/dPvQBFPcJ/aFodsn8f/LJvT6VwMDp4V+PUq4kWw8XWRkQeWwAvIANwAx/FHgn1Irvp5n/ALQtP3En8fdfT61xvxYimTw5B4gtLWQ3vhyZdUhGV+ZY2XzVOD0MZcflQB2xuE+2L8sn+rP/ACyb1HtSrcJ9sk+WT/Vr/wAsm9W9qr2WpR6jHa31nG8tvc24licFfmRsEHr6GrCzP9sk/wBHk/1a919W96ABblPtknyyf6tf+WTere1Z+mToNc1k4k5mi6Rt/wA8l9q0Fmf7ZJ/o8n+rXuvq3vWfpkrDXNZPkSHM0XGV4/dL70AX4bhPNn+WT74/5ZN/dX2ot7hPKb5ZPvv/AMsm/vH2pYZn82f/AEeT747r/dX3pLeV/Kb/AEeT7791/vH3oALe4Tym+WT/AFj/APLJv7x9qLa4QWsfyyfdH/LJv8KLeZ/Kb/R5P9Y/df7x96LaV/ssf+jyfdHdf8aAILG4QaHbjEn/AB7r/wAsm/uj2qWW4T+znG2T/VH/AJZN6fSorGV/7Dtx5Eh/0Zecr/dHvUssr/2c/wDo8n+qPdfT60AOurhDayfLJ93/AJ5N/hRc3CGIfLJ/rE/5ZN/eHtRdTP8AZZP9Hk+76r/jRczOYh/o8n+sTuv94e9AFDXp0aOwwJOL+E8xsP4vpWhNcJ5sHyyf6w/8sm/ut7Vn69KxjsMwSD/T4TyV5+b61oTTP5sH+jyf6w91/ut70AJNcJ50Hyyf6w/8sm/ut7UrXCfbI/lk/wBW3/LJvVfakmmfzYP9Hk/1h7r/AHW96Vpn+2R/6PJ/q27r6r70ADXCfbI/lk/1bf8ALJvVfaoluE/taQ7ZP9Qn/LJv7ze1StM/2yP/AEeT/Vt3X1X3qJZn/tWT9xJ/qE4yv95vegCZbhPtL/LJ9xf+WTep9qSK4Tzpvlk+8P8Alk3oPalWZ/tL/wCjyfcXuvqfekimfzpv9Hk+8O6+g96AFjuU8yX5Zfv/APPJv7o9qSG4TEnyyffP/LJv8KWOZ/Ml/wBHk+/6r/dHvSQzP8/+jyffPdf8aAKehzoumkESf8fE/SNj/wAtn9quQXCeSPlk6n/lk3r9Kp6HK40w/uJD/pE/Qr/z2f3q5BM/kj/R5Op7r6/WgBbe4T7NH8sn3B/yyb0+lR/aE/s7G2T/AFX/ADyb0+lSW8z/AGaP/R5PuDuvp9aj85/7O/495P8AVeq+n1oAL+4Q6fONsn3D/wAsm9PpT5rhPLHyyffX/lk394e1Mv5nOnz/AOjyD5D3X0+tSTTP5Y/0eT7691/vD3oASa4T5Plk++P+WTf4UslynmRfLL9//nk390+1JNM/yf6PJ98d1/xpZJn8yL/R5Pv+q/3T70AJJcJ50PyyfeP/ACyb0PtVO6nQ+INPO2TiKb/lm3+x7Vckmfzof9Hk+8e6+h96p3Urf8JBp58iT/VTcZXn7nvQBca4T7ZH8sn3G/5ZN6r7Uq3CfaX+WT7i/wDLJvU+1I0z/bI/9Hk+43dfVfelWZ/tL/6PJ9xe6+p96AGrcJ9sk+WT/Vp/yyb1b2p0dynmS/LJ9/8A55N/dHtTVmf7ZJ/o8n+rTuvq3vTo5n8yX/R5Pv8Aqv8AdHvQBDaXCC5vvlk5nH/LJv8AnmntU0Nwmw/LL99v+WTf3j7VDaTP9pvf3En+vHdeP3ae9TQzPsP+jyffbuv94+9ADba4QRH5ZP8AWP8A8sm/vH2otbhBax/LJ93/AJ5N/hS20ziI/wCjyf6x+6/3j70lrM4tY/8AR5Pu+q/40AVrm4T/AIR2YbZP+PVv+WTf3PpTbO4QeGoBtk/49FH+rb+59Kdcyt/wjsw8iT/j1bnK/wBz60lnKw8NQDyJD/oi85X+59aALVzcJ9lk+WT7v/PJv8KLi4Tyh8sn+sT/AJZN/eHtRczP9lk/0eT7vqv+NLcTP5Q/0eT/AFid1/vD3oALi4Tyh8sn30/5ZN/eHtUN5cIZ7P5ZP9f/AM8m/uN7VNcTP5Q/0eT76d1/vD3qK8lcz2f7iT/X+q/3G96AJJrhPNg+WT75/wCWTf3W9qVrhPtkfyyf6tv+WTeq+1JNK/mwf6PJ9891/ut70rTP9sj/ANHk/wBW3dfVfegAa4T7ZH8sn+rb/lk3qvtSC4T7Y3yyfcH/ACyb1PtStM/2yP8A0eT/AFbd19V96QTP9sb/AEeT7g7r6n3oApWbh/FeoFQwH2aH7ykfxP61sVj2bFvFd+SjJ/o0PDY/vP6VsUAFFFFABRRRQAUUUUAFFFFABRRRQAUVDNd21vNBDPcRRS3DlIUdwGlYKWIUHqdqk4HYE9qp3niPQ9O1KLT9Q1nT7W9mx5VtPdIkkmemFJyfwoA0q4f4z/8AJGfEv/Xmf/QhXT3fiHRtP1KHT7/V7C1vbjHk201yiSSZOBtUnJ59K5j4z/8AJGfEv/Xmf/QhQB00Mz/2Ta/6PJ92LuvqvvU9xM/lD/R5P9Yndf7w96gheb+ybX90v3Yv4/dfarFy83lL+5X/AFifx/7Q9qAEmmfdF/o8n+s9V9D70s0z+ZB/o8n3z3X+6feid5t0X7lf9Z/f9j7UTPN5sH7lfvn+P/ZPtQBFPM/9oWn+jyfx919PrRdKt2xt7mzeSGaGSOSNtpDKdoIPPTFE7zf2haful/j/AI/b6VKzzfbI/wB0v+rb+P3X2oA89+E13caZFqng29WWS58M3L20RYjc1q5DwMef7pI/4DXoKzP9sk/0eT/Vr3X1b3rgPFHn+Gvi94d8SRRBLXV0Oi6hh+CxO63Y8dd+Vz6ECvQFeb7ZJ+6X/Vr/AB+7e1AAsz/bJP8AR5P9WvdfVves7TJXGuayRBIczRcZXj90vvWirzfbJP3K/wCrX+P3b2rP0xpf7c1nESk+dFkb+n7pfagC/DM/mz/6PJ98d1/ur70W8z+W3+jyfffuv94+9LC83mz/ALpfvj+P/ZX2pLd5vKb9yv33/j/2j7UAFvM/lN/o8n337r/ePvRbTP8AZY/9Hk+6O6/40W7zeU37lfvv/H/tH2otnm+yx/ul+6P4/wD61AEFjK/9h24+zyH/AEZecr/dHvUssz/2c/8Ao8n+qPOV9PrUVi839hW+Ilx9nXnf/sj2qWV5v7Ob90uPKP8AH7fSgB11M/2WT/R5Pu+q/wCNFzM/lD/R5B+8Tuv94e9LdPN9lk/dL93+/wD/AFqS5ebyh+6X/WJ/H/tD2oAoa9K5jsMwSD/T4TyV5+b61fmmfzYP9Hk/1h7r/db3qhrzylLDMSj/AE+HHz/7X0rQmebzYP3K/wCsP8f+y3tQAk0z+bB/o8n+sPdf7re9K0z/AGyP/R5P9W3dfVfekmebzoP3S/6w/wAf+y3tSs832yP9yv8Aq2/j919qABpn+2R/6PJ/q27r6r71Esz/ANqyf6PJ/qE4yv8Aeb3qVnm+2R/uV/1bfx+6+1RK839rSfulz5Cfx/7Te1AEyzP9pf8A0eT7i919T70kUz+dN/o8n3h3X0HvSq832l/3K/cX+P3PtSRPN5037lfvD+P2HtQAscz+ZL/o8n3/AFX+6PekhmfD/wCjyffPdf8AGljebzJf3K/f/v8A+yPakhebEn7lfvn+P/61AFPQ5XGmnEEh/wBIn5BX/ns/vVyCZ/JH+jydT3X1+tU9DeYaacRKR9on/j/6av7Vct3m8kfuV6n+P3+lAC28z/Zo/wDR5PuDuvp9aj85/wCzv+PeT/Vdcr6fWpLd5vs0f7lfuD+P2+lR75v7O/1S/wCq/v8At9KAC/mc6fP/AKPIPkPdfT60+aZ/LH+jyffXuv8AeHvTL95v7PnzEv3D/H7fSpJnm8sful++v8f+0PagBJpn+T/R5Pvjuv8AjSyTP5kX+jyff9V/un3pJnm/d/uV++P4/wD61LI83mRfuV+//f8A9k+1ACSTP50P+jyfePdfQ+9U7qV/+Eg08+RJnypuMrz9z3q5I83nQ/uV+8f4/Y+1U7p5v+Eg0/MS58qbA3/7ntQBcaZ/tkf+jyfcbuvqvvSrM/2l/wDR5PuL3X1PvSM832yP9yv3G/j919qVXm+0v+5X7i/x+59qAGrM/wBsk/0eT/Vr3X1b3p0cz+ZL/o8n3/Vf7o96RXm+2Sful/1a/wAfu3tSxvN5kv7lfv8A9/8A2R7UAQ2kz/ab3/R5P9eO68fu096mhmfYf9Hk++3df7x96htHm+0337pf9eM/P/0zT2qaF5th/cr99v4/9o+1ADbaZ/KP+jyH94/df7x96LWZxax/6PJ931X/ABpbZ5vKP7pf9Y/8f+0faktXm+yx/uV+7/f/APrUAVrmV/8AhHZh5En/AB6tzlf7n1ptnK48NQDyJCPsi85X+59adcvN/wAI7N+6XH2Vud/+x9KSzeb/AIRqDES4+yLzv/2PpQBauZn+yyf6PJ931X/Gi4mfyh/o8n+sTuv94e9LcvN9lk/dL93+/wD/AFqS4ebyh+5X/WJ/H/tD2oALiZ/KH+jyffTuv94e9RXkrmez/wBHkH7/ANV5+Rveprh5vKH7lfvp/H/tD2qG8ebz7PMS/wCv/v8A+w3tQBLNM/mwf6PJ9891/ut70rTP9sj/ANHk/wBW3dfVfekmebzYP3S/fP8AH/st7UrPN9sj/cr/AKtv4/dfagBGmf7ZH/o8n+rbuvqvvQJn+2N/o8n3B3X1PvSs832yP9yv+rb+P3X2pA832xv3K/cH8fufagClZsW8V35ZGQ/ZoeGx/ef0rYrHsyx8V6hvUKfs0PAOf4nrYoAKK4MaMvjbxXr/APbN9qC2Gk3Mdla2Vpey2yhvIjlaVjEyszEygDJwAvTmpZtR1nwtHpfhnTSPEOr3huHt5r+cwrFbRsPmmkAZmZRJGmQuWPJxyaAO3oritP8AH8txqOk6Ze6UsF/dalcabeIlxuS3kigabcp2jerKFx90jdz0xVe7+I179vXT9L0JLq8l1qfSIRJeeWmYofN81jsOFxnIAJAHGTxQB3tFeW6p478S3VlpAsdLgtr2PxINK1GFb792xUbtqOY8lHBBzgEYxg5rr/GPia88OR6THpunR6hd6rfiwhSW48lI2aORw7Hax2jy+QBnBJGSMEA6OivMvFvxVvfCV5Ml9Y6LELOGOWe3m1kC5ucoGcQRBCSF5AL7N2Og60yf4g6toWveNrvWbSFtJ0v7Ktpm9CgPIFWNTlAFDl9zMSduMcjmgD1CiuF8C/EiHxZrN3o8z6VJeQQC5WTSb/7VC8ZbaQSVUqykjIIwcgg9cd1QBwPinR7WL4p+DNXzNJdzX88IMkrMsaCynO1FzhckAnAySBnoKj8XafZaz/bfhbw5p8U+p65t/te8cbo7JCgUSOT/AMtAijZGvfDHA5PdXFha3Vza3FzAkk1o5kt3YZMTFShI9DtZh9CawNS+G3g3WNSmv9U8N6dd3c7bpZpYQzOcYyT+FAHD6xFZQ+E/ivFqzIbhHKxGVgXKixh+zEZ7+Znb/tZ71rfFyTVB8EtWWS3gcNpq/aZJJysiPlc4QIQef9oV2F34Q8O3+p2mo3uiWFxeWSqtvPLbqzxBfugEjt29O1YHxn/5Iz4l/wCvM/8AoQoA14Z9c/su2/0Ky27YsH7S3qMfwVPPPrvljdY2QG9ely394f7FWIfP/sm1/wBXjbF6+q1PcfaPKGfL/wBYnr/eFAFCafXd0WbGy+/x/pLeh/2KJZ9d8yHNjY53nH+kt/dP+xV+b7Ruiz5f+s9/Q0s32jzYP9X98+v900AZc0+ufbrbdZWQb5to+0tzx/uVI0+u/ao/9Bss7GwPtLeq/wCxVuf7R/aFp/q8/Pjr6VI32j7ZH/q8+W3r6rQByXjfRNd8VeFdQ0cWtnFNPbkwSLctmOVWDowO3qHVaZ4F8W6z4s8N2+pJZWYuQggvInnZGinQsrqV28HcCcehFdgftH2xf9Xnyz6+orz7T4pvBnxpvLNRGmmeLovtcXXbHexg+Yo93QF/cqfSgDsln137U+LGxzsXI+0t6t/sVR0+bWRrGqmOzszIZY/MBuGAU+WuMHbzxit5ftH2yT/V/wCrX19WrO0zz/7c1nHl586LOc/88loAWKfXfMmxY2Wd/P8ApLf3R/sUQT675Z22NiRvbrct/eP+xV+H7R5s/wDq/vj1/urRb/aPLb/V/ff1/vGgDPgn13yztsbEje3W5b+8f9ii3n137Om2xsSNvGblv/iK0Lf7R5Tf6v77+v8AeNFt9o+yx48v7o9aAMmzm1saPAEsrIx+QuCblgSNvpsqWSfXfsLZsrLb5Z5+0t0x/uVasfP/ALDt8eXj7Mvr/dFSy/aP7Of/AFePKPr6UAUrifXfs77rGyAxzi5b/wCIpJ59d8sbrGyA3r/y8t/eH+xWhdfaPssmfL+770XP2jyhny/9Ynr/AHhQBhazNrJSy8+zs1AvYiu24Y5bPAPy9Per0s+u+ZDmxss7zj/SW/un/Yo17z/LsN3l/wDH/DjGeu6r832jzYP9X/rD6/3WoAz5Z9d8yHNjZZ38f6S390/7FK0+u/ak/wBBss7GwPtLeq/7FX5vtHmwf6v/AFh9f7rUrfaPtkf+r/1bevqtAGe0+u/ak/0GyzsbA+0t6r/sVGs+uf2lIfsVlv8AJXI+0tjGW/2K1G+0fbI/9X/q29fVaiX7R/asn+rz5Cev95qAKon177Q/+g2Odq5/0pvU/wCxSRz675suLGyzuGf9Jb0H+xWiv2j7S/8Aq/uL6+ppIvtHnTf6v7w9fQUAUI59e3yYsbH73P8ApTeg/wBikin1358WNj985/0lv/iK0Y/tHmS/6v7/AL/3RSQ/aP3n+r++fWgDF0ebWhp58mzs2Xz5uWuGBz5rZ/g9c1ahn13yhtsbEjJ/5eW9f9ypND8/+zTt8vH2ifrn/ns9XIPtHkjHl9T6+tAFCCfXvs8e2xsSNox/pTen+5Ufn679g/48rLb5fX7S3TH+5Wpb/aPs0ePL+4PX0qP/AEj+zv8Alnjyvf0oAz72fXTYzb7KyC7Dki5Y44/3KfLPr2wZsbH7y9LpvUf7FXb/AO0f2fPny8eWfX0p832jyx/q/vr6/wB4UAZ8s+u/JmxsfvjH+kt/8RSyT69vjzY2P3uP9Kb0P+xV+b7R8n+r++PWlk+0eZF/q/v+/wDdNAGdJPrvmxZsbHO44/0lvQ/7FVLmbWv7csS1nZiQRy7FFw2CPlzk7PpW3J9o86H/AFf3j6+hqndef/wkGn58vPlTY6/7FAEbT679qT/QbHOxsD7S3qv+xSifXvtD/wCg2Odq5/0pvU/7FX2+0fbI/wDV52N6+q0q/aPtL/6v7i+vqaAM5Z9d+1Sf6DZbti5H2lvVv9iljn17fLixsfvc/wClN6D/AGKvL9o+2Sf6vPlr6+rU6P7R5kv+r+/7/wB0UAZVtPrn2i822VkT5w3ZuW4Plp0+T0xUsU+vbDixsfvN/wAvTep/2KtWn2j7Te48v/XjPX/nmlTQ/aNh/wBX99vX+8aAM6CfXfLO2xsiN7f8vLf3j/sUlvPrv2dNtjZEY4zct/8AEVoW32jyjjy/9Y/r/eNFr9o+yx48v7vvQBj3E2t/2HKGsrMR/ZjlhctnG3rjZ1pLWbWh4fhCWdmYvsq4Y3DZxt642da0Lnz/APhHpv8AV4+yt6/3KbZ+f/wjUGPLx9kX1/uUAR3E+u/Z33WNiBjnFy3/AMRRPPrvljdY2IG9ely394f7FX7n7R9lk/1f3fei4+0eUP8AV/6xPX+8KAKE8+u+WN1jYgb16XLf3h/sVFdT6551rvsrIHzvlxctydjf7HpmtW4+0eUM+X99PX+8KhvPP8+zz5f+v46/3GoAqSz675kObGxzv4/0lv7p/wBilafXftSf6DZZ2NgfaW9V/wBir832jzYM+X98+v8Adalb7R9sj/1f+rb19VoAz2n137Un+g2WdjYH2lvVf9igT679qb/QbHOwcfaW9T/sVfb7R9sj/wBX/q29fVaB9o+2N/q/uD19TQBm6S10/ibUDfRRRS/Z4flicuMZfuQK3ax7Pf8A8JXqHmbc/Zofu/7z1sUAcpqnhPVv+EgudX8L+IRpEt8iC8hnsluYpWQbVkA3KVfbhc5wQFyOKqf8K48izsJtP1y7ttcs5p521Xykdp3nIMweMjaVbC4UY27FweKh1TxpPo2qXttp2kyahdXHiCLSkjlvyqB3sEnDjKny0GACoz/E/JO07fhLxDe63HqVvq9lDZajpd4bS5S3mMsTHy0kVkYqpwVkXqAQc0AZU3w5zptmbXXLqHWrXUH1H+1TFG7SzuhjfdGRt2lDtCjGABzxyukfDlNL1GyvZNXuLua21a41R3mjUGaSa3MLA4wAOS3A9sAU7/hLPEd5q102h+HIL3SLK9+xTStfCO4kZWCyPHGV27UJP3nBO04qkfiFq6W667LoEC+FmuxbC6+2k3QUy+UJzFs27C2ON+7BzjtQBeu/h+J7e5FtqsttcSa4NaimEKt5Um0LsKnhhgH06+1bWu+H01y70Wd52hOlX4vlAXPmERyR7T6f6zOfasdPHu/wnba3/ZuPP1gaX5Pn/d/0w23mbtvPTdtx7Z71lt8Rta/0nUE8O240Sx1l9JuZ2vz57EXPkCVI9mCuSpILA8kDpkgEuu/C+TV5tfS08R3Wn2PiAFr23jtonZn8tU4kYbgmFXK59cEZq7efD8Xuo6tO+sXEUWqQ2/mRxRqGiuICpinRzkggoDtORmuYs/iH4j0rw/ruoa1ptqfK16SxhmmvWMFsuTkyssWUjTao3YO4uM4613ng/wAQS+JfD6ahPHZo5kdN1jerdQyBTgMki44PoQCOhFADdA0DU9NvZ7zWvEd5rM0saxIjxpDDEoJORGnG455Y88ADArfoooAKKKKACuH+M/8AyRnxL/15n/0IV3FcP8Z/+SM+Jf8ArzP/AKEKAOmhWf8Asm1/eR42xf8ALM+q/wC1Vi4W48pcyR/6xP8Almf7w/2qrwpN/ZNr+9X7sX8HuvvU9wk/lD96v+sT+D/aHvQAsy3G6L95H/rP+eZ9D/tUTLcebB+8j++f+WZ/un/apJkn3RfvV/1n9z2PvSzJN5kH71fvn+D/AGT70ARTrP8A2hafvI8/Pj92fT/eqRluPtkf7yP/AFb/APLM+q/7VRzpN/aFp+9X+P8Ag9vrUjJN9sj/AHq/6tv4PdfegAK3H2xf3kefLP8AyzPqP9quT+I/h7Ute8NXB0iRBq+mtDqGnFUIPnxMxC9f4huX/gVdYUm+2L+9X/Vn+D3HvQqT/bJP3q/6tf4PdvegDH8IeI08XeH7TW7GSMJdW6M8ZjOYnBYOh56qwI/CrOmLN/bms4kjz50WfkPP7pfeuL0KGXwR8XdQ0EME0rxMralYts+WO6X/AF0Q543AbwPY4rs9MSb+3NZxIufOiz8nX90vvQBowrcebP8AvI/vj/lmf7q/7VJbrP5TfvI/vv8A8sz/AHj/ALVEKTebP+9X74/g/wBlfei3Sby2/er99/4P9o+9ABbrceU37yP/AFj/APLM/wB4/wC1RbLP9ljxJH90f8sz/wDFUW6TeU371f8AWP8Awf7R96LZJvssf71fuj+D/wCvQBBYrP8A2Hb4kjx9mX/lmf7o96llWf8As5/3kePKP/LM+n+9UVik39h22JVx9mX+D/ZHvUsqTf2c/wC9XHlH+D2+tADrpbj7LJmSP7v/ADzP/wAVRcrceUMyR/6xP+WZ/vD/AGqLpJvssmZV+7/c/wDr0XKTeUMyr/rE/g/2h70AUNeE/l2G6SM/6fDjCHru+taEy3HmwfvI/wDWH/lmf7rf7VZ+vJMI7DdIp/0+HHyf7X1q/Mk3mwfvV/1h/g/2W96ACZbjzYP3kf8ArD/yzP8Adb/apWW4+2R/vI/9W3/LM+q/7VJMk3mwfvV/1h/g/wBlvehkn+2R/vV/1bfwe6+9ACstx9sj/eR/6tv+WZ9V/wBqolWf+1ZP3kefIT/lmf7zf7VSMk/2yP8Aer/q2/g9196jVJv7Vk/ernyE/g/2m96AJlW4+0v+8j+4v/LM+p/2qSJbjzpv3kf3h/yzPoP9qhUn+0v+9X7i/wAHufeiJJvOm/er94fwew96AFjW48yX95H9/wD55n+6P9qkhW4+f95H98/8sz/8VSxpP5kv71fv/wBz/ZHvSQpPiT96v3z/AAf/AF6AKehrP/Zh2yRgfaJ+sZ/57P71cgW48kYkj6n/AJZn1/3qp6Gkx004lUD7RP8Awf8ATV/erkCT+SP3q9T/AAe/1oAW3W4+zR4kj+4P+WZ9P96o9s/9nf6yPHlf88z6f71Pt0n+zx/vV+4P4Pb60zZN/Z3+tX/Vf3Pb60AF+s/9nz5kjxsP/LM+n+9Uky3Hlj95H99f+WZ/vD/aqK/Sb+z58yr/AKs/we31qSZJvLH71fvr/B/tD3oAJluPk/eR/fH/ACzP/wAVSyLceZF+8j+//wA8z/dP+1STJP8AJ+9X74/g/wDr0siT+ZF+9X7/APc/2T70AJItx50P7yP7x/5Zn0P+1VO6Wf8A4SDT8yR58qbH7s/7HvVyRJvOh/er94/wex96p3STf8JBp+ZVz5U2Pk/3PegC4y3H2yP95HnY3/LM+q/7VKq3H2l/3kf3F/5Zn1P+1TWSb7XH+9X7jfwe6+9OVJ/tL/vV+4v8HufegBFW4+2SfvI8+Wv/ACzPq3+1SxrceZL+8j+//wA8z/dH+1TVSb7ZJ+9X/Vr/AAe7e9OjSfzJf3q/f/uf7I96AIbRZ/tN7iSP/XjP7s/880/2qmhW42H95H99v+WZ/vH/AGqhtEm+032JV/14z8n/AEzT3qaFJ9h/er99v4P9o+9ACWy3HlHEkf8ArH/5Zn+8f9qktVuPsseJI/u/88z/APFUWyTeUcSr/rH/AIP9o+9Fqk32WPEq/d/uf/XoArXKz/8ACOzfvI8fZW/5Zn+59aSzWf8A4RqDEkePsi/8sz/c+tLcpN/wj0371cfZW42f7H1ptmk3/CNQYlXH2ReNn+x9aALdytx9lk/eR/d/55n/AOKpbhbjyh+8j/1if8sz/eH+1SXKTfZZP3q/d/uf/XouEn8ofvV/1ifwf7Q96AFuFuPKGZI/vp/yzP8AeH+1UV4s/n2eZI/9fx+7P9xvepLhJvKH71fvp/B/tD3qK8Sbz7PMq/6/+5/sN70ASzLP5sGZI/vn/lmf7rf7VKy3H2yP95H/AKtv+WZ9V/2qSZJvNg/er98/wf7Le9DJP9sj/er9xv4PdfegBWW4+2R/vI/9W3/LM+q/7VIFuPtjfvI/uD/lmfU/7VDJP9sj/er/AKtv4PdfegJN9sb96v3B/B7n3oApWYceK7/zCrH7NDyox/E/vWxWPZhh4rv97Bj9mh5Ax/E9bFAHLXXgiK61saib11Ya3HrGzyxjclmLby856YG7PrxWno+hJpOpa1eJO0p1a8W6ZSuPLIhji2j14jz+Nc5rfjfXrC812XTvDkN3pfh5wL2d77ZLMvkRzN5SbCCyrJyGYA4GDknGTrnxjt7HVb6LTjoj2umojTjUNYS1uLndGsmIIip3YVl5YqC2VHQmgDduvAdzJqV0bHxNqNhpV9dC7ubC3VFLSZBbZNjeisVBIB7nBGagHw2JkWxfxBev4dW8+2DRzFHt3eZ5oQy43GMPzt9sZxU+geNr7xP4ourTSNLg/seyMJmv5roiSRZrZJkKRhDyN4BBYcYIJ5Ap+MPiJd+HvFA0ezs9LDC1W5Emraj9iW6JLDyoWKMrONvO4gDcKAB/hjIZFt08SXi6TFqq6rBp/kR7Y5Rceeyl8bmUtuwCeN2ecCtI+BYT4a1DR/tz7b7Vm1MyeWMozXQuNmM8jI25/GsHxF8W00nXLzT7ZdFjbTYY5bxNT1mO1lkZ0EnlwLht7BSPmJC5OM960p/HOq6pfyQeCNFt9VjtbOC9uJLq8NvuEyl44owEbLlRnLYUZHNAE3/CC31udU/svxNeWIvNROowCOFCIZGB8xWB4lRs/dbpgYNafhHwrD4U0+6hS5a6uL26a7upzEkQeRgqnaiAKowqjA9MnJNYGo+PtZR9Xu9I8Ox3GlaDxqUk955c7MI1kkSFArKxRWGcsATkA96r6p8TdShbXrnR9Bgu9K8PrFPd3Ut6Y3mheBJv3SbD8wVzwxA4HOTgAHo1Feb+NvGOty6X4qtfC+mCS30nT3F1f/bDDNHK8HmDyVCnJRWRiSy9cDkV3eiyPLoNhJKzO720bMzHJYlRkk0AZl/4z0qx8Xab4b3tPqN9IyFIhkW+InlBkPRchDgdT1xgE1Q1v4hW+jahfRjSNQvbHS9o1TULcRmOyLKH5UsHbCMGbaDgEfSn+KbWWXxl4Llggd0i1Od5nRCQgNlOoLEdOSBk+oFcl4ge60m38feH00vUby98SSO+mNBZySRS+daxwHdIBsQIyEncR8uD3oA6nWPiJbaTfXqx6Tf32n6YF/tPUbbyzFZ7lD8gsGfCMGbaDgEfSq3xlYP8F/EjKQVNnkEd/mFcxqMV34d0Xxr4VGm6jfX2vD/iWvBZySRTebaRQHdIBtQIyEncR8uD3rX+L2mSQfBTV1+2zqLXTVjaNNuyXBUZOQT+RFAHbwwv/ZNr/pEn3Yuy+q+1T3EL+UP9Ik/1idl/vD2qpDZv/ZVqftlx92LjK+o/2anuLNxGP9NuT86d1/vD/ZoAknhfdD/pEn+s9F9D7Us0L+ZB/pEn3z2X+6faoprNw0X+m3H3/VfQ/wCzRLZv5kH+m3P3z3X+6f8AZoAJ4X/tC0/fyfx9l9PpUjQv9sj/ANIk/wBW3ZfVfaq09m/2+1H2y45385Xjj/dqRrN/tcY+23H3G7r6r/s0ASmF/ti/6RJ/qz2X1HtQsL/bJP8ASJP9WvZfVvaojZv9sUfbbn7h5yvqP9mlWzf7ZIPttx9xe6+rf7NAHL/Ebw3qGueHpZNEnf8AtrS3i1DTSQvM0ZYheg+8Ny+nzc1J8P8AX4PF9jd61YzSoly0ReMhd0cgiUOjcdVYEfhXSLZv9rkH224+4vdfVv8AZrzPR0Hgz4yappRuZbfR/EcoltmBUBL4RqzoeMDzFYsPUrgUAeoQwv5s/wDpEn3x2X+6vtRbwv5bf6RJ99+y/wB4+1RRWbmWf/Tbj747r/dX/Zot7NzG3+m3I+d+6/3j/s0AS28L+U3+kSf6x+y/3j7UW0L/AGWP/SJPujsv+FRW9m5ib/TbgfO/df7x/wBmi2s3NrH/AKbcD5fVf/iaAG2MTnQ7Y+fIP9GXjC/3R7VLLC/9nP8A6RJ/qj2X0+lVbG0c6Jbn7ZcD/R1OAVwPlHtUstm/9nsftlx/qjxlfT/doAnuoXFrJ/pEn3fRf8KLmFxEP9Ik/wBYnZf7w9qiubNxayf6bcn5e5X/AOJouLNxEP8ATbk/Ondf7w/2aAKuvROI7DM8h/0+EchePm+lX5oX82D/AEiT/WHsv91vaszXLR1Swzdztm+hHJXj5uvSr8tm/mwf6bcffPdf7p/2aAJJoX82D/SJP9Yey/3W9qGhf7ZH/pEn+rbsvqvtUUtm/mwf6bcffPdf7rf7NK1m/wBrjH224+43dfVf9mgCRoX+2R/6RJ/q27L6r7VGsL/2tJ+/k/1Cc4X+83tQ1m/2uP8A024+43dfVf8AZqNbN/7VkH2y4/1Kc5XP3m/2aALKwv8AaX/0iT7i9l9T7URQv503+kSfeHZfQe1Rizf7Q/8Aptz9xe6+p/2aSOzfzpv9NufvDuvoP9mgCaOF/Ml/0iT7/ov90e1JDC+JP9Ik++ey/wCFRx2T+ZL/AKbc/e9V9B/s0kNm53/6bcffPdf/AImgCDQ4nOmnE8g/0ifoF/56v7VcghfyR/pEnU9l9fpWfolo7aaSLu4X/SJxgFf+er+1W4LNzCP9Nuep7r6/7tAE1vC/2eP/AEiT7g7L6fSo/Jf+zv8Aj4k/1Xovp9KSCzc28f8AptyPlHdfT/dqP7G/9n5+2XH+q6ZX0/3aAJL+Fxp8/wDpEh/dnsvp9Kkmhfyx/pEn317L/eHtVe+s3Gnzn7ZcH5DwSvp/u1JNZv5Y/wBNufvr3X+8P9mgCSaF/k/0iT747L/hSyQv5kX+kSff9F/un2qGazf5P9Nufvjuv/xNLJZv5kX+m3P3vVf7p/2aAJJIX86H/SJPvHsvofaqd1E//CQaePPk/wBVNzhePue1TyWb+dD/AKbc/ePdfQ/7NU7q0ca/YL9ruDmKbnK5H3PagDQaF/tkf+kSfcbsvqvtTlhf7S/+kSfcXsvqfaoWs3+1oPttz9xu6+q/7NKtm/2h/wDTbn7i919T/s0APWF/tkn+kSf6tey+re1OjhfzJf8ASJPv+i/3R7VCtm/2yQfbbj7i919W/wBmljs38yX/AE25+/6r/dH+zQAlpC/2m+/fyf68dl/55p7VNDC+w/6RJ99uy/3j7VUtbNzc3v8AplwMTgcFef3af7NTQ2blD/ptz99u6/3j/s0APtoXMR/0iT/WP2X+8fai1hf7LH/pEn3fRf8ACo7ezcxH/TbgfO/df7x/2aS2s3NrH/ptwPl9V/8AiaAI7mJ/+EemPnyH/RW4wv8Ac+lNs4n/AOEagPnyD/RF4wv9z6Uy5tHHh+Zvtdwf9FY4yuPufSktLRz4bgb7XcAfZFO0Fcfc6dKAL9zC/wBlk/0iT7vov+FFxC/lD/SJP9YnZf7w9qiubNxayf6bcn5fVf8A4mi4s3EQ/wBNuD86d1/vD/ZoAluIX8of6RJ99Oy/3h7VFeRP59n/AKRJ/r/Rf7je1LcWbiIf6bcn507r/eH+zUV3ZuJrP/TLg5m7lePkb2oAszQv5sH+kSffPZf7re1DQv8AbI/9Ik+43ZfVfaoprNxLB/ptz9891/un/ZpWs3+1xj7bc/cbuvqv+zQBI0L/AGyP/SJP9W3ZfVfagQv9sb/SJPuDsvqfao2s3+1xj7bcfcbuvqv+zSCzf7W3+m3P3B3X1P8As0AV7NSviu/Bdn/0aHlsf3n9K2KxbCMxeKtQVpHkP2aE7nxnq/oK2qAPPJ/BOqa5r3ixLjWr7TdI1O+jWa1ijjIu4fsdujFXILJkh0JHULxjGa0b3wFcjUL2Xw54kvdCtdR2fbLa2hjcFlQR742YZjYoqjIz90HGea7KigDE0Pw1HoeraxfR3Us51SWGRll5KeXAkQ+bOWJCZJPc1n+J/B19r91M9p4jurC1uoBBc2bW8dxC4GfmRZAdj/NgkcHAyOK6uigDiZPh3LZzyN4X8R32hxXNvDb3ccUccvmiKMRo6swykmwBdw9BxkVPqngW4n1Oa+0PxFfaPLeW0drfGNEmNwqAhXy4JWQBiN49uOK6+igDhr74a+c99Bp3iHULDTNVVV1KzASU3GIxGzCRwWRnRQGbJz14PNW7nwBazab4rsortoYvEcSxELGD9mVbZYBt554QHtXXUUAcTr3w6fVZtTOneILzSoNYthBqMEMSOs5Eflq4LDKHbhTg8gDoea6+ythZafb2obeIIljDEYzgYz+lT0UAFFFFABXD/Gf/AJIz4l/68z/6EK7iuH+M/wDyRnxL/wBeZ/8AQhQB00Nun9k2vMn3Yv8Alq3qvvU9xbp5Q+aT/WJ/y1b+8PeoIbdP7JteZPuxf8tW9V96sXNugiX5pP8AWJ/y1b+8PegBJrdN0XzSf6z/AJ6t6H3pZrdPMg+aT75/5at/dPvRPbpuh+aT/Wf89W9D70TW6ebB80n+sP8Ay1b+6fegCKe3T+0LTmT+P/lq3p9aka3T7ZH80n+rb/lq3qvvUc9un9oWnMn8f/LVvT61K1un2yPmT/Vt/wAtW9V96AENun2xfmk/1Z/5at6j3oW3T7ZJ80n+rX/lq3q3vQbdPti/NJ/qz/y1b1HvSrbp9sk+aT/Vr/y1b1b3oAFt0+2SfNJ/q1/5at6t71xviXwfD4wsPEOmea8F0k8M9jc72zb3CRKY5AfY8euCa7JbdPtknzSf6tf+Wrere9Z+mQIdc1kEycTRf8tG/wCeS+9AGN8OfELeKPD8p1RJLbWrGb7LqdqZWBinUAE4z91sbgemD7V1Fvbp5TfNJ/rH/wCWrf3j71514qSPwH47j8aqsi6Rfsmn66Vdv3fC+Rcnn+EkoT6MK9FtYI3gLK8hBdiCJWwRuPvQAW9unlN80n33/wCWrf3j70W1un2WP5pPuj/lq3+NFvbp5TfNJ99/+Wrf3j70W1uhtY/mk+6P+Wrf40AQWNuh0O3OZP8Aj2X/AJat/dHvUstun9nOcyf6o/8ALVvT61FY26HQ7c5k/wCPdf8Alq390e9Sy26f2c5zJ/qj/wAtW9PrQA66t0FrJ80n3f8Anq3+NFzboIh80n+sT/lq394e9LdW6C1k+aT7v/PVv8aS5t0EQ+aT/WJ/y1b+8PegChr0CLHYYMnN/COZGP8AF9avzW6ebB80n+sP/LVv7re9UNegRY7DBk5v4RzIx/i+taE1unmwfNJ/rD/y1b+63vQAk1unmwfNJ/rD/wAtW/ut70rW6fbI/mk/1bf8tW9V96Sa3TzoPmk/1h/5at/db3pWt0+2R/NJ/q2/5at6r70ADW8f2yP5pP8AVt/y1b1X3qJbdP7VkGZP9Qn/AC1b+83vUrW6fbI/mk/1bf8ALVvVfeolt0/taQbpP9Qn/LVv7ze9AEy26faX+aT7i/8ALVvU+9JFbp503zSfeH/LVvQe9Ktun2l/mk+4v/LVvU+9JFbp503zSfeH/LVvQe9ACx26eZL80n3/APnq390e9JDbph/mk++f+Wrf40sdunmS/NJ9/wD56t/dHvSQ26Yk+aT75/5at/jQBT0OBDppJMn/AB8T9JGH/LZ/erkFunkj5pOp/wCWrev1qnocCHTSSZP+PifpIw/5av71ct7dPJHzSdT/AMtW9frQAtvbp9mj+aT7g/5at6fWo/s6f2dndJ/qv+eren1qS3t0+zR/NJ9wf8tW9PrUf2dP7OzmT/Vf89W9PrQAX9ug0+f5pPuH/lq3p9afNbp5Y+aT76/8tW/vD3pl/boNPnOZPuH/AJat6fWnzW6eWPmk++v/AC1b+8PegAmt0+T5pPvj/lq3+NLJbp5kXzSff/56t/dPvSTW6fu/mk++P+Wrf40slunmRfNJ9/8A56t/dPvQAklunnQ/NJ94/wDLVvQ+9U7qBB4g08ZkwYpv+Wjf7HvVyS3Tzofmk+8f+Wreh96p3UCDxBp4zJzFN/y0b/Y96ALbW6fbI/mk+43/AC1b1X3py26faX+aT7i/8tW9T70jW6fbI/mk/wBW3/LVvVfelW3T7S/zSfcX/lq3qfegBq26fbJPmk/1a/8ALVvVvenR26eZL80n3/8Anq390e9NW3T7ZJ80n+rX/lq3q3vTo7dPMl+aT7//AD1b+6PegCG0t0Nze8ycTj/lq3/PNPepobdNh+aT77f8tW/vH3qG0t0NzfcycTj/AJat/wA8096mht02H5pPvt/y1b+8fegBttboYj80n+sf/lq394+9FrbobWP5pPu/89W/xpba3QxH5pP9Y/8Ay1b+8fektbdDax8yfd/56t/jQBWubdP+EemOZM/ZW/5at/c+tNs4EPhqA5kz9kU/6xv7n1p1zboPDsxzJ/x6t/y1b+59aSzgQ+GoDmT/AI9FP+sb+59aALVzbp9lk+aT7v8Az1b/ABouLdPKHzSf6xP+Wrf3h70tzbp9lk+aT7v/AD1b/Gi4t08ofNJ/rE/5at/eHvQAXFunlD5pPvp/y1b+8Peoby3QT2fMn+v/AOerf3G96muLdPKHzSffT/lq394e9Q3lugns+ZOZ/wDnq39xvegCWa3TzYPmk++f+Wrf3W96VrdPtkfzSf6tv+Wreq+9JNbp5sHzSffP/LVv7re9K1un2yP5pP8AVt/y1b1X3oARrdPtkfzSf6tv+Wreq+9At0+2N80n3B/y1b1PvStbp9sj+aT/AFbf8tW9V96Bbp9sb5pPuD/lq3qfegCjZoE8V34XcR9mh+8xP8T+tbFY9mgTxXqAXcR9mh+8xP8AE/rWxQAUUUUAFFFFABRRRQAUUUUAFFFFABRRXlXjb4ganoXifUrO31S2tbi0Fv8A2fpj2vmDUfMA+/Ln91825RyMY3HINAHqtcP8Z/8AkjPiX/rzP/oQqjrXiXxG6eLNX0a8toLPws7J9iktt/2wxwJPJufIK8PtXHQjJz0p3xh1Wyl+C+t5uYo5LrTxJFE7gOwJU8DqaAOyhtoP7Jtf3Ef3Yv4B6rVi5tbcRLiCP/WJ/AP7wrLhvtG/su2H2mw3bYs/vE9Rmp7i+0UxjbdWH306SJ/eFAFye1t90X7iP/Wf3B6GlmtbfzYP3Ef3z/AP7pqlNfaKWixdWH3+cSJ6GiW+0UyQ4urDG/n94n900AWJ7aD+0LQeTHj58/IPSpGtbf7ZH+4jx5bfwD1Ws+a+0Y31sVubHaN+4iRMDipGvtF+1Rn7VYY2Nn94nqtAFw2tv9sX9xHjyz/APUUq2tv9sk/cR/6tf4B6tVI32i/a1P2qw27D/wAtE9RQt9ov2pz9qsMbFx+8T1agC6trb/bJP3Ef+rX+AerVn6ZbwHXNZBhjIE0WAVHH7paet9ov2pz9qsMbFx+8T1aqOnXmkLrOrNJcWQRpY/LLOmCPKXOPxoA0b3RdO1ew1DTtQs4ZrW5BilQoOVKAH6Vxnwzkk0ea+8B66UnvdG+eyuZFG68smYhH+qkFG9MD1rsIr7RfNmzdWGN4x+8T+6K4j4gWFvJa2ninwzcWLa9oMks0Vv5q4vYCT5kDDvuUZX0IGOtAHodva2/lN+4j++/8A/vGi2tbc2seYI/uj+AVheGfFHhzxD4btNWs7mzWK7UyBJHQOmWOVYdiOh+laNvfaKLZA11YA7ecyJQBLY20B0O3JhjJ+zqc7B/dFSy21v8A2c58iPPlH+AelZ1le6MNFgV7mxDi3UEGRM521LJfaL9gYC6sN3lHjzEznFAF66tbcWsmII/u/wBwUXNtbiIYgj/1ifwD+8Kp3N9optnC3VgTjjEiUXF9opjG26sM706SJ/eFADNet4FjsNsMYzfwg4UdN1aE1rb+bB+4j/1h/gH91qxNavNIdLHybiybF7EW2OnC55J9qvS32imSHF1YYDnP7xP7poAuTWtv5sH7iP8A1h/gH91qVrW3+2R/uI/9W38A9VqlLfaKZYcXVhgOc/vE/umhr7RftUZ+1WGNjZ/eJ6rQBda1t/tkf7iP/Vt/APVaiW2t/wC1pB5MePIT+Af3mqu19on2qM/arDGxs/vE9Vpi32jf2nIftNjt8lQD5iYzlqANFbW3+0v+4j+4v8A9TSRWtv5037iP7w/gHoKpi+0T7Q5+1WGNq4/eJ6miO+0XzZc3VhjcMfvE9BQBdjtbfzJf3Ef3/wC4P7opIbW3/efuI/vn+AVTjvtE3y5urD73H7xPQUQ32ijfm6sPvnGZEoANDtoG00loYyftE/VB/wA9nq5Ba2/kjMEfU/wD1rI0a90dNPImubFW8+Y4aRM481sfpircF9ogiG66sM5PWRPWgC7b2tv9mjzBH9wfwD0qP7Nb/wBnZ8iPPlf3B6VWgvtEFvHuurDO0ZzInpTPt2i/YMfabDd5XTzEznFAFy/trcafPiCMHYf4B6U+a1t/LH7iP76/wD+8KoXt9opsZglzYFthwBImelPlvtFKDF1YfeXpInqKALk1rb/J+4j++P4BSyWtv5kX7iP7/wDcH901SmvtEOzF1YffGcSJRJfaJvixdWH3uf3iehoAuSWtv50P7iP7x/gHoap3VtAPEGngQx4MU2RsHP3KJL7RfOixdWGNxz+8T0NVLm90c67YstzYmMRTbiJEwD8mM/rQBrta2/2yP9xH9xv4B6rSra2/2l/3Ef3F/gHqaotfaL9qQ/arDGxs/vE9VpVvtE+0OftVhjav/LRPU0AW1tbf7ZJ+4j/1a/wD1anR2tv5kv7iP7/9wf3RVFb7RftUh+1WGNi4/eJ6tSx32ib5c3Vh97j94noKAJ7S2tzc32YY+Jxj5B/zzSpobW32H9xH99v4B/eNZtrfaMLi8LXNiAZgVzInI8tOn45qWG+0QIc3Vh95usiepoAt21rb+UcwR/6x/wCAf3jRa21ubWPMEf3f7gqnb32iiM7rqwzvfrIn940W19ootow11YA45zIlAD7m2gHh2Y+THn7KxzsH9ym2dtAfDUBMMefsinOwf3KrXF7o50GVVubHzPsxAAkTOdv86baXujjw9CrXNiJPsqggyJnOz+dAGtc2tuLWT9xH93+4KLi1txEP3Ef+sT+Af3hVO4vtFNs4W6sCdvGJEonvtFMYxdWGd6dJE/vCgC7cWtv5QxBH99P4B/eFQ3ltAJ7PEMfM/PyD+41QT32imMbbqwzvXpIn94VHd3ujGa023NiQJstiROBsbr+lAGhNa2/mwYgj++f4B/dala1t/tkf7iP/AFbfwD1WqUt9opkhxdWGA/OJE/umhr7RftSH7VYY2Nn94nqtAF1rW3+2R/uI/wDVt/APVaQWtv8AbG/cR/cH8A9TVNr7RftSH7VYY2Nn94nqtAvtF+1MftVhjYP+WiepoASzRI/FeoCNVUfZoeFGP4nrYrD0yW2m8T6g1k8Tx/ZoRmIgjOX9K3KACiiigAooooAKKKKACiiigAooooAK4DXPA2t3lx4gs9K1DTo9K8SndfG7t3kngJiWJvLIYKRtQEbvunPXpXf0UAee6p4B1p/7Y0zQ9Us7fRdfVRf/AGiJ3uY/3SwyGNgQpLoi8sODk89Kk+MVrDD8FPEEccahYbEInH3QCoArvq4f4z/8kZ8S/wDXmf8A0IUAb0MOl/2Va/urPO2LPyr6ip7iDSvLGIrP76dFX+8KWG5j/sm15b7sX8B9V9qsXNzGYl+9/rE/gP8AeHtQBWmg0rdFiKz+/wA/KvoaJYNK8yHEVnjfz8q/3TVie5jLRfe/1n9w+h9qWa5j82Dlv9Yf4D/dPtQBSnh0v7da4itMfPn5V9KkaDSvtcf7qzxsbPyr6rUk9zH/AGhaH5uN/wDAfT6VI1zH9sj5b/Vt/AfVfagCuYNK+1r+6s8bD/CvqKFg0r7XJ+6s8bF/hX1arBuY/tinLf6s/wAB9R7Uq3Mf2yT73+rX+A+re1AFZYNK+1P+6s8bF/hX1aqGnQ6ada1cPHalBLHsyq4A8pen41sLcx/bJPvf6tf4D6t7Vn6ZPGNc1kndgzRY+Q/88l9qAJ4oNK82bMVnjeMfKv8AdFEEGleW2YrP77dVX+8asQ3Mfmz8t98fwH+6vtRb3MflN9777/wH+8fagDy2f+z/AIY+Lmvmggfwlr1032o7VYaZdlsCT/ZifgHspGeM4PpNrFpLWkbeXZnKg52pzS3EFhquk3NhqVutza3HmRywyREq6ljkEYrz/wAMa3J8O9dt/CGvTTSaFen/AIkOpTZPln/nzkY9x/AT1HHsADubKHTDotuWitN/2dc5Vc52ipZINL/s9sRWe7yj/CvpT7G4jGhW4+bP2Zf4D/dHtUstzH/ZzjLf6o/wH0+lAENzBpX2aTbFZ5x2VaLiDSvLG2KzzvToq/3hVi6uYzayct93+4f8KLm5jMQ5b/WJ/Af7w9qAMjW4dNCWPlR2ozfQhtqr0zzn2q/LBpXmQYis8bzn5V/umoNeuI2jsMbuL+E/cP8Ae+laE1zH5sH3v9Yf4D/db2oArSwaV5sGIrPG85+Vf7poaDSvtcf7qzxsbPyr6rVia5j82D73+sP8B/ut7UrXMf2yP73+rb+A+q+1AFZoNK+1x/urPGxv4V9VqNYdL/tSQeVabfJXHyrjO5qutcx/bI/vf6tv4D6r7VEtzH/ash+b/UJ/Af7ze1ADBBpX2h/3VnjYv8K+ppI4NK86bMVnjcMfKvoKtLcx/aX5b7i/wH1PtSRXMfnTct94fwH0HtQBXjg0rzJcxWf3uPlX0FJDBpWHzFZ/fP8ACtWo7mPzJfvff/uH+6PakhuY8Sfe++f4D/hQBl6LDph04+bHaFvPm+8q5x5rY/SrkEGleUMxWfU/wr61HodxGumkHd/x8T/wH/nq/tVyC5jEI5bqf4D6/SgCvBBpX2ePMVnnaM5VfSmeTpf9n/6qz3eV/dX0q5b3MYto+W+4P4D6fSo/tMf9nY+b/Vf3D6fSgCtew6WLCbbFZ52HGFX0qSWDStgxFZ/eX+Ff7wqW/uYzp8+C33D/AAH0+lPmuY/LHLffX+A/3h7UAVpoNK+TEVn98fwrSyQaV5kWIrP73Pyr6GrE1zH8nLffH8B/wpZLmPzIuW+//cP90+1AFWSDSvOixFZ43HPyr6GqlzDpv9vWAWO12GKbcAq4/gxmtSS5j86HlvvH+A+h9qp3VxGfEGnn5sCKb+A/7HtQA9oNK+1p+6s8bG/hX1WlWDSvtD/urPG1f4V9TVhrmP7ZHy33G/gPqvtSrcx/aX+99xf4D6n2oAqrBpX2uT91Z42Lj5V9WpY4NK3y5is/v8fKvoKnW5j+2SH5v9Wv8B9W9qdHcx+ZLy33/wC4f7o9qAKNrDpZuLzdFaYEw25Venlp/wDXqWGDSthzFZ/eb+FfU0+0uYxc3v3uZx/Af+eae1TQ3Mew8t99v4D/AHj7UAVbeDSvLO6Kzzvfqq/3jRbQaV9mj3RWedvOVWrFtcxiI/e/1j/wH+8fai1uYxax/e+7/cP+FAGdcQ6Z/YEpEdpv+zHBCrnO2ktIdMPh2EtHab/sq5JVc52VZubiP/hHZh82fsrfwH+59KbZ3EY8NQD5s/ZFH3D/AHPpQA+4g0r7LJiKzzt7KtE8GleUMRWed6dFX+8KsXNzH9lk5b7v9w/4UXFzH5Q+9/rE/gP94e1AFeeDSvKGIrPO9Oir/eFRXcOl+dabYrTHnc4VemxqvXFzGYhy330/gP8AeHtUN5cRmez+9xP/AHD/AHG9qAGSwaV5kOIrP7/Pyr/dNDQaV9qT91Z42N/CvqtWJrmPzYOW++f4D/db2pWuY/tkf3v9W38B9V9qAKzQaV9rT91Z42N/CvqtAg0r7W37qzxsH8K+pqy1zH9sj5b/AFbfwH1X2pBcx/bG5b7g/gPqfagDP05YE8UagLVY1T7NDxGABnL+lbdY9m4k8V6gVzj7ND1BH8T1sUAFFFFABRRRQAUUUUAFFFFABRRRQAUUU1pY0dUZ1Vn+6pOC30oAdXD/ABn/AOSM+Jf+vM/+hCu2aWNZFRnUO33VJ5P0FcT8Z/8AkjPiX/rzP/oQoA6aG4T+ybX5ZPuxf8sm9V9qsXFwnlD5ZP8AWJ/yyb+8Paq8M/8AxKbX91J92L+H3WrFxP8Auh+6k/1ifw/7QoAJ7hN0Xyyf6z/nk3ofaia4TzYPlk/1h/5ZN/dPtSTz/NF+6k/1n932NLNP+9g/dSffP8P+yaAIp7hP7QtDtk/j/wCWTen0qRrhPtkfyyf6t/8Alk3qvtUc8/8AxMLT91J/H/D7VI0/+mR/upP9W/8AD7rQAG4T7Yvyyf6s/wDLJvUe1Ktyn2yT5ZP9Wv8Ayyb1b2pDP/pi/upP9Wf4fcUqz/6ZJ+6k/wBWv8Pu1AAtyn2yT5ZP9Wv/ACyb1b2rP0ydBrmsnEnM0XSNv+eS+1aCz/6ZJ+6k/wBWv8Pu1Z+mTY1zWT5chzNF0Xp+6WgC/DcJ5s/yyffH/LJv7q+1FvcJ5TfLJ99/+WTf3j7UQz/vZ/3Un3x/D/srRbz/ALpv3Un33/h/2jQAW9wnlN8sn33/AOWTf3j7Vm6vo+k+KPDb6Trlm11aToAyNE2VPZlOMhh2IrSt5/3TfupP9Y/8P+0aLaf/AEWP91J90fw0Aec+DPFN54buYPBfjO4kmllh36LqckZAvotv+qY4/wBanT/aGD9fRJbhP7OcbZP9Uf8Alk3p9Kw9Y8P6X4s8ERaXrNnJLE1ujRyKMPC4X5ZEb+Fh2P8ATiud8LeLr7SJm8FeN2k/tWOFv7O1F12pqsIHDAn/AJagYDL1780AegXVwn2WT5ZPu/8APJv8KLm4QxD5ZP8AWJ/yyb+8Pai6nzayfupPu/3aLmfMQ/dSf6xP4f8AaFAFDXp0aOwwJOL+E8xsP4vpWhNcp5sHyyf6w/8ALJv7re1Z+vTZjsP3cgxfwnlf9qtCaf8AewfupP8AWH+H/ZagBJrhPOg+WT/WH/lk391vala4T7ZH8sn+rb/lk3qvtSTT/vYP3Un+sP8AD/stStP/AKZH+6k/1bfw+60ADXKfbI/lk/1bf8sm9V9qiW4T+1ZDtk/1Cf8ALJv7ze1StP8A6ZH+6k/1bfw+61Es/wDxNpP3Un+oT+H/AGmoAmW4T7S/yyfcX/lk3qfakiuE86b5ZPvD/lk3oPalWf8A0l/3Un3F/h9zSRT/AL6b91J94fw+woAWO5TzJfll+/8A88m/uj2pIbhMSfLJ98/8sm/wpY5/3kv7qX7/APd/2RSQz8P+6k++f4aAKehzoumkESf8fE/SNj/y1f2q5BcJ5I+WTqf+WTev0qnoc2NNP7uQ/wCkT9F/6bPVyCf9yP3UnU/w+9AC29wn2aP5ZPuD/lk3p9Kj+0J/Z2Nsn+q/55N6fSpLef8A0aP91J9wfw+1R+f/AMS7/VSf6r+77UAF/cIdPn+WT7h/5ZN6fSnzXCeWPlk++v8Ayyb+8PamX8+dPn/dSfcP8PtT5p/3Y/dSffX+H/aFABNcJ8nyyffH/LJv8KWS5TzIvll+/wD88m/un2pJp/ufupPvj+Glkn/eRfupfv8A93/ZNACSXCedD8sn3j/yyb0PtVO6uEPiDTztk4im/wCWbf7HtVySf99D+6k+8f4fY1Tupv8AioNPPlycRTcbf9ygC41wn2yP5ZPuN/yyb1X2pVuU+0v8sn3F/wCWTep9qRp/9Mj/AHUn3G/h91pVn/0l/wB1L9xf4fc0ANW4T7ZJ8sn+rX/lk3q3tTo7lPMl+WT7/wDzyb+6PamrP/pkn7qT/Vp/D7tTo5/3kv7qT7/93/ZFAENpcILm9+WTmcf8sm/55p7VNDcJsPyyffb/AJZN/ePtUNpP/pN7+6k/14/h/wCmaVNDP8h/dS/fb+H/AGjQA22uEER+WT/WP/yyb+8fai1uEFrH8sn3f+eTf4UW0+Ij+6k/1j/w/wC0aLWfFrH+6k+7/doArXNwn/COzDEn/Hq3/LJv7n0pLO4QeGoBtk/49FH+rb+59KW5m/4p2YeXJ/x6tzt/2KSzmx4agHlyf8ei87f9igC1c3CfZZPlk+7/AM8m/wAKLi4Tyh8sn+sT/lk394e1FzP/AKLJ+6k+7/douJ/3Q/dSf6xP4f8AaFAC3FwnlD5ZPvp/yyb+8Paoby4Qz2fyyf6//nk39xvaprif90P3Un30/h/2hUN5Pmez/dSf6/8Au/7DUASzXCebB8sn3z/yyb+63tStcJ9sj+WT/Vt/yyb1X2pJp/3sH7qT75/h/wBlqVp/9Mj/AHUn+rb+H3WgAa4T7ZH8sn+rb/lk3qvtSC4T7Y3yyfcH/LJvU+1K0/8Apkf7qT7jfw+60gn/ANMb91J9wfw+5oApWbh/FeoFQwH2aH7ykfxP61sVj2b7/FeoHay/6NDwwx/E9bFABRRRQAUUUUAFFFFABRRRQAUUUUAFeG+JrS71nVvHGr32iaffW+iXIX7RcXDR3lvBFbxy4tWCkRMCWk3E4YtjoK9yrm9Y8BaDruqNfajBOXlCrcxRXUkcN2F+6Jo1YLJj/aB446cUAeeazYaZ4g0H4i+ItRgRtS0znTLyVR51mkVlFNEY26pl3LEDGSTmt74u390/wT1fzdPuHafTVeWZDGEiYlcggsG/IGuk1fwB4f1zVjqGoW87PJs8+GO6kjhudn3PNiVgsm3tuB9OlZnxn/5Iz4l/68z/AOhCgDoobub+yrUfYLj7sXO6P1H+3U9xdzGMf8S+5H7xP4o/7w/26bDJJ/ZNr+5P3Yv4h6rVi5kk8pf3J/1ifxD+8KAIZrubdF/xL7n7/wDej9D/ALdEt3N5kH/Evufvn+KPn5T/ALdSzySbov3J/wBZ/eHoaWaSTzYP3J/1h/iH900AVJ7uY39qfsFwMb+N0fPH+/UrXc32yM/2fc/cbjdH6r/t0s8kn9oWn7k/x/xD0qRpJPtkf7k/6t/4h6rQBEbub7Yp/s+5+4eN0fqP9uhbub7ZIf7PufuLxuj9W/26lMkn2xf3J/1Z/iHqKFkk+2SfuT/q1/iHq1AES3c32uQ/2fc/cXjdH6t/t1n6bcyjW9YIsbhi00eVDR5X90vX5v5VrLJJ9sk/cn/Vr/EPVqztMd/7c1nERP76LIyOP3S0AW4rubzZ/wDiX3P3x/FHx8q/7dEF3MI2/wCJfcn53/ij/vH/AG6lhkk82f8Acn74/iH91aLeSTym/cn/AFj/AMQ/vGgCG3u5vKb/AIl9yfnf+KP+8f8AbotruYWsf/EvuT8o53R//F1NbySeU37k/wCsf+If3jRbSSfZY/3J+6P4hQBSsbqYaHbgWFwR9nUbg0eD8o/2qy/F3h+y8YeFZNN1fS7kqFEkE6PGJLeQD5ZEbfkEf/WrasXk/sK3/dH/AI9l53D+6Kllkk/s5/3J/wBUf4h6UAcD4c8a6rp1wPCHj21ki10KRZ3gKLFqka/xqS2BJjG5ASe49u6uLuYxD/iX3I+dP4o/7w/26yvGvhex8YeHJdP1S2dShEtvcxOFltpR92RG7MP/AK1c94f8Zalp2o23g/x7GIddyv2O+UgQapGrD5kPaTH3k/EcGgDqNcuZWSwzY3CYvoSMtHz83Thqvy3c3mwf8S+5++f4o+flP+3VXXncx2GYiP8AT4e4/vVoTSSebB+5P+sP8Q/utQBDLdzebB/xL7n75/ij5+Vv9uhrub7XH/xL7n7jcbo/Vf8AbqWaSTzoP3J/1h/iH91qVpJPtkf7k/6tv4h6rQBC13N9rj/4l9z9xuN0fqv+3Ua3c39qSH7Bcf6lON0f95v9urTSSfbI/wByf9W38Q9VqJZJP7Wk/cn/AFCfxD+81AAt3N9pf/iX3P3F/ij9T/t0kd3N503/ABL7n7w/ij44H+3U6ySfaX/cn7i/xD1NJFJJ5037k/eH8Q9BQBFHdzeZL/xL7n7396P+6P8AbpIbuYb/APiX3J+c/wAUf/xdTxySeZL+5P3/AO8P7opIZJMSfuT98/xCgDO0S6lXTSBY3DD7RPyGj/56v6tVyC7mEI/4l9yeT/FH6/79QaG7jTDiIn/SJ/4h/wA9nq5bySeSP3J6n+IetAEUF3MLeP8A4l9yflH8Ufp/v1H9rm/s/H9n3H+q67o/T/fq1bySfZo/3J+4P4h6VH5kn9nf6k/6r+8PSgCG+u5jp84On3A+Q8lo+OP9+pJrubyx/wAS+5Hzr/FH/eH+3Tr+ST+z5/3J+4f4h6U+aSTyx+5P31/iH94UAQzXc3yf8S+5Hzj+KP8A+LpZLubzIv8AiX3P3v70f90/7dSzSSfJ+5P3x/EKWSSTzIv3J+//AHh/dNAEEl3N50P/ABL7n7x/ij9D/t1TurqU6/YN9huARFNhS0eT9z/arSkkk86H9yfvH+IehqndO/8AwkGn/ujnypuNw/2KAJmu5vtaH+z7n7jcbo/Vf9ulW7m+0P8A8S+5+4v8Ufqf9upWkk+2R/uT/q2/iHqtKskn2l/3J+4v8Q9TQBAt3N9sk/4l9z9xeN0fq3+3Sx3c3mS/8S+5+/8A3o/7o/26kWST7ZJ+5P8Aq0/iHq1Ojkk8yX9yfv8A94f3RQBTtbuYXN7/AKBcHM46NHx+7T/bqaG7m2H/AIl9yfnb+KP+8f8AbotJJPtN9+5P+vH8Q/55pU0Mkmw/uT99v4h/eNAEFvdzCI/8S+5Pzv8AxR/3j/t0W13MLWP/AIl9yfl6ho//AIupbaSTyj+5P+sf+If3jRaySfZY/wByfu/3hQBRubqY+H5l+w3AH2Vhu3R4+51+9TbS6lHhuBRY3BH2RRuDR4PydfvZqe5d/wDhHZv3Rx9lbncP7lNs3f8A4RqAeUcfZF53D+5QBNc3cxtZP+Jfcj5eu6P/AOLouLubyh/xL7kfOn8Uf94f7dS3Mkn2WT9yfu/3hRcSSeUP3J/1ifxD+8KAIri7mMQ/4l9yPnT+KP8AvD/bqK7upjPZ5sLgYm7tHz8jf7dW7iSTyh+5P30/iH94VDePJ59n+6P+v/vD+41ACTXcxlg/4l9yPnP8UfPyn/bpWu5vtcf/ABL7n7jcbo/Vf9upZpJPNg/cn75/iH91qVpJPtkf7k/6tv4h6rQBC13N9rj/AOJfc/cbjdH6r/t0C7m+1t/xL7n7g43R+p/26laST7ZH+5P+rb+Ieq0CST7Y37k/cH8Q9TQBn2EjSeKtQZ4XhP2aH5XKk9X9CRW1WRZknxZqG5dp+zQ8Z/2nrXoAKKKKACiiigAooooAKKKKACiiigAooooAK4f4z/8AJGfEv/Xmf/QhXcVw/wAZ/wDkjPiX/rzP/oQoA6eEzf2Ta/In3Yv4z6r7VYuWm8pfkT/WJ/Gf7w9qrwib+ybX50+7F/AfVferFyJvKX50/wBYn8B/vD3oAJ2m3RfIn+s/vn0PtRMZvNg+RP8AWH+M/wB0+1E4m3RfOn+s/uH0PvRMJvNg+dP9Yf4D/dPvQBFOZv7QtPkT+P8AjPp9KlZpvtkfyJ/q3/jPqvtUU4m/tC0+dP4/4D6fWpWE32yP50/1b/wH1X3oACZvti/In+rP8Z9R7UK032yT5E/1a/xn1b2oIm+2L86f6s/wH1HvQom+2SfOn+rX+A+re9AApm+2SfIn+rX+M+re1Z+mGX+3NZwiZ86LPzn/AJ5L7VoKJvtknzp/q1/gPq3vWfpgl/tzWcOmfOiz8h/55L70AaEJm86f5E++P4z/AHV9qLczeU3yJ/rH/jP94+1EIm82f50++P4D/dX3otxN5TfOn+sf+A/3j70AFuZvKb5E/wBY/wDGf7x9qS2M32WP5E+6P4z/AIUtuJvKb50/1j/wH+8fekthN9lj+dPuj+A/40AQWJl/sK2wiY+zL/Gf7o9qllM39nP8if6o/wAZ9PpUViJf7CtsOmPsy/wH+6PepZRN/Zz/ADp/qj/AfT60APujN9lk+RPu/wB8/wCFYnjTwvaeL/D7afqUSowkR7e5ikIltpQw2yI2OGFbd0JvssmXT7v9w/40XIm8oZdP9Yn8B/vD3oA8zt/F2saZrGleEPHsUa6r9riay1SP5bfU1DYyOPkk5G5fxHBFemTNN5sHyJ/rD/Gf7re1c34/8O2vifQbfTNVCtFNeRBZI12yRMSQHRs8MPWuetPE+u+CdbsNA8fzJc2E0nl2HiTZtSVsECO4GcJJ6N0b86APRZjN50HyJ/rD/Gf7re1DGb7ZH8if6tv4z6r7USiXzYPnT75/gP8Adb3oYTfbI/nT/Vt/AfVfegAZpvtkfyJ/q2/jPqvtUamb+1pPkT/UJ/Gf7ze1SMJvtkfzp/q2/gPqvvUaib+1pPnTPkJ/Af7ze9AEqmb7S/yJ9xf4z6n2pImm86b5E+8P4z6D2pVE32l/nT7i/wAB9T70kQm86b50+8P4D6D3oAWNpvMl/dp9/wDvn+6PakhabEnyJ98/xn/CljE3mS/On3/7h/uj3pIRN+8+dPvn+A/40AU9DMv9mHCIf9In6uf+ez+1XbdpvJHyJ1P8Z9fpVLQxL/Zhw6f8fE/VD/z2f3q7bibyR86dT/AfX60AFuZvs0fyJ9wfxn0+lR5m/s77if6r++fT6VJbib7NHh0+4P4D6fWo8Tf2d99P9V/cPp9aAC/M39nz5RP9Wf4z6fSpJjN5Y+RPvr/Gf7w9qjvxN/Z8+XT/AFZ/gPp9akmE3lj50++v8B/vD3oASczfu/kT74/jP+FLIZvMi+RPv/3z/dPtSTCb5PnT74/gP+NLIJvMi+dPv/3D/dPvQAkrTedD8ifeP8Z9D7VTujL/AMJDp/yJnypsfOf9j2q5IJvOh+dPvH+A+h96p3Ql/wCEg0/50z5U2PkP+x70AXGM32yP5E/1bfxn1X2pVab7S/yJ9xf4z6n2pGE32yP50/1bfwH1X3pVE32l/nT7i/wH1PvQAimb7ZJ8if6tP4z6t7UsbTeZL8iff/vn+6PakUTfbJPnT/Vp/AfVveljE3mS/On3/wC4f7o96AIbQzfab75E/wBeP4z/AM809qmhM2w/In32/jP94+1Q2gm+033zp/rx/Af+eae9TQibYfnT77fwH+8fegBLYzeUfkT/AFj/AMZ/vH2otWm+yx/In3f75/wothN5Rw6f6x/4D/ePvRaib7LHh0+7/cP+NAFW5Mv/AAjs3yJj7K38Z/ufSkszL/wjMGETH2Rf4z/c+lLciX/hHZvnTH2Vv4D/AHPrSWYl/wCEagw6Y+yL/Af7n1oAt3Jm+yyfIn3f75/wouDN5S/In+sT+M/3h7UXIm+yyfOn3f7h/wAaLgTeUPnT/WJ/Af7w96AC4M3lD5E++n8Z/vD2qK8Mvn2eUT/X/wB8/wBxvapbgTeUPnT76fwH+8PeorwS+fZ5dP8AX/3D/cb3oAkmM3mwfIn3z/Gf7re1Kxm+2R/In+rb+M+q+1Ewm82D50++f4D/AHW96GE32yP50/1bfwH1X3oAGM32yP5E/wBW38Z9V9qAZvtjfIn3B/GfU+1DCb7ZH86f6tv4D6r70ATfbG+dP9WP4D6n3oAo2ZY+LNQ3gA/ZYehz/E9a9ZFnuHiy/wB5BP2WHoMfxPWvQAUUUUAFFFFABRRRQAUUUUAFFFFABWRrvifS/DkumxanMUl1O8js7WNRlpJHIA49Bnk9vxFa9eNePYfFkWvw6ldaFp92n9uWMOmz/wBpFCkS3CFI9nlHaXcZZsn+Hg7RQB3Wt/EXRNA1aaxvkvnW18v7bdwWrSQWW/7vmuPu5BB74BBOM1S+M/PwZ8S/9ef/ALMK43xBrFto+nfEXw9q6Fdb8QMz6bZojO1351pHEojOPm2yKwJ7YzxXQfFuxvYPgjqqNfbVt9MWOaPyw3msNoJ3HkUAdzCJv7JtfnT7sX8B9V96sXIm8pfnT/WJ/Af7w96yobLUv7Ltj/a3G2LA+zLxyKnuLHUxGM6tn50/5dl/vCgC9OJt0Xzp/rP7h9D70TCbzYPnT/WH+A/3T71RmsdT3RZ1bPz8f6MvHBolstTEkOdWz8/H+jLx8poAszib+0LT50/j/gPp9alYTfbI/nT/AFb/AMB9V96zZ7LUhfWwOq5J34P2ZeOKkax1P7VGP7W52Nz9mX1WgC8RN9sX50/1Z/gPqPehRN9sk+dP9Wv8B9W96omy1P7Wo/tbnYefsy+ooWx1P7U4/tbnYvP2ZfVqALyib7ZJ86f6tf4D6t71n6YJf7c1nDpnzos/If8AnkvvTlsdT+1OP7W52Lz9mX1aqOnWeoNrOrKmp7WWWPe32dTv/dL27ccUAbkIm82f50++P4D/AHV96LcTeU3zp/rH/gP94+9UYrHU/Nmxq2PnGf8ARl5+UUQWWpmM41bHzt/y7L/eNAF63E3lN86f6x/4D/ePvSWom+yx/On3R/Af8apQWOpmM41bHzt/y7L/AHjSW9lqZtkxq2Bt6fZloAnsRL/YVth0x9mX+A/3R71LKJv7Of50x5R/gPp9azbKy1I6Nbsuq7V+zqQv2dTgbemalkstS+wMTq3HlHj7MvpQBoXQm+yyZdPu/wBw/wCNFyJvKGXT/WJ/Af7w96o3NjqYtnzq2Rjp9mWi4stTEYzq2fnT/l2X+8KAG68JfL0/Lof9PhxhD/e+tSa5pFvrunHTNXhgu7O5JSWGSM4YbT7/AIgjkHms/WrPUESx8zU/MzexBf8AR1G054NXpbHU/Mhzq2fnOP8ARl4+U0AcBK2v/CNLZbmebXvBsUmPPdC93pSYI5A/1sQHf7yj2Ar0Ow1CDV4rW/0u9t7u0nhZ4poRuVxlehBqKew1FniV9V3BnIwbZP7prhLn4da54TvLjUvhpqsVtcXG6WbSLiMCznOVzsX/AJZOfUccAEYoA9KYTfbI/nT/AFbfwH1X3qNRN/a0nzpnyE/gP95veuE8L+OJNf1kaNqt3caD4iijbzdMvrZAx6cxt0lU4JyOwziutWy1L+05B/a3zeSuW+zr0y3FAGmom+0v86fcX+A+p96SITedN86feH8B9B71SFjqf2h/+JvztXn7MvqaSOx1PzZcatg7hn/Rl54FAF+MTeZL88f3/wC4f7o96SETYk+dPvn+A/41SjsdT3y41f8Ai5/0ZeeBSRWOpnfjV8fOf+XZaAHaGJf7MOHQf6RP1Q/89n96u24m8kfOnU/wH1+tY2jWeovp5MeqbF8+YY+zqefNbJ/E81agsdTMQxq+OT/y7L60AX7cTfZo8On3B/AfT61Hib+zvvp/qv7h9PrVWCx1M28eNXwNo4+zL6VH9i1L7Bn+1uPK6fZl9KAL1+Jv7Pny6f6s/wAB9PrUkwm8sfOn31/gP94e9Zt7ZakLGYtq24bDkfZlGeKklsdT2DOr5+Zf+XZfUUAXZhN8nzp98fwH/GlkE3mRfPH9/wDuH+6feqE1jqY2Z1fPzj/l2WlksdT3xZ1f+Lj/AEZeODQBdkE3nQ/On3j/AAH0PvVO6Ev/AAkOn/OmfKmx8h/2PemyWOp+dFnVsnccf6MvHBqpc2eojXLFTqmXMc21vs6/L9zPHvQBssJvtkfzp/q2/gPqvvSqJvtL/On3F/gPqfeqDWOp/akH9rc7G5+zL6rSix1P7Q//ABN+dq8/Zl9TQBdUTfbJPnT/AFafwH1b3pYxN5kvzx/f/uH+6PeqC2Op/apB/a3Oxefsy+rUsdjqe+XGr/xc/wCjLzwKALFoJvtN986f68fwH/nmnvU0Im2H54/vt/Af7x96zLWy1I3F5t1XBEwBP2deT5ac/wCfSpYrHUyhxq+Pmb/l2X1NAF22E3lHDp/rH/gP94+9FqJvsseHT7v9w/41Rt7HUzGcatj53/5dl/vGi2sdTNtHjVsDb0+zLQBJciX/AIR2b50x9lb+A/3PrSWYl/4RmDDpj7Iv8B/ufWqdxZ6iNBlY6rlPsxJT7OvI29M0lrZ6ifD0LLqmE+yqQn2deBs6ZoA2LkTfZZPnT7v9w/40XAm8ofOn+sT+A/3h71RuLHUxbPnVsjb0+zLRPY6n5Yzq2fnT/l2X+8KAL1wJvKHzp99P4D/eHvUV4JvPs8un+v8A7h/uN71WnsdTEYzq2fnX/l2X+8KiurLUhNabtWyTNgH7OvB2NzQBpTCbzYPnT75/gP8Adb3pWE32yP50/wBW38B9V96oS2OpiSHOrZ+fj/Rl4+U0rWOp/akH9rc7G5+zL6rQBeYTfbI/nT/Vt/AfVfegCb7Y3zp9wfwH1PvVFrHU/tSD+1udjc/Zl9VoFjqf2ph/a3Owc/Zl9TQAWe4eLL/eQT9lh6DH8T1r1h6XFPD4n1Bbm4+0P9mhO/YF4y/GBW5QAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVw/xn/5Iz4l/wCvM/8AoQruK4f4z/8AJGfEv/Xmf/QhQB00MT/2Ta/6RJ92LsvqvtU9xC/lL/pEn+sTsv8AeHtUEMH/ABKbX97J92L+L3Wp7iD90P3sn+sT+L/aFABNC+6L/SJP9Z6L6H2pZoX8yD/SJPvnsv8AdPtSTQfNF+9k/wBZ/e9jSzQfvYP3sn3z/F/smgCKeJ/7QtP9Ik/j7L6fSpGhf7ZH/pEn+rfsvqvtUc8H/EwtP3sn8f8AF7VI0H+mR/vZP9W38XutAAYn+2L/AKRJ/qz2X1HtQsL/AGyT/SJP9WvZfVvagwf6Yv72T/Vn+L3FCwf6ZJ+9k/1a/wAXu1ACrC/2yT/SJP8AVr2X1b2rO0yJzrmsgTyDE0XOF5/dL7VorB/pkn72T/Vr/F7tWdpkOdc1keZIMTRchuv7paANCGF/Nn/0iT747L/dX2ot4X8tv9Ik++/Zf7x9qIYP3s/72T74/i/2Vot4P3bfvZPvv/F/tGgAt4X8pv8ASJPvv2X+8fai2hf7LH/pEn3R2X/Ci3g/dN+9k++/8X+0aLaD/RY/3sn3R/FQBBYxOdDtz9okH+jLxhf7o9qllif+zn/0iT/VHsvp9KisYM6HbnzZP+PZeN3+yKllg/4lznzZP9Uf4vagB11C/wBlk/0iT7vov+FFzE/lD/SJP9YnZf7w9qLqDFrJ+9k+7/eouYMRD97J/rE/i/2hQBQ16JxHYZnkP+nw9QvHzfSr80L+bB/pEn+sPZf7re1UNehxHYfvJDm/hHLf7VX5oP3sH72T/WH+L/ZagAmhfzYP9Ik/1h7L/db2pWhf7ZH/AKRJ/q27L6r7Uk0H72D97J/rD/F/stStB/pkf72T/Vt/F7rQBjeJfBukeLFhtdehNysas8UnCSQtlfmR1AZT7g1x0q+Nfh7qkjxzX3jPQREu5QEOo2iZOMcYnHX0bkelelNB/pkf72T/AFbfxe61EsH/ABNZB5sn+oT+L/aagDK8LeKtH8Y28l54f1ZrlUCrLGVCyQtk/K6FcqfqK2oon86b/SJPvDsvoPauX8R/DfR/EWpNfrLdaXrEaDytU0+XyZ15PUjhxwOGz+Fc/F4g8XeBLiSHxta3HiDSQwxrukw/vIhj/lvbjkcfxJkfjQB6THC/mS/6RJ9/0X+6PakhhfD/AOkSffPZf8KzvD+s6T4lsXvtC1VL62Zh+8hlzg7RwR1B9jg1owwcP+9k++f4qAKehxOdNOJ5B/pE/QL/AM9X9quQQv5I/wBIk6nsvr9Kp6HDnTT+8kH+kT9G/wCmz1cgg/cj97J1P8XvQAtvC/2aP/SJPuDsvp9Kj8p/7O/4+JP9V6L6fSpLeD/Ro/3sn3B/F7VH5H/Eu/1sn+q/ve1ABfxONPn/ANIkPyHsvp9KfNC/lj/SJPvr2X+8PamX8GNPn/eyf6s/xe1Pmg/dj97J99f4v9oUAE0L/J/pEn3x2X/ClkhfzIv9Ik+/6L/dPtSTQfc/eyffH8VLJB+8i/eyff8A73+yaAEkhfzof9Ik+8ey+h9qp3UT/wDCQaePPkz5U3OF4+57Vckg/fQ/vZPvH+L2NU7qH/ioNPHmScxTc7v9ygC20L/bI/8ASJPuN2X1X2pywv8AaX/0iT7i9l9T7UjQf6ZH+9k+438XutKsH+kv+9k+4v8AF7mgBqwv9sk/0iT/AFadl9W9qdHC/mS/6RJ9/wBF/uj2pqwf6ZJ+9k/1a/xe7U6OD95L+9k+/wD3v9kUAQ2kT/ab3/SJP9eOy8/u09qmhhfYf9Ik++3Zf7x9qhtIP9Jvf3sn+vH8X/TNKmhg+Q/vZPvt/F/tGgBttE/lH/SJP9Y/Zf7x9qLWF/ssf+kSfd9F/wAKLaDMR/eyf6x/4v8AaNFrBm1j/eyfd/vUAVrmJ/8AhHZj58mPsrcYX+59KbZxP/wjUB8+QD7IvGF/ufSnXMP/ABT0x82T/j1bjd/sU2zhz4agPmSf8ei8bv8AYoAt3ML/AGWT/SJPu+i/4UXEL+UP9Ik/1idl/vD2ouYP9Fk/eyfd/vUXEH7ofvZP9Yn8X+0KAFuIX8of6RJ99Oy/3h7VDeRP59n/AKRIf3/ov9xvapriD90P3sn30/i/2hUN5Biez/eyf6/+9/sNQBLNE/mwf6RJ989l/ut7UrQv9sj/ANIk/wBW3ZfVfakmg/ewfvZPvn+L/ZalaD/TI/3sn+rb+L3WgBGhf7ZH/pEn+rbsvqvtQIX+2N/pEn3B2X1PtQ0H+mR/vZP9W38XutAg/wBMb97J9wfxe5oApWalfFd+GdnP2aHlsf3n9K2Kx7NdnivUBuZv9Gh5Y5/ietigAooooAKKKKACiiigAooooAKKKKACiiuG8U+K/E+hjV9UtNGsf7E0ZN8zXdw0c14oQO5hwCowDtG77zAjigDua4f4z/8AJGfEv/Xmf/QhVbWPHutQPrOo6Jpdpc6N4fC/2h58rpcSHylmkEYAKgpG6nDdTkcYqb4xSpP8E/EUsTBkksdysO4JUg0AdTDbp/ZNr80n3Yv+Wjeq+9T3FugiHzSf6xP+Wrf3h71BDbx/2Ta/e+7F/GfVfep7i2j8ofe/1ifxn+8PegAmt03RfNJ/rP8Anq3ofelmt08yD5pPvn/lq390+9JNbR7ovvf6z++fQ+9LNbR+ZB9775/jP90+9AEU9un9oWnzSfx/8tG9PrUjW6fbI/mk/wBW3/LVvVfeo57eP+0LT738f8Z9PrUjW0f2yP73+rb+M+q+9AAbdPti/NJ/qz/y1b1HvQtun2yT5pP9Wv8Ay1b1b3oNtH9sX73+rP8AGfUe9C20f2yT73+rX+M+re9ACrbp9rk+aT7i/wDLVvVves/TIFOuayMycTRdJG/55L71fW2j+1yfe+4v8Z9W96z9MgjOuayDuwJosfMf+eS0AaENunmz/NJ98f8ALVv7q+9Fvbp5TfNJ99/+Wrf3j70Q20fmz/e++P4z/dX3ot7aPy2+999/4z/ePvQAW9unlN80n+sf/lq394+9Ftbp9lj+aT7v/PVv8aLe2j8pvvf6x/4z/ePvRbW0ZtY/vfdH8Z/xoAgsYEOh2x3Sf8ey/wDLRv7o96llt0/s5zuk/wBUf+Wren1qKxt4zodsTuz9mX+M/wB0e9Sy28f9nOfm/wBUf4z6fWgB11boLWT5pPu/89W/xoubdBEPmk/1if8ALVv7w96Lq2jFrJ977v8AfP8AjRc20YiH3v8AWJ/Gf7w96AKGvQKsdhhpOb+EcyMf4vrV+a3TzYPmk/1h/wCWrf3W96oa9BGsdhjdzfwj7x/vfWr81tH5sH3v9Yf4z/db3oAJrdPNg+aT/WH/AJat/db3pWt0+2R/NJ/q2/5at6r70k1tH5sH3v8AWH+M/wB1vehraP7ZH97/AFbfxn1X3oAVrdPtkfzSf6tv+Wreq+9RLbp/asg3Sf6hP+Wjf3m96ka2j+2R/e/1bfxn1X3qNbeP+1ZB83+oT+M/3m96AJlt0+0v80n3F/5at6n3pI7dPOm+aT7w/wCWreg96VbaP7S/3vuL/GfU+9JFbR+dN977w/jPoPegDj9d+Fuj6vqk+r6Rc3nh/Xd3GpabKUd+BxIv3ZB655PrWXaa74z8Iu1t4w0W48QWCscazom4yY9ZLbO4HuSmR7V6LHbR+ZL977/98/3R70kNtH8/3vvn+M/40Ac34I8TeHvEmmsujatFczLNMzwLOyyxgysRujJDLwR1ArpILdPJHzSdT/y1b1+tcdP8NfC3imzN1qemKl+txMUv7Z2huEIlcAiRSCce+RWXF4b+IXhdN3h7XbfxRYKTiy1stHcKuei3CcMfdxQB6Nb26fZ4/mk+4P8Alq3p9aj+zp/Z33pP9V/z1b0+tcHY/FLSrJY7bxro+reFrgAKZL2J3tmP+zOmVI9ziuysLrTNV0b7Rpd7DeQ+V/rLe48xenqCRQBav7dBp853Sf6s/wDLVvT61JNbp5Y+aT76/wDLVv7w96iv7eMafP8Ae/1Z/jPp9akmto/LH3vvr/Gf7w96ACa3T5Pmk++P+Wrf40slunmRfNJ9/wD56t/dPvSTW0fyfe++P4z/AI0sltH5kX3vv/3z/dPvQAklunnQ/NJ94/8ALVvQ+9U7qBB4g08Zk5im/wCWjf7HvVyS2j86H733j/GfQ+9U7q3jHiDTx82DFN/Gf9j3oAuNbp9sj+aT7jf8tW9V96VbdPtL/NJ9xf8Alq3qfemtbR/a4/vfcb+M+q+9OW2j+0v977i/xn1PvQA1bdPtknzSf6tf+Wrere9Ojt08yX5pPv8A/PVv7o96attH9sk+9/q1/jPq3vTo7aPzJfvff/vn+6PegCG0t0Nze/NJxOP+Wjf88096mht02H5pPvt/y1b+8feobS3jNze/e4nH8Z/55p71NDbR7D9777fxn+8fegBttboYj80n+sf/AJat/ePvRa26G1j+aT7v/PVv8aLa2jMR+9/rH/jP94+9FrbRm1j+993++f8AGgCtcwJ/wj0x3Sf8erf8tG/ufWm2cCHw1Ad0n/Hop/1jf3PrTrm3j/4R6Y/Nn7Kx++f7n1ptnbxnw1Afmz9kU/fP9z60AW7m3T7LJ80n3f8Anq3+NFxbp5Q+aT/WJ/y1b+8Pei5to/ssn3vu/wB8/wCNFxbR+UPvf6xP4z/eHvQAtxbp5Q+aT76f8tW/vD3qG8t0E9n80n+v/wCejf3G96luLaPyh9776fxn+8Peory3jE9n97mf++f7je9AEs1unmwfNJ98/wDLVv7re9K1un2uP5pPuN/y1b1X3pJraPzYPvffP8Z/ut70NbR/bI/vfcb+M+q+9AA1un2yP5pP9W3/AC1b1X3oFun2xvmk+4P+Wrep96Gto/tkf3v9W38Z9V96BbR/bG+99wfxn1PvQBSs0CeK78Dcf9Gh+8xP8T+tbFY9mgj8V34XOPs0PU5/ietigAooooAKKKKACiiigAooooAKKKKACvNvEY8Tal4zf7d4Ov8AVdB090exgt761SO5lHPnSq8oY7T91SMDG45OMek0UAeY63ofihI/FWkaNoiz2vis+Z9te7jVbBpLdIJRIpO5sBNw2A5zjirHxi0bT4/gzrTPaQSzWeniOGeSJWdACo4YjI/CvRq4f4z/APJGfEv/AF5n/wBCFAHQw6ZYf2Van7Fb5KxZPlL6j2qe40ywEYxZWw+dP+WK/wB4e1QQ/YP7Ktf+PfO2LP3fUVYuPsHljH2b76f3f7woASbTLANFiytvv/8APFfQ+1LLplgJIMWVty5z+5X+6faib7Buix9m+/8A7PoaJfsHmQY+zffOfu/3TQBFPptgL+1AsrcA78jyl54+lSNplh9rjH2K2xsbjyV9V9qjn+wfb7XH2fHz5+76VK32D7XH/wAe2Njf3fVaAEOmWH2tR9itsbD/AMsV9R7ULplh9rkH2K2xsXjyV9W9qD9g+2L/AMe2PLP931FKv2D7XJ/x7Y2L/d9WoARdMsPtcg+xW2Ni/wDLFfVvaqGm6fZNresK1pAVSaMKDEML+6U8cVoL9g+1yf8AHtjYv931as/TfsX9t6xu8jb50e3O3H+qXpQBfi0ywMs+bK24cY/cr/dHtRb6ZYGM5srY/O//ACxX+8fali+webPn7N98Y+7/AHVot/sHltn7N99/7v8AeNACW+mWBjObK2Pzv/yxX+8fai20ywNrGTZWxO3/AJ4r/hRbmw8ps/Zvvv8A3f7xotvsH2WPP2bO0f3aAILHTbFtEt2aztyxt1JJiXJO0e1SyaZYDT3IsrfPlE58pfT6VFY/Yf7Et932fd9nXOduc7RUsv2D+z2x9nz5R/u+lADrnTLAW0hFlbA7e0K/4UXGmWAjGLK2Hzp/yxX+8PalufsH2aTH2bOP9mkuPsHlDH2f/WJ/d/vCgChrmn2UaWHl2luu6+hU4iAyC3Sr8umWAlgxZW3LnP7lf7p9qo659i2WHl+R/wAf0OcY6bqvy/YPNgx9m++c/d/umgBJdMsBLBiytuXOf3K/3T7UNplh9rjH2K2xsbjyV9V9qJfsHmwY+zffOfu/3WpW+wfa4/8Aj2xsb+76rQAjaZYfa4x9itsbG48lfVfao102w/tSRfsVvjyUOPKX+83tUrfYPtcf/HtjY3931Wo1Nh/akn/HvjyU/u/3moAkGmWH2hx9itsbF/5Yr6n2oj0ywM02bK24YY/cr6D2pR9g+0P/AMe2Ni/3fU0kf2Dzps/ZvvDH3fQUALHplh5kubK2+9x+5X+6Pakh0ywO/NlbffP/ACxX/Clj+weZL/x7fe/2f7opITYYfP2b75/u0AVNF06xfTSXs7dj9onGTEp4ErgdqtwaZYGIZsrbqf8Alivr9KqaJ9h/s07/ALPn7RP129PNfFW4PsHkjP2bqf7vrQARaVpz2qB7C1YMgyDCpzx9K43V/g/4P1OE3tpYPouoeXkXekSm2fOM8hflP4qa7OD7B9njz9mztH930qPNh/Z//Lvnyv8AZ9KAPO7rwv4/8NWkp02/0XxTZKhzDqdmtrchfRZYxtY+7Crf/Ceafp8P/FZ+CtR8OFWXzLh7Jbm1Xkf8togw/MCu5vjYf2fPt+z52HGNvpT5vsHljH2b76/3f7woAx9J1rwf4kRG8P3ukagdwLLbtGzKPdRyPxFbMmmWHmRYsrb73P7lfQ+1cx4k+HXgbxGyy6hpFityXB+1Wp8iYH13oQT+Oawn8Ba5oLRt4P8AHkrxhvlstejS8jPB48zh1H0zQB6HJplgJocWVtgsc/uV9D7VTudOsRr1ggs7cK0UxIES4ONmO1cV/wAJR400aaNfEXgrT9ViUnN14fvEbPB/5Yy7W/WnSfFPwims2T6zFeaDtjlDpqunSQjJ24+bBU9D0NAHfNplh9rjH2K2xsb/AJYr6r7U5dMsPtDj7FbY2L/yxX1PtWVpvifwnrdzGdH1jSb0bGyILiNiDleoByK1V+wfaH/49sbF/u+poAaumWH2uQfYrbGxePJX1b2pY9MsDJLmytuH4/cr/dHtQv2D7ZJ/x7Y2L/d9WpY/sHmS5+zff4+7/dFAENrptgbm9BsrcgTgDMS8fu09qmh0ywKHNjbfeb/livqfaobX7B9pvc/Z8eeMZ2/880qaH7BsOfs332/u/wB40ANt9MsDGc2Vsfnf/liv94+1FtplgbWMmytidv8AzxX/AApbf7B5Rz9n++/93+8aLb7B9ljz9mzt/wBmgCrc6dYjw/M4s7cMLViG8pc52delJaadYnw5A5s7cubRSWMS5zs69KW5+w/8I/Nj7Pu+ytj7uc7KS0+w/wDCOQZ+z7/si5ztznZQBaudMsBayEWVsDt/54r/AIUXGmWAiGLK2Hzp/wAsV/vD2pbn7B9lkx9mzt/2aLj7B5Qx9m++n93+8KAEuNMsBEMWVsPnT/liv94e1R3em2ImswLK3AM+DiJefkb2qW4+weUMfZvvp/d/vCorv7D59nj7Pjzucbf7jUASS6ZYCSDFlbcuc/uV/un2obTLD7XGPsVtjY3/ACxX1X2om+webBj7N985+7/dNK32D7XH/wAe2Njf3fVaAEbTLD7XGPsVtjY3Hkr6r7UDTLD7Ww+xW2Ng48lfU+1K32D7XH/x7Y2N/d9VoH2D7W3/AB7Y2D+76mgCpYQRW/inUEt4kiX7NCdqKFHV/StqsWw8r/hKtQ8jZt+zQ/cxjq/pW1QAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVw/xn/5Iz4l/68z/AOhCu4rh/jP/AMkZ8S/9eZ/9CFAHTQ3UH9k2o86P7sX8Y9VqxcXVuYl/fx/6xP4x/eFV4bhP7JteJPuxf8sm9V9qsXNwnlL8sn+sT/lk394e1ABPdW+6L9/H/rP749DRNdW/mwfv4/8AWH+Mf3TRPcJui+WT/Wf88m9D7UTXCebB8sn+sP8Ayyb+6fagCKe6g/tC0PnR4G/+MelSNdW/2yP9/H/q2/jHqtRz3Cf2haHEn8f/ACyb0+lStcJ9sj+WT/Vt/wAsm9V9qAEN1B9sU+fH/qz/ABj1FKt1b/bJP38f+rX+MerUhuE+2LxJ/qz/AMsm9R7Uq3CfbJPlk/1a/wDLJvVvagAW6t/tkn7+P/Vr/GPVqztMuIRrmskzRgGaLB3Dn90taK3CfbJPlk/1a/8ALJvVvas/TJ0GuaySJOZoukbf88l9qAL8N1b+bP8Av4/vj+Mf3Vot7q38tv38f33/AIx/eNLDcJ5s/wAsn3x/yyb+6vtSW9wnlN8sn33/AOWTf3j7UAFvdW/lN+/j++/8Y/vGi2urcWseZ4/uj+MUW9wnlN8sn33/AOWTf3j7UW1wn2WP5ZPuj/lk3+FAEFjcwDQ7cGaMH7OvG8f3RUst1B/Zzjz48+Uf4x6VFY3CDQ7cYk/491/5ZN/dHtUstwn9nOMSf6o/8sm9PpQA66urc2smJ4/u/wB8UXN1AYhieP8A1ifxj+8KW6uENrJ8sn3f+eTf4UlzcIYh8sn+sT/lk394e1AFDXrmFo7DbNGcX8JOGHA3VoTXVv5sH7+P/WH+Mf3WrP16dGjsMCTi/hPMbD+L6VoTXCebB8sn+sP/ACyb+63tQAk11b+dB+/j/wBYf4x/dala6t/tkf7+P/Vt/GPVaSa4TzoPlk/1h/5ZN/db2pWuE+2R/LJ/q2/5ZN6r7UADXVv9sj/fx/6tv4x6rUS3UH9qyHzo8eQn8Y/vNUrXCfbI/lk/1bf8sm9V9qiW4T+1pDtk/wBQn/LJv7ze1AEy3Vv9pf8Afx/cX+MeppIrq386b9/H94fxj0FKtwn2l/lk+4v/ACyb1PtSRXCedN8sn3h/yyb0HtQAsd1b+ZL+/j+//fH90UkN1bgSfv4/vn+MUsdwnmS/LJ9//nk390e1JDcJ+8+WT75/5ZN/hQBT0O5gXTSGmjB+0T9XH/PV6uQXVv5I/fx9T/GPWqehzoNNIIk/4+J+kbH/AJbP7Vct7hPJHyydT/yyb1+lAC291bi2j/fx/cH8Y9Kj+1Qf2djz48+V/fHpUlvcJ9mj+WT7g/5ZN6fSo/tCf2djbJ/qv+eTen0oAL+6gOnzgTxn5D/GPSnzXVv5Y/fx/fX+Mf3hTL+4Q6fP8sn3D/yyb0+lSTXCeWPlk++v/LJv7w9qAEmurf5P38f3x/GKWS6t/Mi/fx/f/vj+6aSa4T938sn3x/yyb/ClkuE8yL5ZPv8A/PJv7p9qAEkurfzof38f3j/GPQ1RvZraTXrAPJEyeTOGBYEfwdavSXCedD8sn3j/AMsm9D7VTup0PiDTziTiKb/lm3+x7UAYOs/DzwFrt2p1LQNKkZkYtJGixOTkdWTB9e9ZA+FemWE7f8Iv4v8AEGgqqgrFb6oZYe/VJN2fzr0FrhPtkfyyfcb/AJZN6r7Uq3CfaX+WT7i/8sm9T7UAeeLpfxJ0q5f+zfG2ia0Ai4XV9P8AJOMnjdC3P1x3qxb+KfiBYtIupeENL1I7vml0vWUTsOiTKv8A6FXdLcJ9sk+WT/Vp/wAsm9W9qWO4TzJflk+//wA8m/uj2oA4KH4qQWNxd/2x4W8S2RaUFmWwFwifIo+9EzDtVmw+M/gC4cwyeIobObc2Y72KS3K8nr5igV11pcJ9pvvlk/14/wCWTf8APNPamywWGoW5jv7NbmPe3yTWxcdT2IoAq6T4q8PalHjTtd026LOxAgvI3z8x9DWha3VuLWPM8f3f74rkLj4YfD/VI3N54SsNxd8tDZmEn5j3QCs2D4QeF4rdG0i78RaOcddP1O5TH0yTQB3FzcwHw7MBNHn7KwxvH9yks7mAeGoAZo8/ZFGN4/uVwU/w+1O20aR9P+InitVEBYx3RSdT8vTmMcU228L+PY9Dia1+Jc3l/ZwRDceH4XAG3puGD+NAHpNzdW/2WT9/H93++KLi6t/KH7+P/WJ/GP7wrz+ey+KlrbyeV4k0G/XHS60iaLP/AHw1LJqPxZgQfaNO8J3ihl/495LuIk7h/eQj9aAPQLi6t/KH7+P76fxj+8KhvLmAz2eJo+J+fnH9xq4uTxX8QYowt14At5wGX5rXVwMncOzxD+dLc+PPEEUtq2o/DrXYwsuf9Fmt593yMMACQev6UAdxNdW/mwfv4/vn+Mf3WpWurf7ZH+/j/wBW38Y9VripfijEkkRuvBvjG3CvyW0Zn/hP9wtUcnxo8IW90rai+q2AVWB+1aRcrg5Hoh9KAO5a6t/tkf7+P/Vt/GPVaQXVv9sb9/H9wfxj1NcZD8aPh5c3SNH4ps1AVgfNV48HK/3lHpWlb/EjwXc3TG38VaTJ8gGFvEJ6ntmgDUs5Ek8V6gY2Vh9mh5U5/ietiuf0fU7HVPE2oS6ddw3MYtoAWicMBy/pXQUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAeU+IJdU1OLxz4gttb1Gwn8MSPHp9vBcFID5NtHOxkj+7JvZyDuzgYxitD4tamL34N6tFHa3bz3umiVEhtJZVUHBOXVSq4GepFaeu/D06zqGomHXLux03Wdn9q2EMSEXW1Qhw5G5NyKqtjqB2rQ8Xa3pWk6YmmahbXl42pxyW8Vjp8DSzSps+faB0AU8k4AyPUUAc1H8WdMWwghPh7xVuQRg/8SSbsRnt7VLN8XdKdAF8PeKsh1P/ACBJuzA+ldnoet2XiLSItS0x3aCQsuJIyjo6sVZGU8qwYEEH0rQoA88l+LulO0ePD3ir5Wyf+JJN6H2ok+LulNJER4e8VYVsn/iSTehHp716HRQB5xL8W9Le7t5F8PeKtse7d/xJJu4+lSN8XdKNwj/8I94qwqMD/wASSbuR7e1eh0UAeeH4u6V9pD/8I94qwEI/5Ak3qPagfF3ShcO//CPeKsFFA/4kk3Yn2969DooA88Hxe0oXDv8A8I94qwUUD/iSTdifb3qjp/xZ0uPVtVlOg+J2EssZAXRpiVxGowRjg9/oRXqNYGia/oWp+Jtc07RrkXF5ZtDJfmM7kV3Uoqg9MgRcgdPrmgDm4/i7pSySk+HvFWGbI/4kk390D09qIfi7pSIQ3h7xVksx/wCQJN3Yn0r0OigDzyH4u6UkZDeHvFWSzH/kCTd2J9KSD4u6VHAiN4e8VZAwf+JJN/hXolFAHm1r8WdMh0uGB/D3irekKocaJNjIXHpUj/FzS2s2jHh7xVuMe3/kCTdcfSvRaKAPPJ/i7pUkDqvh7xVkjA/4kk3+FE3xd0qSMBfD3irO9T/yBJuzA+leh0UAeXax8WdLnjs9ug+J08u8icl9GmGQG6Djr7Vek+LulNJER4e8VYV8n/iSTf3SPT3rZ8U+LNI0y/i0y7tNR1C6jVL14NOtXmaBFf5ZH29BuU4HU4OAa6HT7+11XTbbUNPmWe1uollhlTo6MMg/kaAOFk+LulNJER4e8VYV8n/iSTf3SPT3oPxe0o3CP/wj3irARgf+JJN3I9vavQ6KAPPD8XtKNwj/APCPeKsBGB/4kk3cj29qYPi3pYv3m/4R7xVtaJVH/Ekm6gk+nvXo1FAHno+L2lCZm/4R7xVgqB/yBJvf296RPi9pSySMfD3irDEEf8SSb0HtXodFAHnqfF7SleQnw94q+Zsj/iSTegHpSR/F7Sl358PeKuWJH/Ekm/wr0OqWr6tY6Do9zqmqziC0tUMkshBOB7Ackk8ADkk0Aef6T8WtKgsCjaB4oY+fMcposxHMrHHTrzz71ai+L2lJHg+HvFWcn/mCTev0rofCviTTNaN3aWNve2VzbP509pqFu0MqiVmYPtbqrHdgj0I4xXRUAeew/F7SkhRW8PeKsqoB/wCJJN/hTP8Ahbml/Y/L/wCEe8VbvL2/8gSbrj6V6LRQB51dfFzS5rSWNPD3ircykDOiTf4U6T4vaUygDw94q+8D/wAgSbsQfSvQ6KAPPJfi9pT7ceHvFXDAn/iSTf4Ur/F7SmeMjw94q+Vsn/iSTehHpXoVFAHnj/F7SmkjYeHvFWFJJ/4kk3ofaqtx8WtKfW7KUaB4oxHFLlTos2452cgY5H+Ir02sTW9c0nRNY0hdRkYXmozNZWaIMli2GYkeg2Lk9sj1oA5c/F3SjcI//CPeKsBWB/4kk3cj29qUfF7ShMzf8I94qwVA/wCQJN2z7e9ehUUAeeL8XdKFw7/8I94qwyKB/wASSbsT7e9Knxe0pWkJ8PeKvmbI/wCJJN6AentXoVFAHnNv8W9Ljmumbw94qxLKGX/iSTdNij09Qakj+L2lKpB8PeKvvE/8gSbuSfSvQqKAPPIfi7pSRkN4e8VZ3sf+QJN3Yn0og+LulRwIjeHvFWQMH/iSTf4V6HRQB5pc/FrS/wCxZoT4f8UK32dkJbRZgAduOTjpSWnxa0saFDAPD/ihmFsqZXRZiCduODjpXa+J9YtNF0KSe/gubmOZ1tlgtI98srSHaFVcjJ5/IGl8Oakmp6SrxabqGnJCfJWHUIfKkIUDBxk5HOM+xoA5Kb4u6VJA6L4e8VZIwP8AiSTf4UTfF3SnjAXw94qzvU/8gSbswPpXodFAHnk3xd0p4wF8PeKs7lP/ACBJuxB9KjuPi3pcstsy+HvFWI5dzZ0SbptYenuK9HooA87k+LulNJER4e8VYVsn/iSTf3SPT3pT8XdKNwj/APCPeKsBWB/4kk3cj29q9DooA80uvid4evZ1a78J+I51CsD5vh+VuuPUe1ZFx4i+Hl5OzXfw11GYFR9/woSc5PP3K9iooA83+G0/hqTxNrQ8K+G7rQka2t2ljn05rTf80gBwQM9/1r0iuRi8a6CPFzQCK/SS6lXTl1BrZxaSzRtJ+6WTpuDM49CRjORiuuoAKKKKACiiigAooooAKKKKACiiigAooooAK4TxZqVp4a+JGha/rkwttK/s67smuXU+XBMzwuu4/wAO5Y2AJ9MV3dFAHJfDp/tOh6hqMcbpbajqt1dWvmIULxNIQr4PIDYLDPZga62iigAooooAKKKKACiiigArhfCun2elfFPxPZaZaw2lrDpmmLHDAgREG654AHAruqKACiiigAooooAKKKKACiiigDzvx18Q9K0DxEvh6HUNP0vU7u3D3OpXjhVtIckKQOskmSxVOg6k44PW+FLfSbTwjpdt4dmWfS4bZI7WVW3B4wMBs984zmteigAooooAKKKKACiiigArL8SajDpPh67v7qwm1GG3UPJbwRCR2XcMkKeu373rgcZPFalFAHnHga9tNQ+Imt3ugajNrmmXlpHJNqM658mZXYLbRuAAUCszbQMqTyctXo9FFABRRRQAUUUUAFFFFABXi/jCHxhb+LrDVL3QrC6Z9egi06T+1SoWFQ+yPZ5R2FuWZsnnAxgDHtFFACKSVG4YPcUtFFABRRRQAUUUUAFFFFAHHfEhdKOl6ZJ4gu9TsLCHUFke9sHCCAiNwGlf7yJk43LyGK8jrUfw3vJru31cW+oXmp6HHdhdKvr1meSaPy1L4duXQSFgGOc88nFdrRQAUUUUAFFFFABRRRQAUUUUAeGaATpcujaZa65qlx4qt9XEN5o8kjNAsHnt5jmHG1V8vLrL1Jxyc4r3OiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKAOL+KOl+d4H1nV4dR1Wxu9N0y5mt2sdQmt13rGWBZUYBsEDrms60ij8Kjw/PHdavfy6lG8khvtXuJlVktZJPuuxGCc8fQ9QK7XX9Ii1/w3qWj3EjxRahay2ryJjcqupUkZ781SvfC1veppKvPKo0tHSPGPn3wtEc/g2frQByGneOvGeqR6FJBoujxJ4jszcWPmXchNuVRXzLheQVJwF5BwCe9Q33xamtfD+jvcjR9L1O/mvIZpNRumW1iNrL5UhUgbm3NjaOOCcniuw03wha6bb+G4ormZx4etTawFgP3q+UseW98LniqcfgGK0t7Y6Xq97Y3trcXc0V3EsbHbcy+bJGyspVl3bccZ+QHNAFnwH4wi8aeHXv4/s/mW9zJazm1l82FnTHzRtgEqQVIyARnB6Vyvh/xnr+qWOlab4a061a4urKe8afVL6WRYwlw0eC2C7knGOmB9AD3+jaY+k6f5E2oXmoys7SSXF44Z2Zjk4AAVVHZVAAFY/hvwPZ+Gri0mtrqeY2tnJZqJAPmV5vNJOB1zx9KAF0bxHN4j+G51poDZXEtrNvjSTd5ciFkba3HG5Tg/SuX8A+LfEg0/wZaeIbS2lttb0xTb3S3TyXJkjgVy8u4YO8AtwcgnnPWu10bw1b6N4UOhQzySQ4mHmPjd+8dmPtwXP5VRg8DWUFl4atTczvH4etWtoeQDKpg8kliOhxzxjmgDmNH+KN5eeNNP0W+Ogv8A2k8sX2bTb83FxYskbuBKQNh+4QdpGCe9c74P1jxBqGteFJNb1YJo1n4ai1O5nl1WaIv2aWbjEh3DGHbbtyc54rudM+GkWmz6ERr2oz2+gOTY2rpCsaqYmiw2xFLNtb7xOePc5veHvAVh4fmsHiuJbkWWkJpISZVIeNW3bjx1PT0oAyNV8T2+oeNtCl0HWI77TZNL1N5RY3m6KV4/s+MlDjcu44PUbj60ad8QGtPD9297ZlGtNCtdTs1adpHu0kjxtLNyWEi7MnJO5SetdHf+ErG91qy1BCbY2drc2qxQoqqwn8vcx46jyxj61nXvw60y+j8OJNcXA/sFI4l2kD7VGhjYJJxyN8MbYHdfegDlfEHxkbR9b1Cy83QYDo4RbuC9vWSe6k8sO6wALgAbtoZurccdavy/E+6k8dDR7ZdJtbfzYBDFqNxJBcX0cioxlhJXYQN5AXJJKkcZFdDeeCmfU9QutJ1/UtIj1RxJewWnlFZHCBN6lkLRsVVQSpHQHg81HrHgJNbuJY7zW9SfTJ5Ull0+Ty5UDLtxsd0Lxg7QSFbuSMZoA62iiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKAP/2Q==)

Use the first graph to model methodology.

You should use the visualiser to check answers.

Different for each graph.

Workings should be shown on graphs.

For each graph:

1. Work out the half-life.
2. Find the count rate or number of nuclei left after two half lives have elapsed.
3. Demonstrate that the half life is a constant.

**All working should be shown on the graphs.**

Chart, line chart

Description automatically generated

Chart

Description automatically generated

![Chart

Description automatically generated](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDmRXhpZgAATU0AKgAAAAgABAE7AAIAAAAJAAAISodpAAQAAAABAAAIVJydAAEAAAASAAAQzOocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAEZlcm5hbmRhAAAABZADAAIAAAAUAAAQopAEAAIAAAAUAAAQtpKRAAIAAAADNTgAAJKSAAIAAAADNTgAAOocAAcAAAgMAAAIlgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAADIwMTk6MDI6MTEgMTM6NTk6MTgAMjAxOTowMjoxMSAxMzo1OToxOAAAAEYAZQByAG4AYQBuAGQAYQAAAP/hCxtodHRwOi8vbnMuYWRvYmUuY29tL3hhcC8xLjAvADw/eHBhY2tldCBiZWdpbj0n77u/JyBpZD0nVzVNME1wQ2VoaUh6cmVTek5UY3prYzlkJz8+DQo8eDp4bXBtZXRhIHhtbG5zOng9ImFkb2JlOm5zOm1ldGEvIj48cmRmOlJERiB4bWxuczpyZGY9Imh0dHA6Ly93d3cudzMub3JnLzE5OTkvMDIvMjItcmRmLXN5bnRheC1ucyMiPjxyZGY6RGVzY3JpcHRpb24gcmRmOmFib3V0PSJ1dWlkOmZhZjViZGQ1LWJhM2QtMTFkYS1hZDMxLWQzM2Q3NTE4MmYxYiIgeG1sbnM6ZGM9Imh0dHA6Ly9wdXJsLm9yZy9kYy9lbGVtZW50cy8xLjEvIi8+PHJkZjpEZXNjcmlwdGlvbiByZGY6YWJvdXQ9InV1aWQ6ZmFmNWJkZDUtYmEzZC0xMWRhLWFkMzEtZDMzZDc1MTgyZjFiIiB4bWxuczp4bXA9Imh0dHA6Ly9ucy5hZG9iZS5jb20veGFwLzEuMC8iPjx4bXA6Q3JlYXRlRGF0ZT4yMDE5LTAyLTExVDEzOjU5OjE4LjU4MTwveG1wOkNyZWF0ZURhdGU+PC9yZGY6RGVzY3JpcHRpb24+PHJkZjpEZXNjcmlwdGlvbiByZGY6YWJvdXQ9InV1aWQ6ZmFmNWJkZDUtYmEzZC0xMWRhLWFkMzEtZDMzZDc1MTgyZjFiIiB4bWxuczpkYz0iaHR0cDovL3B1cmwub3JnL2RjL2VsZW1lbnRzLzEuMS8iPjxkYzpjcmVhdG9yPjxyZGY6U2VxIHhtbG5zOnJkZj0iaHR0cDovL3d3dy53My5vcmcvMTk5OS8wMi8yMi1yZGYtc3ludGF4LW5zIyI+PHJkZjpsaT5GZXJuYW5kYTwvcmRmOmxpPjwvcmRmOlNlcT4NCgkJCTwvZGM6Y3JlYXRvcj48L3JkZjpEZXNjcmlwdGlvbj48L3JkZjpSREY+PC94OnhtcG1ldGE+DQogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgIDw/eHBhY2tldCBlbmQ9J3cnPz7/2wBDAAcFBQYFBAcGBQYIBwcIChELCgkJChUPEAwRGBUaGRgVGBcbHichGx0lHRcYIi4iJSgpKywrGiAvMy8qMicqKyr/2wBDAQcICAoJChQLCxQqHBgcKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKioqKir/wAARCAFsAmwDASIAAhEBAxEB/8QAHwAAAQUBAQEBAQEAAAAAAAAAAAECAwQFBgcICQoL/8QAtRAAAgEDAwIEAwUFBAQAAAF9AQIDAAQRBRIhMUEGE1FhByJxFDKBkaEII0KxwRVS0fAkM2JyggkKFhcYGRolJicoKSo0NTY3ODk6Q0RFRkdISUpTVFVWV1hZWmNkZWZnaGlqc3R1dnd4eXqDhIWGh4iJipKTlJWWl5iZmqKjpKWmp6ipqrKztLW2t7i5usLDxMXGx8jJytLT1NXW19jZ2uHi4+Tl5ufo6erx8vP09fb3+Pn6/8QAHwEAAwEBAQEBAQEBAQAAAAAAAAECAwQFBgcICQoL/8QAtREAAgECBAQDBAcFBAQAAQJ3AAECAxEEBSExBhJBUQdhcRMiMoEIFEKRobHBCSMzUvAVYnLRChYkNOEl8RcYGRomJygpKjU2Nzg5OkNERUZHSElKU1RVVldYWVpjZGVmZ2hpanN0dXZ3eHl6goOEhYaHiImKkpOUlZaXmJmaoqOkpaanqKmqsrO0tba3uLm6wsPExcbHyMnK0tPU1dbX2Nna4uPk5ebn6Onq8vP09fb3+Pn6/9oADAMBAAIRAxEAPwD6RooooAKKKKACiiigCrqWp2Wj6bNqGq3UVpaQLukmlbaqjOBz7kgAdyQK5qD4jabdeCbfxJbWd7LHeXbWdpZrGBPPKJmiChSQASUJ+YjAznGK6140kXbIiuMg4YZ5ByD+YzXklpY31n8O9B1BrC8l/sfxRdX1xbxQs0phNzdIWCAZbAlD4HUDIoA9B0DxMmsWt6byxuNJu9Pk8u7tbtkLRfKHDbkZlKlSCCD6+lZmg/EK31vUrO3l0jUNOg1OFp9Mu7oR+XeRqAxI2sWQ7TuAYAleao6PA/il/GGpWkVxbWmrwR2Vo91bvA0myFlMmxwGC7pCASB901haQ9x4mk8F6RHpuo2U2gW0n9qSXNnJElu/2RrcRq7AK5LSZG0kYXNAHVaP8Q4NV1Oxgm0bUbCz1UMdMv7kR+VeBVL8BXLJlAWXcBkAn2o0b4hQatqlhby6NqNhaasGOl39wI/KvAql+ArlkyoLLuAyAT7VyVk8/iXT/BfhiHTtStLvQ2V9UluLKSKO28q1khwsjAK5Z3G3aTlcmptIup9cTwL4fi0vUbe78PzRzao9xZSRR2/k20kW0SMAr73cbdpOVyaAPV6K8v8Ait4i8V+DodJvNCvhdfatRKSWf2VMtCsbyMoJ5ztTA75rstLuZ9ZsYL7TtbE9pcwJPDKtuvzK2cfyoA3qKy4rbUpFYnVSMMV/4917GmCHUzaxy/2py+zj7Ovcj/GgDXorHeLU01CG3GqcSRu5P2deNpUf+zVKLXUjIy/2qflA/wCXdaANOisgw6n9lkl/tTlN/H2decEj+lPe21JXjA1U/O2P+PdeOCf6UAalFYoTUzqzWn9p/KIBLu+zrnJYjH6VNHa6k5cf2qRtbH/HuvoKANSisnyNS+zpJ/ahyxXj7Ovcgf1pzW2pLKi/2qfmz/y7rQBqUViwrqcmpXNsdTwIURgfs687s/4U8w6mLWSX+1OU38fZ15wT/hQBr0VmNa6krIP7VPzHH/HuvoT/AEoNrqQlVP7VPKk/8e69sf40AadFYtqup3F1eRHU8C3mEYIt15zGrZ/8ep4h1L7Ik39qcsFOPs698f40Aa9FZb22pLJGv9qn5iR/x7r6ZoFtqRnZP7VOFUHP2de5P+FAGpRWLbJqc9tLIdTwUkkQAW687WI/pUjW+pLCj/2ocsVGPs69yB/WgDWorLNtqQnVP7VOGUtn7OvYj/GhLXUneQHVT8jY/wCPdeeAf60AalFYVn/al1pUd22p7WdclRbrgc4q09rqSsg/tU/M2P8Aj3X0J/pQBp0Vli21IztH/apwqg5+zr3J/wAKjeLU1t55P7U5iDYH2decCgDYorFhTU5dPt7g6ngyrGSPs68bsf41MbbUhOqf2qcMpOfs69iP8aANSisxLXUmZx/ap+Vsf8e6+gP9aq339qWmk3V4up7mgjkcKbdcHbn/AAoA3aKy3tdSR4wNVPztt/49144J/pQLbUvPMf8Aap4UNn7OvrQBqUVlx22pOzg6qRtbH/HuvpUEy6nFYwzjU8mR4lI+zrxvZV/rQBt0VltbaksqL/ap+bP/AC7rQLbUjOyf2qcKoOfs69yf8KANSisgw6mLWSX+1OU38fZ15wT/AIUy8TU7Z7VV1Pd584iObdeBtJz+lAG1RWZ9l1Lztn9qn7uc/Z1oW11Jmcf2qflOP+PdfQH+tAGnRWQIdTNok39qcsFOPs698f40yddThvrSAankTlgT9nXjC5oA2qKyxbakZ2T+1ThVBz9nXuT/AIU3yNS+zvJ/anKluPs69iR/SgDWorLlttSjQEaqTllH/Huvcgf1qF11NdWhtP7T+WSCSUt9nXIKsgx/4/8ApQBtUVlpbakzyD+1T8jY/wCPdeeAf60zydT+xib+1OSgbH2dfSgDXorLe21JXjA1U/O2P+PdeOCf6VGkWptqEtv/AGpxHEjg/Z153Fx/7LQBsUVlx22pPvzqpG1iP+PdaYIdS+yxy/2py+zj7OvGSP8AGgDXorLNtqQnWP8AtU4ZSc/Z17Ef41Dbpqc17dwHU8C3dVB+zrzlQf60AbVFZJg1IWjTf2pyqk4+zr2pz22pK8Y/tU/O2P8Aj3Xjgn+lAGpRWX9m1Lzyn9qnAUHP2dfU1DZrqd01yG1Pb5M5iGLdeQADn9aANqisgQ6kbWOX+1OX2ZH2de5H+NSG11ISqn9qnlSf+Pde2P8AGgDTorLFtqRneP8AtU4VQc/Z17k/4VPpE81zp4e4YPIsssZYLjdtkZQcfQUAXaKKKACiiigAooooAKKKKACiiigAooooAKKKKAOC+I+0+IvAm84X+3hk5x/y7zd6zNDWDwB8RJfDrysvh/XSbjSWEpCWlxy0ltwcANy6DjuBmtT4jHb4k8BnBP8AxPhwP+veatfxXoUfirRb7S5Vmglkije3uUA328ysWjkXnqrAH8x3oA17cW218zn77f8ALc+v1qIC3/s+D98c/u/+Wx9R71z/AMPvFlzrWl3FhrluYPEOlymDU7dcYD9pFGfuOPmB6dR2rpBMf7Pg/cyf8s+w9R70AQzC3/tq1/fHHky5PnH1T3qdRbefJ+/PQf8ALc+/vUc0x/tq1Pkyf6iXjA9Y/erCzHz5P3MnRew9/egCsRb/AGCf98c/vP8AlsfU+9Syi282D9+fvn/luf7re9NMx/s+f9zJ/wAtOw9T71LLMfNg/cyffPYf3W96AKIFv/wkb/vjt+yLz5x/vnvmrcItt0uZz9//AJ7n0HvUAmP/AAkrnyZP+PReMD++fercMx3S/uZPv+g9B70AVyLb7FD++Ocx/wDLc+o96kkFt9oi/fnv/wAtz6fWgzH7DD+5k6x9h6j3p8kx+0Q/uZO/Yen1oAo2wt/7dv8AMxx5cOD5x5+971MRb/2fP++Of3n/AC2PqfemW0x/t7UD5MnMcPGBx9/3qYzH+z5/3Mn/AC07D1PvQA+QW3mRfvz97/nuf7p96CLb7Qn78/cb/lufUe9SSTHzIv3En3vQf3T70NOftKfuJPuN2HqPegDP08W/9oapmYgfaVx++PP7mP3qYC3/ALNi/fHO1P8Alsfb3pmnTEajqv7mQ5uV7Dj9zH71MJj/AGZEPJk+6nYe3vQA6UW3nQ4nP3j/AMtz6H3oUW32uT9+fuL/AMtz6t70+WY+dD+5k+8ew9D70LMftcn7mT/Vr2Hq3vQBSsRb/YbjMxB8+f8A5bH/AJ6N71O4tvssf74/ej/5bn+8PemWExFhcfuZD+/n7D/no3vU8kx+yx/uZPvR9h/eHvQAjC2+1x/vzjY3/Lc+q+9EQtvMnzOfvj/luf7q+9PaY/bI/wBzJ/q27D1X3pYZj5s/7mT/AFg7D+6vvQBmaWLf/hHYMzEHZ084jv6ZrQkFt5kX78/f/wCe5/un3qlpUxHhuAeVIfk6gD1+taMk58yL9xL9/wBB/dPvQBEotvtcn7848tf+W59W96hlFv8AYbv98c4fH74+n1qysx+2SfuZP9WvYere9QyzH7DefuZOj9h6fWgCC1Fv/YtnmY52Q5HnH/Z96tMLb7XH+/P3G/5bn1X3qG0mP9i2X7mT7kPOB/s+9WWmP2yP9zJ/q27D1X3oAbGLbfLmc/f/AOe5/uj3rP1gW/8AwjWo7ZiW8mbA84nP3u2a1Ipjvl/cSff9B/dHvWfrExPhnUh5Mg/cTckDj73vQBbmFt5kGJz/AKw/8tz/AHW96ALb7Y37842D/lufU+9PmnPmQfuZP9Yew/ut70CY/bG/cyf6sdh6n3oAZCLbdL+/P3/+e59B71TuRb/2TbYmOfNt8jzj/wA9E96vwzHdN+5k+/6D0HvVO6mP9kWw8mT/AFtvzgf89E96ALMgtvtEX789/wDlufT60ii2+1yfvz9xf+W59W96kkmP2iH9xJ37D0+tCzH7ZJ+5k/1a9h6t70AVyLf+z5/3xz+8/wCWx9T71Dqgt/O0/bMT/pYz++Jx8je9WTMf7Pn/AHMn/LTsPU+9RapMTNp37mQYu16gc/I3vQBPi2+1f6842f8APc+v1pYxbeZL+/P3v+e5/uj3p/nH7V/qZPueg9frSxznzJf3Ev3vQf3R70AVQLb+zYv3xztT/lsfb3qG8Fv/AGtpuJjjdJk+cePkPvVkTH+zYv3Mn3U7D1HvUN7Mf7X00+TJw0nGBz8h96ALCi2+1yfvzjYv/Lc+re9RgW/2Kb98c5k/5bn1PvU6zn7ZJ+5k+4vYere9MEx+wzfuZOsnYep96AC4Ft5YxOfvp/y3P94e9VJRb/8ACSWv747fsk3PnH+/F3zV65mPlD9zJ/rE7D+8Peqssx/4SW1Pkyf8ek3GB/fi96AJ4hbebP8Avz98f8tz/dX3qLFt/Za/vjnyhx5x9PrViKc+bP8AuZPvjsP7q+9R+cf7KX9zJ/qhzgen1oAJRbeZB+/P3zn9+f7re9Qxi3/tq5/fHH2eLB84/wB6T3q1LMfNg/cyf6w9h/db3qCKY/25cnyZP+PeHjA/vSe9AEkAtv3n78/fP/Lc/wCNRAW/9nwfvjn93/y2PqPerEEx/efuZP8AWHsP8ajEx/s+D9zJ/wAs+w9R70AKwtvtcf7842N/y3PqvvVSyFv/AGrqWZjjzEwfOPP7tferzTH7ZH+5k/1bdh6r71VsZiNW1M+TJzJHxgcfu196AHkW39myfvjnY3/LY+/vUkotvMg/fn75/wCW5/un3pDMf7Nk/cyfcbsPf3qSWY+bB+5k++ew/ut70AMAtvtbfvzjYP8AlufU+9VNLFvvv90xH+ltj98RnhferwmP2xv3Mn3B2HqfeqmlTEPf/uZD/pbdAPRfegB6i3/s+D98c/u/+Wx9R71MRbfaE/fn7jf8tz6j3pizH+z4P3Mn/LPsPUe9Tmc/aU/cSfcbsPUe9AESi2+1yfvzjYv/AC3Pq3vUeg4/ss7TkfabjBzn/ls9TrMftkn7mT/Vr2Hq3vUOhHOlscY/0m44P/XZ6ANGiiigAooooAKKKKACiiigAqG9u4dPsLi8um2QW8bSyNjOFUZJ/IVNUV1H51pLH5aS70K7JPutkdD7UAcZpXxEmnm0+TX9DbR7DVoXn065a7WUyKsfm4kRR+7YxgsACw4IyDxTtD+IF1qGoaYmr6C+lWOtQvNpl012shlCp5m2RAB5bGPLYyw4IzmuL0zwFeazfaVbvo+saRDp0Fys41K/8+C3LwPCsFr85ymZC24gcIoz2GzpOm61rsnhHS9T0K80yPw/bSC+uJ2j8uSX7M1uqxFWJcHezZwAAB3OKANrSviDd3V7pT6toDabpOt5/s2+N4shkPlmRRJHtHllkVmHLdMHBpdH8fXt7qGk/wBp+H207S9cJGmXpu1kaQ7DIgkj2jyyyKxHLdMHBrCs9N1rXbLwj4cv9BvdOj0FlbULyYx+U5jtnhUREMS+5nDdBgDnnipdKtNc1NfBeiXmg3unr4clSa+vJzH5TtDbvEoiIYl9zOG6DAHPPFAGl8Rc/wDCSeA9uCf7eGM/9e81dipuPtknyx/6tf4j6t7VwPxB06ZfFXgpm1S8dZde+VD5eIswSn5cJnjpyTXZrpkv2px/at99xecx+rf7FAHJeMdM1HStQt/HOgWX2nUdM3xXtrCTuvrMtl0x3ZD86/QjnNdRpOrQ634bsNR0qaC5s7hYnilRzhhuHtwQeCOxzUsGmSlX/wCJrfD526GP1/3K85Gly/DfxBAU1G4g8I63MrOQyBdOvWIOTlcLHJ+QbHQGgD0qYz/23a/LHnyJf4j6x+1WFNx58nyx9F/iPv7Vmy6bKNYtl/tS9JMMp3ZTI5Tj7v8AnFTrpkvnyD+1b7oOcx89f9igCUmf+z5/ljx+8/iPqfappTcebB8sf3z/ABH+63tWedMl+wzH+1L3jzOMx4PJ/wBipJdMlEkH/E1vuX9Y+PlP+xQAoM//AAkr/LHn7Iv8R/vn2q3CbjdL8sf3/wC8fQe1ZQ06X/hIWT+07zP2VTvymfvnj7vSrUWmSlpf+JrfDD+sfPA/2KAJyZ/sMPyx4zH/ABH1HtUkhuPtEPyx9/4j6fSqB0yX7HEf7UvuTHxmPjkf7FPk0yXz4h/at8evOY+OP9ygAtjP/b2oYWPPlw5+Y/7ftUxM/wDZ8/yx/wDLT+I+p9qz7bTpTrd8v9p3oKxxEsCmW+91+Wpjpkv2Cc/2pe8eZxmPB5P+xQBoyG48yL5Y/vf3j/dPtQxuPtKfLH9xv4j6j2qnJpcoki/4mt9971j44P8AsUp0uX7Qg/tW++63OY/Uf7FADdOM/wDaOq4WPP2lc/Mf+eMftUwM/wDZkXyx42p/Efb2rPsNOla/1MDU7xdtwoJBTLfuozk/L74/Cphpsv8AZ0R/tS95VOMx4HT/AGKAL8puPOh+WP7x/iPofahTcfbJPlj/ANWv8R9W9qqSaZL50P8AxNb45Y94+OD/ALFC6ZL9qkH9q333F5zH6t/sUAOsDP8AYLjCx48+f+I/89G9qnkM/wBlj+WP70f8R/vD2rOstNlaxnI1O9XE0wwCnOHb/Z71M+mS/Zoz/al8fmTjMfHzD/YoAusbj7ZH8sf+rb+I+q+1LCbjzJ/lj/1g/iP91faqbaZL9qjH9q333G5zH6r/ALFEWmSmSb/ia3ww/rHz8o/2KAI9KM//AAjcGFjxs7sfX6VoyG48yL5Y/v8A94/3T7ViaZp0r+H4XGpXigp9xSmBz/u1oSaXLvi/4mt8fm9Y+OD/ALFAFpTcfbJPlj/1a/xH1b2qCUz/AGG8+WPGHz8x9PpUS6ZL9rkH9q333F5zH6t/sVFLpsosro/2penAfjKc8f7lAE9qZ/7FssLHjZDj5j/s+1WWNx9sj+WP/Vt/EfVfasu102U6PZt/ad6AUi+UFMDO3p8tWW0yX7VGP7VvvuNzmP1X/YoAuxG43y/LH9/+8f7o9qz9YM//AAjOpbljx5E2cMf9r2qSPS5d8v8AxNb4fN6x88D/AGKo6tp0qeHdQc6leOFhlJRimGxnr8tAGzMbjzIPlj/1h/iP91vakBuPtjfLH/qx/EfU+1VJdMlEkP8AxNb45f1j4+U/7FA0yX7Ww/tW++4Ocx+p/wBigC3CbjdN8sf3/wC8fQe1U7oz/wBkW2Vjx5tv/Ef+eie1LDpkpaX/AImt8Pn7GPngf7FVLnTpRpdu39p3hBktxtJTAzIn+z2oA1pDcfaIflj7/wAR9PpQpuPtknyx/wCrX+I+re1VH0yXz4h/at935zHxx/uULpkv2px/at99xecx+rf7FAExM/8AZ8/yx4/efxH1PtUWqmfztOysf/H2uMMf7je1RHTJfsEx/tS948zjMeDyf9iotS06VZbDOp3j7roAbiny/K3I+XrQBq5uPtX3Y/uf3j6/SljNx5kvyx/e/vH+6Paqf9mS/acf2rffc65j9f8AcpU0uXfL/wATW++96x88D/YoAlBn/s2L5Y8bU/iPqPaoL0z/ANsablY87pMfMf7h9qjGmy/2fEf7UveVTjKYHT/YqG806VdV05Tqd4SzSYYlMr8h6fLQBqqbj7ZJ8sf3F/iPq3tTAZ/sM3yx9ZP4j6n2quumS/anH9q333F5zH6t/sUwaZL9jlP9qX3Bk4zHzyf9igC/cm48oZWP/WJ/Ef7w9qqSmf8A4SW1+WPP2Sb+I/34vakuNMlEY/4mt8fnTqY/7w/2KrS6dKPENsn9p3hJtZjvymRh4+Pu9Of0FAGpEbjzZ/lj++P4j/dX2qPM/wDZS/LHjyh/EfT6VBFpkpkm/wCJrfDDjvHz8o/2Kj/s2X+zFb+1L3/VA7cx46f7lAF+U3HmwfLH/rD/ABH+63tUERn/ALcufljz9nh/iP8Aek9qjl0yUSQf8TW+OXPePj5T/sVDHpsp1m4X+1L0EQRHdlMn5pOPu+360AaMBuP3nyx/6w/xH/CowZ/7Pg+WPH7v+I+o9qgh0yU+Z/xNb4fOehj5/wDHKjGmy/YYT/al7z5fGY8Dkf7FAGgxuPtkfyx/6tv4j6r7VUsTP/a2p4WPPmR5+Y/8819qRtMl+1IP7VvvuNzmP1X/AGKrWWnStqmoqNTvFKyICwKZb92vX5aANAmf+zZPljxsb+I+/tUkpuPNg+WP75/iP91vaqJ0yX+z5D/al79xuMx47/7FPl0yUSQ/8TW+OXPePj5T/sUAXAbj7Y3yx/cH8R9T7VT0oz77/Cx/8fbZyx9F9qBpkv2ph/at99wc5j9T/sVV0zTpXe+xqd4u26YfKU54Xk/L1oA0FM/9nwfLHj93/EfUe1Tk3H2lPlj+438R9R7VnDTJfsMJ/tS958vjMeByP9ipjpcv2hB/at991ucx+o/2KALKm4+2SfLH/q1/iPq3tUOhZ/sts9ftNxnH/XZ6iXTJftUg/tW++4vOY/Vv9in+H1KaTtLM5W4uBubqf3z8mgDTooooAKKKKACiiigAooooAKKKKACiiigAooooA4L4jhT4i8Cb13L/AG8MjGc/6PN2rr1S1+2Sf6OMeWv/ACxPq3tXI/EU48SeAyAT/wAT4cD/AK95q7JZG+2SfuX/ANWvdfVvegCO3S12vm3H+sb/AJYn1+lZ+qaRpWteGW03UrJZrW6jSOVDCRuBI744Poa1LeRtr/uX/wBY3dfX61GJG/s+D9y//LPuvqPegDz/AMHXN3oHiiHwb4oUztbQSnSdRlj51C3ymFPHMsYGG9Rg+9egqlr58n+jjoP+WJ9/aua8deGf+EsW0t45JrHULVZLnT72MjdbTqU2v15HJBHcE0/wT4rutbW80/XLE2fiDTCkWoWykbSSDtljJPMbjkH6jtQBuFLb+z5/3Az+8/5Yn1PtUsqWvmwf6OPvn/lif7p9qQyN/Z8/7l/+WndfU+9TTSN5sH7l/vnuv91vegDPCW3/AAkj/uBt+yLx5J/vntircKWu6X/Rx9//AJ4n0HtUIkb/AISVz5L/APHovGR/fPvVuGRt0v7l/v8AqvoPegCsUtvsUP8Ao4zmP/lifUe1SSJa/aIv9HHf/lifT6Upkb7DD+5frH3X1HvUkkjfaIf3L9+6+n1oAz7ZLb+3b/MAx5cOB5J4+97VMUtv7Pn/AHAz+8/5Yn1PtTbWRv7e1D9y/wDq4eMjj7/vUxkb+z5/3L/8tO6+p96AHSJa+ZF/o4+9/wA8T/dPtQyWv2hP9HH3G/5YH1HtUskjeZF+5f7/AKr/AHT70NI32lP3L/cbuvqPegDO09Lb+0NUzACPtK4Hknj9zH7VMEtv7Ni/cDO1OfJPt7UmnSN/aOq/uXP+kr3HH7mP3qUSN/ZkP7l/upzlfb3oAWVLXzof9HH3j/yxPofahUtftcn+jj7i/wDLE+re1SyyN50P7l/vHuvofehZG+2SfuX/ANWvdfVvegChYpbfYbjMAJ86f/lif+eje1TyJa/ZY/8ARx96P/lif7w9qbYSN9guP3Ln9/P3H/PRvep5JG+yx/uX+9H3X+8PegBrJa/a4/8ARx/q2/5Yn1X2ohS18yf/AEcf6wf8sT/dX2qRpG+2R/uX/wBW3dfVfelhkbzZ/wBy/wDrB3X+6vvQBl6Wlv8A8I5BugBbZ18onv64rQkS13xf6OPv/wDPE/3T7VT0p2HhuAeU5+Trkev1rRkkbzIv3L/f9V/un3oAhVLX7ZJ/o4xsX/lifVvaoZUtvsN3+4GcPj9yfT6VbWRvtkn7l/8AVr3X1b3qCWRvsN5+5fo/dfT60AV7VLb+xbPMAzshyfJPP3farTJa/a4/9HH3G/5Yn1X2qK0kb+xLL9y/3Ie6/wCz71aaRvtkf7l/9W3dfVfegCONLXfL/o4+/wD88D/dHtVDWEt/+Ea1HbAA3kzYPkkY+93xWpFI2+X9y/3/AFX+6Pes/WXY+GNSHlOP3E3OR/te9AFqZLXzIP8ARx/rD/yxP91vagJa/bG/0cY8sf8ALE+p9qlmkbzYP3L/AOsPdf7re9Akb7Y37l/9WO6+p96AIoUtd03+jj7/APzxPoPaqd0lt/ZNtiAZ823yfJP/AD0T2rQhkbdN+5f7/qvoPeqd1I39kWv7p/8AW2/OR/z0T3oAsSJa/aIf9HHf/lifT6UKlr9rk/0cfcX/AJYn1b2qWSRvtEP7l/4u6+n1pFkb7ZJ+5f8A1a919W96AKxS2/s+f9wM/vP+WJ9T7VDqiW3m6ftgA/0sZ/ckZ+RvarRkb+z5/wBy/wDy07r6n3qLVZG87Tv3Lj/S17j+43vQBPstftX/AB7j7n/PE+v0ojS18yX/AEcfe/54H+6PapPMb7V/qX+56r6/WljkbzJf3L/f9V/uj3oAqBLb+zYv9HGdqc+Sfb2qG8S2/tbTcQADdJkeSefkPtVsSN/ZsX7l/up3X1HvUF7I39saZ+5f70nGRz8h96AJ1S1+1yf6OPuL/wAsT6t7VGEtvsU3+jjOZP8AlifU+1WFkb7ZJ+5f7i919W96YJG+wzfuX6yd19T70AJcJa+UMW4++n/LE/3h7VUlS2/4SS1/cDb9kmyPJP8Afi7YrQuZG8ofuX/1id1/vD3qpLI3/CS2p8l/+PSbjI/vxe9AE0SWvmz/AOjj74/5Yn+6Paotlt/Za/uBnyhz5J9PpVqKRvNn/cv/AKwd1/ur71F5jf2Uv7l/9UOcr6fWgAlS182D/Rx98/8ALE/3W9qgiS2/tu5/cDH2eLA8k/3pParcsjebB+5f/WHuv91veoIpG/ty5/cv/wAe8PGV/vSe9AD4Etf3n+jj/WH/AJYn/Coglt/Z8H7gZ/d/8sT6j2qzBI37z9y/+sPdf8ajEjf2fB+5f/ln3X1HvQAMlr9sj/0cY2N/yxPqvtVSyS2/tXU8wAjzEwPJPH7tfatBpG+2R/uX/wBW3dfVfeqljI39ran+5f8A1kfGRx+7X3oAcUtv7Nk/0cZ2Nz5J9/apJUtfMg/0cffP/LE/3T7UGRv7Nk/cv9xucr7+9SyyN5sH7l/vnuv91vegCIJa/a2/0cfcH/LE+p9qqaWltvv90AP+ltj9yTgYX2rQEjfbG/cv9wd19T71U0qRg9/+5c/6W3cei+9AChLb+z4P3Az+7/5Yn1HtUxS1+0p/o4+43/LA+o9qasjf2fB+5f8A5Z919R71OZG+0p+5f7jd19R70AQqlr9rk/0cY8tf+WJ9W9qj0HA0s7RgfabjAxjH756sLI32yT9y/wDq17r6t71BoXOmNxj/AEm44/7bPQBo0UUUAFFFFABRRRQAUUUUAFI7bI2baW2gnC9TS1X1CCW6025t7edreaWJkjmXrGxBAYfQ80AeeeG/ijd6lfQNqltpy2d1Zz3hjsblpbjTliAJW5UgbSckdsMMYPWr2i+ONae90aXxHptjaab4gheawe2nd5ICIjMEmBUAkxhjlTgFSPesXSfh7qLtpNnPothoiafaTWt/qFpOHfUxJAYzwFBILkSEychlHXJNaOleGfEN/N4ZsfEFjbWln4cgdHniuvM+2yG3aAFFwCi7XZju5zgYPWgCxpvjjW1m0W+8QadYW2i+IDiykt53aa3JiaaMSgqAdyIfu9Dxz1p2keNNekvNCutc02wg0jxEwSxe3ndpoGaJpY1lBUA7kU/d6HjnrVOy8MeIdSt/DOia5YW9rp/h4q0t3HdbzelLd4U2JjKg79x3dMYGetSaX4e8SXJ8K6VrFhbWll4ZkSR7yO68w3rRwPDHsTAKg79x3dMYGetAFj4i5PiTwHsIB/t4YJGf+XeauxVbj7ZJ+8j/ANWv/LM+rf7VcB8Q9KtYfFPgqbzrxTNr3zlr6UquYJT8oLYX8APTpXXrYWP2px9vusbF5+3yerf7VAGhbrcbXxJH/rG/5Zn1/wB6ogs/9nwfvI8fu/8AlmfUf7VVILCxKvm/uh87f8v8nr/vVGLCx+wwn7dc5Pl5H26Tjkdt1AF2ZZ/7atf3kefIl/5Zn1j/ANquW8ZeGdYn1WDxR4UlhHiDS49iwsCkd/ATlrdznv1U9m9M5ralsbIavbKL65KmGUk/bpMjlO+7ip1sLHzpP9Puug/5f5Pf/aoAo+GfEkHivwrLqGnyBMNLHcW00RWW2lBO6N13cMM/yNbsy3HmwfvI/vn/AJZn+63+1XmXijRJPCt9ceLvDTz3NvIHGt6bFduJLlASFnQ7uZEHUH7y8da7PT5dF1rTrDUtL1a4uLS6HmRyLfycqVP+1wexHUcigC+Fn/4SR/3kefsi/wDLM/3z71chW43S/vI/v/8APM+g/wBqsUWNl/wkDL9uudv2UHd9ufOdx4zu/SrUVhY7pc390Pn/AOf+T0H+1QBbKz/YYf3keMx/8sz6j/aqSRbj7RF+8j7/APLM+n+9WYbCx+xxH7dc5ymR9vk9R/tVJJYWPnxf6fdY5/5f5PT/AHqAJLZZ/wC3tQxJHny4c/uz/t+9TFZ/7Pn/AHkeP3n/ACzPqf8AarLt7GyOtXqm9uQojiwwvnBP3u+7mpTYWP2GY/brnI8zA+3yc8ntuoA1ZFuPMi/eR/f/AOeZ/un/AGqVluPtKfvI/uN/yzPqP9qs97Cx3xf6fdfe/wCf+T0P+1QbCx+0J/p91ja3P2+T1H+1QA/Tln/tHVcSR5+0rn92ef3MfvUwWf8As2L95Hjan/LM+3+1WXY2Nk1/qQa9uQFuFCkXzjI8pOSd3P1/DtUosLH+z4j9uuc7UyPt0nt23UAakq3HnQ/vI/vH/lmfQ/7VCrcfbJP3kf8Aq1/5Zn1b/aqhJYWPnRYv7o/Mf+X+T0P+1QthY/apB9vusbF5+3yerf7VAEtgs/2C4xJHjz5/+WZ/56N71YkWf7LH+8j+9H/yzP8AeH+1WTZWNkbKctfXIImmAAvpBn52xxu//XUz2Fj9mjP2+6zlOPt8nqP9qgDSZbj7ZH+8j/1bf8sz6r/tUQrceZP+8j/1g/5Zn+6v+1VBrCx+1Rj7fdY2Nz9vk9V/2qIrCx8ybN/dDD8f6fJz8o/2qADSln/4RuDEkeNneM+v1rRkW48yL95H9/8A55n+6f8AarA02ys20CFmvbhWK8qL1wBz6bqvyWFjvi/0+6+9/wA/8nof9qgC8q3H2yT95H/q1/5Zn1b/AGqhlWf7DefvI8YfP7s+n+9VZbCx+1SD7fdY2Lz9vk9W/wBqoZLGy+x3RF9c5AfA+3Sc8f73NAFu1Wf+xLLEkeNkOP3Z/wBn3q0y3H2yP95H/q2/5Zn1X/arHtrGyOkWjG+uQxSLIF9IAOnbdxVlrCx+1Rj7fdY2Nz9vk9V/2qANGNbjfL+8j+//AM8z/dH+1WdrCz/8IzqWZIyPImziM/7XvSx2Fjvkzf3X3v8An/k9B/tVR1Wys18PX7Je3DMsMpCm9dgevbdzQBuTLcebB+8j/wBYf+WZ/ut/tUBbj7Y37yPPlj/lmfU/7VUJbCx8yHF/dH5+f9Pk4+U/7VAsLH7Uw+33WNg5+3yep/2qAL8K3G6b95H9/wD55n0H+1VO6Wf+yLbMkePNt/8Almf+eie9RxWFiWlzf3X3/wDn/k9B/tVVubGyGl25F7ckmSDIN85AzIueN3/6qANqRbj7RD+8j7/8sz6f71CrcfbJP3kf3F/5Zn1b/aqg9hY+fF/p91jnP+nyen+9SLYWP2px9vusbF5+3yerf7VAFsrP/Z8/7yPH7z/lmfU/7VQ6os/nadmSP/j7XGIz/cb3qsbCx+wzH7dc5HmYH26T1PbdUWpWNkstjtvrls3QBzfOcDa3P3uPrQBtbbj7V/rI/uf88z6/71LGtx5kv7yP73/PM/3R/tVnfYLH7T/x/wB1jZ1+3yev+9SpYWO+X/T7r73/AD/yeg/2qALIWf8As2L95Hjan/LM+3+1UN6s/wDa+m5kjzukx+7P9w+9VhYWP9nxH7dc52px9uk9u26oruxshqmngXtyQzPkm+ckfIeh3cUAbKrcfbJP3kf3F/5Zn1b/AGqYFn+xTfvI8Zk/5Zn1P+1VNbCx+1OPt91jYvP2+T1b/aqMWFj9jlP265zl+Pt8nqf9qgDTuVuPKGZI/wDWJ/yzP94f7VVJVn/4SW1/eR5+yTf8sz/fi96jnsLERjF/dH51/wCX+Q/xD/aqrJY2Q8QWyi+udptZSW+3PkHdHxndx1PHt7UAbMS3Hmz/ALyP74/5Zn+6v+1UW2f+yl/eR48of8sz6f71VYrCx8ybN/dff4/0+Tn5R/tVF9gsf7NB+3XOfLHH2+T09N1AGpKtx5sH7yP/AFh/5Zn+63+1UESz/wBuXP7yPP2eH/lmf70nvVaWwsRJDi/uvvnP+nycfKf9qoo7Gy/ti4U31ztEERB+3SZJ3Sd93+fxoA1YFuP3n7yP/WH/AJZn/wCKqILP/Z8H7yPH7v8A5Zn1H+1VWGwsT5mb+6Hzn/l/k/8AiqiFhY/YYT9uucny8j7dJxyO26gDUZbj7ZH+8j/1bf8ALM+q/wC1VSxWf+1tTxJHnzI8/uz/AM8196jawsftSD7fdY2Nz9vk9V/2qq2djZHU9QDX1yAsiYIvnBPyDqd3NAGqVn/s2T95HjY3/LM+/wDtVJKtx5sH7yP/AFh/5Zn+63+1WYbCx/s+Q/brnOxuPt8nv23VJLYWIkhxf3X3+f8AT5OPlP8AtUAXwtx9sb95H9wf8sz6n/aqppSz77/Ekf8Ax9tnMZ9F96jFhY/aiPt91jYOft8nqf8AaqrptjZM17uvblcXTAYvnGRgc/e5+tAGoqz/ANnwfvI8fu/+WZ9R/tVOVuPtKfvI/uN/yzPqP9qskWFj9hhP265yfLyPt8nqO26pjYWP2hf9PusbW/5f5PUf7VAF5VuPtkn7yP8A1a/8sz6t/tVDoWf7LbPJ+03GcD/ps9VlsLH7VIPt91jYvP2+T1b/AGqn8PKqaPtRiyi4nAYtuJHnPznv9aANOiiigAooooAKKKKACiiigAooooAKKKKACiiigDg/iMdviTwGcE/8T4cD/r3mrsVn/wBMk/dSf6tf4fdq474i5/4STwHtAJ/t4dTj/l3mrs1M32yT5E/1afxn1b2oAbbz4V/3Un+sb+H3qMT/APEvg/dSf8s/4fcVNbmba+ET/WN/GfX6VEDL/Z8HyJ/yz/jPqPagCOaf/idWp8qT/US/w+8dWFn/AH8n7qTov8P1qCYy/wBt2vyJnyJf4z6x+1WVM3nyfInRf4z7+1AFcz/8S+f91J/y0/h9zXn1/JJ8LNefU4beQ+DL+4827hRDnS52BBlUf88mJyyj7p5HXFehky/2fP8AIn/LT+M+p9qW9h+1RpBc28MsMpZHjc7ldSjAggjkEUAVILyOfXhPAGkjkskZGQZDAsSCD3FXoZ/ml/dSff8A7vsK8x027k+FnjCHRNUff4avgItKu2YkaeWclbeViPu5yEY9Oh9R6fCZt0vyJ9/++fQe1AERn/0GH91J1j/h9xT5J/8ASIf3Unf+H2ppMv2GH5E6x/xn1HtUkhm+0Q/Inf8AjPp9KAKVtN/xPtQPlycxw/w/79TGf/iXz/upP+Wn8PuajtTL/b2ofImfLhz85/2/apiZf7PuPkT/AJafxn1PtQBLJP8AvIv3Un3/AO7/ALJoaf8A0lP3Un3G/h9xSyGbzIvkT7/98/3T7UMZvtKfIn3G/jPqPagCjp02NR1X93Jzcr/D/wBMY6mE/wDxLIh5Un3U/h+lR6cZf7R1XCJ/x8rn5z/zxj9qlBl/syH5ExtT+M+3tQBJLP8Avof3Un3j/D7GhZ/9Mk/dSf6tf4fdqdKZvOh+RPvH+M+h9qFM32yT5E/1a/xn1b2oAqWE2LC4/dyf6+f+H/po1TyT/wCix/upPvR/w/7QqGwMv2C4wif6+f8AjP8Az0b2qeQy/ZY/kT70f8Z/vD2oAVp/9Mj/AHUn+rb+H3Wlhn/ez/upP9YP4f8AZWlYzfbI/kT/AFbfxn1X2ohM3mz/ACJ/rB/Gf7q+1AGdpU2PDcA8uQ/J1C+9aMk/7yL91J9/+7/sms/SjL/wjcGETGz++fX6VoyGbzIvkT7/APfP90+1ADFn/wBMk/dSf6tf4fdqhln/ANBvP3UnR/4farCmb7ZJ8if6tf4z6t7VBKZfsN58idH/AIz6fSgCO0n/AOJLZDy5PuQ/w/7tWWn/ANMj/dSf6tv4fdar2hl/sSy+RMbIf4z6r7VaYzfbI/kT/Vt/GfVfagAin+eX91J9/wDu/wCyKz9Ymz4Z1IeXIMwTclf96tGIzb5fkT7/APfP90e1Z+smX/hGNSyiY8ibPzn/AGvagC9NP+9g/dSf6w/w/wCy1IJ/9Mb91J/qx/D7mnTGbzYPkT/WH+M/3W9qAZvtjfIn+rH8Z9T7UANhn+ab91J9/wDu+wqndTf8Si2Hlyf623/h/wCmiVehM26b5E+//fPoPaqd0Zf7ItcomPNt/wCM/wDPRPagC1JP/pEP7qTv/D7ULP8A6ZJ+6k+4v8Pu1OkM32iH5E/i/jPp9KRTN9sk+RP9Wv8AGfVvagCEz/8AEvn/AHUn/LT+H3NRapNmbTv3cgxdr1X/AGGqYmX+zp/kT/lr/GfU+1RaqZfO07KJ/wAfa4+c/wBxvagC15/+lf6qT7n933pY5/3kv7qT7393/ZFGZvtf3E+5/fPr9KWMzeZL8iff/vn+6PagCAT/APEtiHlSfdT+H3FQXs3/ABN9NPlycNJ/D/sGrAM39mxfIn3U/jPqPaob0y/2xpnyJndJj5z/AHD7UAWVn/0yT91J9xf4fdqYJ/8AQZv3UnWT+H3NSqZvtknyJ9xf4z6t7VGDL9hm+ROsn8Z9T7UAOuZ8xD91J/rE/h/2hVWWb/ipbU+XJ/x6Tcbf9uKrlyZvKHyJ/rE/jP8AeHtVSUy/8JLa/Imfsk38Z/vxe1AFmKf97P8AupPvj+H/AGVqPz/+JUo8qT/VD+H2qaIzebP8iffH8Z/ur7VFmb+yV+RMeUP4z6fSgB8s/wC9g/dSf6w/w/7LVBFP/wATy5PlSf8AHvD/AA/7UlWZTN5sHyJ/rD/Gf7re1QRGX+3Ln5Ez9nh/jP8Aek9qAJYJ/wDWfupP9Yf4ajE//Evg/dSf8s/4fcVNAZv3nyJ/rD/Gf8KiBl/s+D5E/wCWf8Z9R7UAPaf/AEyP91J/q2/h91qrYzY1bUz5cnMkf8P/AEzWrjGb7ZH8if6tv4z6r7VUsTL/AGtqeETPmR5+c/8APNfagCUz/wDEtkHlSfcb+H61JLP+9g/dSffP8P8AstTSZf7Nk+RMbG/jPv7VJKZvNg+RP9Yf4z/db2oAaJ/9Mb91J9wfw+5qrpU2Hv8A93If9LbovstXAZvtjfIn+rH8Z9T7VU0oy77/AAif8fbfxn0X2oAkWf8A4l8H7qT/AJZ/w+4qcz/6Sn7qX7jfw+4qJTL/AGfB8if8s/4z6j2qYmb7SnyJ9xv4z6j2oAYs/wDpkn7qT/Vr/D7tUOhHOlsembm46/8AXZ6sKZvtknyJ/q1/jPq3tVfQs/2Y2ev2m4z/AN/noA0aKKKACiiigAooooAKKKKACmTLI0LrC4jkKkK5XcFOODjv9KfRQB57HrPifT/F95b3msWuoaXo9g15qbpp3kkMVYxxIfMPzYUuT2G3+9waV4t8QWs3hu78RS2Mtj4igeQRW9u0bWTiAzqu8ufMGxWBOByAehxW/pHhuaPT9fg1h45H1m9uJZGhYn904EcYyQOREqA9sg9aw9I8Ga+91oNv4ln019O8OwvFbG0Mhku2MJgDyKwATCM3ALcnqMUAR2Xi3xBZQ+GtY16awl0zxCQDbwWzJJZF4HmjG8ud4whVsgcnIwOKfpnijxHE3hfUtZmsJtP8SusYtoLZkeyaSBpoxvLneMIVbIHJyMDik0/wZ4gn/sDTPEM2mto/h4gwNatIZrwrC0MZkVlCphXJIBbJA6Cn6V4Q8RGfw7Y67Ppv9leG3WS2ktWkM12yQtDGZFZQqYVyxALZIHQUAO+IoLeJPAYDFT/bw5Hb/R5q7FYX+2Sf6RJ/q17L6t7VwHxD0fTYfFPgqYW0aNPr375843ZglJyfrXYLpmjfanBSLGxcfvT6t70AX7eF9r/6RIP3jdl9fpUQif8As+D/AEiT/lnxhfUe1VYNM0Yq+5Ivvt/y1Pr9aiGm6P8AYYTsi3Hy8/vT6jPegC7NE/8AbVqPtEn+ol5wvrH7VYWF/tEn+kSdF7L7+1ZEum6QNXtlCxbDDKT+9PXKY7/Wp10zRvOkGyLGBj96ff3oAtGJ/wCz5/8ASJP+WnZfU+1SzQv5sH+kSffPZf7re1ZZ03R/sMx2Rbh5mP3p9TjvUsumaMJIcJFgvz+9P90+9AFfVtDtNevrzStXBurO6sAksbqvzAufbjHUEcg81zPhjVbzwj4ij8EeJLyd4ZONE1WXaftaKB+5kJHEqjA/2hz169INO0j/AISBk2xeX9lB/wBaeu4+9Vdc8G+GvEuj3WnagiKrPmKaObEkDgDbIhzwwPIP9KAOgMT/AGGH/SJOsfZfUe1Pkhf7RD/pEnfsvp9K868J6rbC9bwp4uhhi1y1CNBciQiPU4MgeanPD4++nY8jjp2z6Zo3nxYSLHOf3p9PrQBJbRP/AG9qA8+T/Vw84Xn7/tUxif8As+f/AEiT/lp2X1PtWXb6dpB1q9Vli2LHFt/en/az3qU6bo/2GY7Itw8zH70+px3oA1pIX8yL/SJPv+i/3T7UNC/2lP8ASJPuN2X1HtWe+maMHiwkX3uf3p9D70HTNF+0INkWNrZ/en1HvQA/TonOo6r/AKRIMXK84Xn9zH7VMIn/ALNi/wBIk+6nGF9vasux07SGvtSDrFtW4UJ+9PTykPr6k1KNN0f+z4jsi3bUz+9Pt70AaksL+dD/AKRJ949l9D7ULC/2yT/SJP8AVr2X1b2qhJpmjCaLCRYJOf3p9D70LpmjfapBsixsXH70+re9AE1hE5sLj/SJB+/n7L/z0b2qeSJ/ssf+kSfej7L/AHh7Vk2Wm6Q1lOXWLcJpgP3p6B2x39KmfTNH+zRkJFnKZ/en1HvQBpNC/wBsj/0iT/Vt2X1X2ohhfzZ/9Ik/1g7L/dX2qg2maN9qjGyLGxs/vT6r70RaZoxkmykXD8fvT/dHvQAaVE58NwHz5ANnQBfX6VoyQv5kX+kSff8ARf7p9qwNN07SX0CF5Fj8wrzmQ+v1q/Jpmi74sJF97n96fQ+9AF5YX+2Sf6RJ/q17L6t7VDLE/wBhvP8ASJOj9l54+lVl0zRvtUg2RY2Lj96fVveoZNN0cWd0QkW4B9v70+n1oAuWkT/2LZH7RJ9yHjC8fd9qstC/2yP/AEiT/Vt2X1X2rHttO0g6RaMyxbykW796f9nPerLaZo32qMbIsbGz+9PqvvQBoxQvvl/0iT7/AKL/AHR7Vn6xE48M6kTPIQIJuCF5+97UR6Zo2+TKRfe4/en0HvVHVdO0lPD1+8Sx+YsMpXEhPPOO9AG5NC/mQf6RJ/rD2X+63tQIX+2N/pEn+rHZfU+1UJdM0YSQ4SLl+f3p/un3oGmaN9qYbIsbB/y1PqfegC/DC+6b/SJPv+i+g9qp3UT/ANkWx8+T/W2/GF/56J7UyLTNGLS5SL7/AB+9PoPeqlxp2kjS7dlWLeZIAf3p6GRc9/TNAG1JC/2iH/SJO/ZfT6ULC/2yT/SJP9WvZfVvaqD6Zo3nxAJFjnP70+n1pF0zRvtTgpFjYuP3p9W96ALZif8As+f/AEiT/lpxhfU+1RapE4m07NxIf9LXqF4+Rvaqp03R/sMx2Rbh5mP3p9TjvUWpadpCy2PlrFhroBsSnptb3+lAG15L/av+PiT7novr9KWOF/Ml/wBIk+96L/dHtWd/ZmjfacbIsbP+ep9frSppmjb5cpF97j96fQe9AFkRP/ZsX+kSfdTjC+o9qhvYn/tfTf38nLSc4Xj5D7VWGm6P/Z8R2RbiqZ/en296iu9O0hdU09VWLYzSb/3p/uHHegDZWF/tkn+kSfcXsvq3tTBE/wBhm/0iTrJ2X1PtVNdM0b7U42RY2Lj96fVveoxpmj/Y5Tsi3Avj96fU470AadzC/lD/AEiT/WJ2X+8PaqksT/8ACS2o8+TP2SbnC/34vao59M0YRjakWd6/8tT/AHh71Vk07SB4gtkCxeWbWUn96eoaPHf3NAGzFC/mz/6RJ98dl/ur7VH5T/2Up+0Sf6ocYX0+lVItM0YyTZSLAcY/en+6Peo/7N0f+zVbZFu8sH/Wnrj60AacsL+bB/pEn+sPZf7re1QRRP8A25cj7RJ/x7w84X+9J7VWl0zRhJDhIsFzn96f7p96ij03SDrFwpWLYIIiP3p67pM9/YUAasEL/vP9Ik/1h7L/AIVEIn/s+D/SJP8Aln2X1HtVWHTNGPmZSL75x+9P+NRDTdH+wwnZFuPl5/en1Ge9AGo0L/bI/wDSJP8AVt2X1X2qrYxP/a2p/wCkSDEkfOF5/dr7VE2maN9qQbIsbG/5an1X3qrZ6dpDanqCusW1ZECfvT/cHv60Aapif+zZP9Ik+43GF9/apJYX82D/AEiT757L/db2rMOm6P8A2fIdkW7Y2P3p9/epJdM0YSQ4SLBc5/en+6fegC+IX+2N/pEn3B2X1PtVTSonL3+J5B/pbdl54X2qMaZo32ojZFjYP+Wp9T71V03TtIZr3zFi+W6YLmU9MD3oA1Fif+z4P9Ik/wCWfGF9R7VOYX+0p/pMn3G7L6j2rJGm6P8AYYTsi3Hy8/vT6jPepjpmjfaEGyLG1v8AlqfUe9AF5YX+2Sf6RJ/q17L6t7VDoQxpbAnP+k3HJ7/vnqsumaN9qkGyLGxcfvT6t71P4eVE0fbFjYtxOFwc8ec+KANOiiigAooooAKKKKACiiigAooooAKKKKACiiigDg/iMSPEngMhSx/t4cDv/o81disr/bJP9Hk/1a919W96474i5/4STwHtIB/t4YJGf+XeauxVbj7ZJ+8j/wBWv/LM+rf7VABbyvtf/R5D+8buvr9aiEr/ANnwf6PJ/wAs+6+o96lt1uNr4kj/ANY3/LM+v+9UYWf+z4P3keP3f/LM+o96AGTSv/bVr/o8n+ol4yvrH71YWV/tEn+jydF7r7+9V5ln/tq1/eR58iX/AJZn1j96sKtx9ok/eR9F/wCWZ9/9qgCEyv8A2fP/AKPJ/wAtO6+p96lllfzYP9Hk++e6/wB1veois/8AZ8/7yPH7z/lmfU+9TSrcebB+8j++f+WZ/ut/tUAUxK//AAkrn7PJ/wAei8ZX++ferkMr7pf9Hk+/6r6D3qoFn/4SR/3kefsi8+Wf7596twrcbpf3kf3/APnmfQf7VAHOeLfDFv4q0O0WSOe01CzkSbT9QhK+ZaS8AMvPI9VPBHXsRV8H+M7nV7yTQ/EFmbTxLpYIvbdSAsy9FniyeY26+xOD2z1JWf7DD+8jxmP/AJZn1H+1XO+MvCE+u3FlqWmXcdh4g0/e1hfJGeDjmKTn5o26Ee+RQBtW0r/29qB8iT/Vw8ZXj7/vUxlf+z5/9Hk/5ad19T71y3gTxVN4mvdUS9gGm6zZCKHUNPlXLQyDdyvPzIeqt0INdSVn/s+f95Hj95/yzPqfegCaSV/Mi/0eT73qv90+9K0r/aU/0eT7jd19R70SLceZF+8j+/8A88z/AHT/ALVDLcfaU/eR/cb/AJZn1H+1QBS06VxqOq/uJDm5XjK8fuY/ephK/wDZsX+jyfdTnK+3vUWnLP8A2jquJI8/aVz+7P8Azxj96lCz/wBmRfvI8bU/5Zn296AJZZX86H/R5PvHuvofehZX+2Sf6PJ/q17r6t70SrcedD+8j+8f+WZ9D/tUKtx9sk/eR/6tf+WZ9W/2qAK1hK/2C4/0eQ/v5+6/89G96nklf7LH/o8n3o+6/wB4e9QWCz/YLjEkePPn/wCWZ/56N71PIs/2WP8AeR/ej/5Zn+8P9qgBzSv9sj/0eT/Vt3X1X3ohlfzJ/wDR5P8AWDuv91fehluPtkf7yP8A1bf8sz6r/tUsK3Hmz/vI/wDWD/lmf7q/7VAGfpUrjw3APIkPydQV9frWjJK++L/R5Pv+q/3T71naUs3/AAjcGJI8bO6H1+taMi3HmRfvI/v/APPM/wB0/wC1QA1ZX+2Sf6PJ/q17r6t71DLK/wBhvP8AR5Oj9144+tTqtx9sk/eR58tf+WZ9W/2qglWf7DefvI+j5/dn0+tAEdpK/wDYlkPs8n3Iecrz933q00r/AGyP/R5P9W3dfVfeq1qs/wDYtliSPGyHH7s/7PvVlluPtkf7yP8A1bf8sz6r/tUAOilffL/o8n3/AFX+6Pes7WJXPhnUgYJAPIm5JXj73vWjGtxvl/eR/f8A+eZ/uj/arP1hZv8AhGdSzJGR5E2QEP8Ate9AF6aV/Ng/0eT/AFh7r/db3oEr/bG/0eT/AFY7r6n3pZluPNg/eR/6w/8ALM/3W/2qQLcfbG/eR58sf8sz6n/aoAIZX3Tf6PJ9/wBV9B71TupX/si2/cSf6235yv8Az0T3q5Ctxum/eR/f/wCeZ9B/tVTuln/si2zJHjzbfH7s/wDPRPegC5JK/wBoh/0eTv3X0+tCyv8AbJP9Hk/1a919W96WRbj7RD+8j7/8sz6f71Iqz/bJP3kf+rX/AJZn1b/aoAiMr/2fP/o8n/LTnK+p96i1SVzNp3+jyD/S17rz8je9Sss/9nz/ALyPH7z/AJZn1PvUWqLP52nZkj/4+1xiM/3G96ALfmv9q/495Pueq+v1pY5X8yX/AEeT73qv90e9JtuPtX+sj+5/zzPr/vUsa3HmS/vI/vf88z/dH+1QBAJX/s2L/R5PupzlfUe9Q3sr/wBr6b+4k+9JxlefkPvU4Wf+zYv3keNqf8sz7e9Q3qz/ANr6bmSPO6TH7s/3D70AWllf7ZJ/o8n3F7r6t71GJX+wzf6PJ1k7r6n3qRVuPtkn7yP7i/8ALM+rf7VMCz/YZv3keMyf8sz6n3oAfcyv5Q/0eT/WJ3X+8Peqksr/APCS2p8iTP2SbjK/34verlytx5QzJH/rE/5Zn+8P9qqkqz/8JLa/vI8/ZJv+WZ/vxe9AFqKV/Nn/ANHk++O6/wB1feovNf8Aspf9Hk/1Q5yvp9amiW482f8AeR/fH/LM/wB1f9qots/9lL+8jx5Q/wCWZ9PrQBJLK/mwf6PJ/rD3X+63vUEUr/25c/6PJ/x7w8ZX+9J71PKs/mwfvI/9Yf8Almf7rf7VQRLP/blz+8jz9nh/5Zn+9J70ATwSv+8/0eT/AFh7r/jUQlf+z4P9Hk/5Z85X1HvUsCz/ALz95H/rD/yzP/xVRhZ/7Pg/eR4/d/8ALM+o96AJGlf7ZH/o8n+rbuvqvvVWxlcatqf+jyH95HxleP3a+9WmW4+2R/vI/wDVt/yzPqv+1VWxWf8AtbU8SR58yPP7s/8APNfegCYyv/Zsn+jyfcbnK+/vUksr+bB/o8n+sPdf7re9RlZ/7Nk/eR42N/yzPv71LKtx5sH7yP75/wCWZ/ut/tUAIJX+2N/o8n3B3X1PvVTSpXD3+IJD/pbdCvHC+9XAtx9sb95H9wf8sz6n/aqppSz77/Ekf/H22cxn0X3oAlWV/wCz4P8AR5P+WfdfUe9TmV/tKf6PJ9xu6+o96hVZ/wCz4P3keP3f/LM+o96mK3H2lP3kf3G/5Zn1H+1QA1ZX+2Sf6PJ/q17r6t71DoRzpbEjH+k3HB7fvnqZVuPtkn7yP/Vr/wAsz6t/tVDoWf7LbPJ+03GcD/ps9AGjRRRQAUUUUAFFFFABRRRQAVU1bUE0nRb3UZVLJaW8k7KO4VSxH6VbqG8tIb+xntLpN8FxG0Uin+JWGCPyNAHlHhzx/qUjWWoajq91NHdabNeSWt3pnkW8zJF5hWzlCAttwQd7NuXLCtPTNf1/S28J6hrWrtqFt4ht3a5tjbxItrJ9ma4XyiihtoCMuHLE5BzV3Tfh7frJpdp4g1mHUtI0WJ4tPt47TypXDRGEGZ95DFY2ZflVc5yafofgPVLW/wBJ/t/WoNR0/QYXh02CO0MTtuj8oPMxchmEZK/KFByTQBnWuv6/pNl4T17VtZkv7TXyFu7FreJUtjJbvMnlMqhsKU2neWyDnipNM1nxDZJ4O1fU9Ze+t/EkiRXNk1vEqWzS27yoYmVQ2FKbTvLZBzxVzSvAWqxXWj2+u61bX+jaDk6fax2Zjkc+W0SGZy5DFEZgNoGScml0fwLq9tfaLFrOt297pHh8ltNt4rMxyswjMcbTOXIYojMBtAyeTQBH8RXQ+JPAg8wDGvDJB6f6PNXYK0X2yT/Sv+Wa/wAY9WrhfiHpOmQ+KfBMyadaq82vfvmW3XdJmCUnOBk8812K6fpP2px/ZsONi4H2T3b/AGaALNu0W183WP3jfxj1qMNF/Z8H+lf88+N49RUUFhpJV86bCfnb/l09/wDdqMWGlfYYT/Z0O4+Xk/ZOvI/2aAJpmi/tq1/0njyZed445jqwrRefJ/pXYfxj3rPlsNLGsWyjToQhhlJX7J1OUxxt+tTrp+k+dJ/xLYcYGP8ARPr/ALNAEhaP+z5/9K/56cbx6mpZWi82D/Sv4z/GP7rVRNhpX2GY/wBnQ7v3mD9k6cn/AGakl0/SRJDjTYRl+f8AROvyn/ZoAQNH/wAJI/8ApPH2Red4/vmrcLRbpf8ASv4/749BWYLHS/8AhIGX+z4dn2UHb9l4zvPOMVai0/Sd0udNhPz8f6J7D/ZoAlLRfYof9K7x8bx6inyNF9oi/wBK9f4x6VTNhpX2OI/2bDnMeT9k68j/AGafJp+k+fFjTYcc5H2Trx/u0Acn4n8MS3/iK51/w1era+JNPgjFrK8mI7lDuLQSj+JGx16qcEVo+E/F1l4q8O3b75LHUbVpIr/TpnHmWsuT8p9QezDgj8QNG3sdMOtXytp8JQRxbV+y9PvZ4xxXNeLvBFtewHXvDFtFZeIbLeY2NuRFdxhjmCYYwVI6HqpwQeKAO6kaLzIv9K/i/vj+6aGaL7Qn+lfwN/GPUVyvhTX/AA94rs8ppEdlqVpJ5WoabNajzbSTaflYAcg4yG6EfiB0B0/SftCf8S2HG1uPsnuP9mgBuntH/aGqZucf6SuDvHP7mOpQ0f8AZsX+lc7U43j2qjYWOltf6mH0+FlW4UKDa52jyozjpxzk/jUosNK/s+I/2dDu2pk/ZPp/s0AX5Wi86H/Sv4j/ABj0NIrRfa5P9K/5Zr/GPVqrSafpPnRY02HG45/0Trwf9mhbDSftUg/s2HGxcD7J7t/s0AFi0f2G4zc4/fz8bx/z0ap3aL7LH/pX8Uf8Y/vCs+ysdLaynL6dCSJpgCbXOBvbHap3sNK+zRkabDncmT9k/wBof7NAFtmi+2R/6V/yzb+Meq0sLReZP/pX/LQfxj+6tVWsNJ+1Rj+zYcbGyPsnuv8As0RWGk+ZNnTYTh+P9E6fKP8AZoAh0to/+Ecgzc4OzpvHrWjI0XmRf6V/H/fH901j6ZZaY3h+Fn0+FnK8sbXJPPrir0mn6TvixpsP3uf9E9j/ALNAFlWi+2Sf6V/yzX+MerVBK0X2G7/0ns/8Y54pi6fpP2qQf2bDjYvH2T3b/ZqKWw0sWd0Rp0OQHwfsnTj/AHaAJbVov7Fs/wDScfJDxvHH3ass0X2uP/Sv+Wbfxj1Ws22sdLOj2jNp0JYpFub7LnP3c84qy2n6T9qjH9mw42NkfZPdf9mgC3G0W+X/AEr+P++P7orP1ho/+EZ1HFzk+TNxvHP3qmj0/Sd8udNh+9x/onsP9mqOrWWmL4d1Bo9PhWRYZSrC1wQecc44oA15mi8yD/Sv+Wh/jH91qQNF9sb/AEr/AJZjnePU1Wl0/SfMhxpsIy/P+idflP8As0Cw0n7Ww/s2HGwcfZPc/wCzQBZhaLdL/pX8f98egqpdNH/ZNt/pOT5tvxvHH7xKdFp+klpc6bCfn4/0TpwP9mqlzY6YNLtyunwhjJBk/ZeuZEzzjvzQBqSNF9oi/wBK9f4x6UK0X2uT/Sv4F/jHq1Vn0/SfPixpsOOc/wCie3+7Qun6T9qcf2bDjYvH2T3b/ZoAkLRf2fP/AKV/z043j1NRao0fnafi5z/pYz844+RqYbDSvsEx/s6HcPMwfsnTk/7NRalY6Wsths0+Fd10A2LXGRtbjpzQBp7ovtX/AB9fwf3x60sbReZL/pX8X98f3RVX+z9J+0/8g2HGzp9k9/8AdoTT9J3y502H73H+iew/2aAJA0X9mxf6V/CnG8e1Q3jR/wBr6b/pORukyd44+Q0wWGlf2fEf7Oh3bUyfsn0/2ahu7HSxqunhdPhCs0m4C1xu+Q9sc0AaatF9sk/0r+Bf4x6tTA0X2Kb/AErvJxvHqahXT9J+1OP7NhxsXj7J7t/s0wWGlfY5T/ZsOcyYP2Tpyf8AZoAu3LReUP8ASs/On8Y/vCqkrR/8JJa/6Tx9km53j+/FS3Gn6SIxjTYQd6f8un+0P9mq0ljpY8Q2yjT4RGbWYlfsvBO+PBxj3P50AaUTRebP/pX8Y/jH91aj3Rf2Wv8ApXPlDjePSootP0kyTZ02E/OMf6J0+Uf7NR/YNK/sxT/Z0O7yhz9k9vXbQBdlaLzYP9K/5aH+Mf3WqGJo/wC27n/SePs8PO8f3pKZLp+kiSHGmwj5zn/ROvyn/ZqGOw0v+2LhTp0OwQREL9k6HdJk42/T8qAL8DRfvP8ASv4z/GKjDRf2fB/pX/PPjePUVFDp+knzM6bCfnOP9E/+xqMWGlfYYT/Z0O4+Xk/ZOvI/2aALrNF9sj/0r+Bv4x6rVWxaP+1dTzc4HmJg7xz+7Wlaw0n7Ug/s2HGxuPsnuv8As1Ws7HSzqeohtPhKrIm0fZc7f3a9scUAXi0X9myf6V/A3G8e9SStF5kH+lfxn+Mf3WqkbDSv7PkP9nQ7tjYP2T6/7NSS6fpIkhxpsI+c5/0Tr8p/2aALIaL7W3+lfwD+MepqrpbR77/Nzj/S2/jHPC0osNJ+1MP7NhxsHH2T3P8As1V0yx0tnvvM0+FsXTBc2ucDC8dOKAL6tF/Z8H+lf88+N49RUxaL7Sn+lfwN/GPUVQFhpX2GE/2dDuPl5P2TryM/w1KdP0n7Qn/Ethxtbj7J7j/ZoAsK0X2uT/Sv+Wa/xj1ao9B/5BZwcj7Tcc+v756iXT9J+1SD+zYcbFwPsnu3+zUnh9VTSdsahEFxcBVAxgec/GO1AGnRRRQAUVwulePbmX4m6v4b1a1igso7hbfTLxMjzZRBHK8T5J+bbJuXGMhW7ir/AIY8Zx6pb20WrPFDf3t/f21rFFG+JFtpnTOeQDsUE5IyScelAHV0Vzl74+8PWNuJZbyWQteS2EccNrLJJJcRZ3xqqqST8pxjg9iaq6f8TPDOqXdnb2dzcs13KYFdrKVY4pskeTI5XCSfKfkYg/mMgHW0VwXhH4oafrMcFrq7m31Ga+uLMGO1lW38xJpFjj80gr5hjRW27snPA5ArYPxA8PDXzpH2mYyi4+yG4FrJ9nFx/wA8TNt2b+23PXjrxQB0tFYmj+LtI17Vbyw0qWeeWyeSKeT7LIsSSI+x4/MKhSwPYHOCCODmtugAooooAKKKKAOD+I24eJPAe0An+3hgE4/5d5q7FWuPtkn7uP8A1a/8tD6t/s1x3xFBPiTwGASp/t4cjt/o81disT/bJP8ASJP9WvZfVvagAt2uNr4jj/1jf8tD6/7tRhp/7Pg/dx4/d/8ALQ+o/wBmpLeJ9r/6RJ/rG7L6/SoxE/8AZ8H+kSf8s+y+o9qAGTNP/bVr+7jz5Ev/AC0PrH7VYVrjz5P3UfQf8tD7/wCzVeaJ/wC2rUefJnyJecL6x+1WFif7RJ/pEnRey+/tQBCWn/s+f93Hj95/y0Pqf9mpZWuPNg/dx/fP/LQ/3W/2aiMT/wBnz/v5P+WnZfU+1TSxP5sH+kSffPZf7re1AFQNP/wkr/u48/ZF48w/3z7Vbha43S/u4/v/APPQ+g/2aqCJ/wDhJXHnyZ+yLzhf759qtwxPul/0iT7/AKL6D2oAjLT/AGGH93HjMf8Ay0PqP9mnyNcfaIf3cff/AJaH0/3aYYn+ww/6RJ1j7L6j2qSSJ/tEP+kSd+y+n0oAp2zT/wBvahiOPPlw5/eH/b9qmLT/ANnz/u48fvP+Wh9T/s1DbRP/AG9qA8+T/Vw84Xn7/tUxif8As+f9/J/y07L6n2oA5nxf4Svr6/g8QeFzbab4ntvliuWYmO6jAJMEygfMh7HqpwRU/hDxr/wlMk1tPZf2brWngx6hptxIRJAxxgg4wyHqrDgiumkifzIv9Ik+/wCi/wB0+1cz4u8FHX7i1v8ATNTm0vXrJGaz1GJVyOR+7kAHzxnupoA2dOaf+0dVxHHn7Suf3h/54x+1TBp/7Mi/dx42p/y0Pt/s1x3gbxVc32uapoPigf2X4mhkWSW2Qgx3CCNF82FiPmU4zjquQD612Iif+zIv38n3U4wvt7UASytcedD+7j+8f+Wh9D/s0K1x9sk/dx/6tf8AlofVv9miWJ/Oh/0iT7x7L6H2oWJ/tkn+kSf6tey+re1AFawaf7BcYjjx58//AC0P/PRvap5GuPssf7uP70f/AC0P94f7NQWETmwuP38g/fz9l/56N7VPJE/2WP8A0iT70fZf7w9qAHM1x9sj/dx/6tv+Wh9V/wBmlha48yf93H/rB/y0P91f9mkaJ/tkf+kSf6tuy+q+1LDE/mz/AOkSf6wdl/ur7UAZ+lNP/wAI3BiOMjZ18w+v0rRka48yL91H9/8A56H+6f8AZrO0qJz4bgInkA2dAF9fpWjJE/mRf6RJ9/0X+6fagBqtcfbJP3cf+rX/AJaH1b/ZqGVp/sN5+7jxh8/vD6fSp1if7ZJ/pEn+rXsvq3tUEsT/AGG8/fydH7L6fSgBlo0/9i2WI48bIcfvD/s+1WWa4+2R/u4/9W3/AC0Pqv8As1WtYn/sWyPnyfch4wv+z7VZaJ/tkf8ApEn+rbsvqvtQA6JrjfL+6j+//wA9D/dH+zWfrDT/APCM6lmOMDyJskSH/a9q0Ion3y/6RJ9/0X+6Pas/WInHhnUiZ5CPIm4IXn73tQBfma482D93H/rD/wAtD/db/ZpA1x9sb93Hnyx/y0Pqf9mlmifzYP8ASJP9Yey/3W9qQRP9sb/SJP8AVjsvqfagAha43Tfu4/v/APPQ+g/2ap3TT/2RbZjjx5tvj94f+eie1XIYn3Tf6RJ9/wBF9B7VTuon/si2/fyH97b8YX/nontQBcka4+0Q/u4+/wDy0Pp/u0K1x9sk/dx/cX/lofVv9miSJ/tEP+kSd+y+n0oWJ/tkn+kSf6tey+re1AERaf8As+f93Hj95/y0Pqf9motUafztOzHH/wAfa4xIf7je1SmJ/wCz5/38n/LTsvqfaotUicTadmeQ/wClr2Xj5G9qALe64+1f6uP7n/PQ+v8Au0sbXHmS/u4/vf8APQ/3R/s0nlP9q/4+JPuei+v0pY4n8yX/AEiT73ov90e1AEIaf+zYv3ceNqf8tD6j/ZqC9af+19NzHHndJj94f7h9qmET/wBmxf6RJ91Oy+3tUN7E/wDa+m/v5OWk5wvHyH2oAtq1x9sk/dx/cX/lofVv9mmBp/sM37uPGZP+Wh9T/s09Yn+2Sf6RJ9xey+re1MET/YZv38nWTsvqfagB9y1x5QzHH/rE/wCWh/vD/ZqrK0//AAktr+7jz9km48w/34vardzE/lD/AEiT/WJ2X+8PaqksT/8ACS2o8+TP2SbnC/34vagC1E1x5s/7uP74/wCWh/ur/s1Hun/spf3cePKH/LQ+n+7UsUT+bP8A6RJ98dl/ur7VF5T/ANlL/pEn+qHGF9PpQBJK1x5sH7uP/WH/AJaH+63+zUETT/25c/u48/Z4f+Wh/vSe1TyxP5sH+kSf6w9l/ut7VBFE/wDblyPPkz9nh5wv96T2oAnga4/efu4/9Yf+Wh/+JqMNP/Z8H7uPH7v/AJaH1H+zUkET/vP9Ik/1h7L/AIVGIn/s+D9/J/yz7L6j2oAkZrj7ZH+7j/1bf8tD6r/s1VsWn/tbU8Rx58yPP7w/8819qtNE/wBsj/0iT/Vt2X1X2qrYxP8A2tqf7+QfvI+cLz+7X2oAmLT/ANmyfu48bG/5aH3/ANmpJWuPNg/dx/fP/LQ/3W/2ajMT/wBmyfv5PuNxhff2qSWJ/Ng/0iT757L/AHW9qAANcfbG/dx/cH/LQ+p/2aqaU0++/wARxn/S2zmQ+i+1WxE/2xv9Ik+4Oy+p9qq6VE5e/wATyD/S27LzwvtQBKrT/wBnwfu48fu/+Wh9R/s1OWuPtKfu4/uN/wAtD6j/AGagWJ/7Pg/fyf8ALPsvqPapzE/2lP8ASJPuN2X1HtQA1WuPtkn7uP8A1a/8tD6t/s1DoWf7LbPB+03GcH/ps9TLE/2yT/SJP9WvZfVvaodCGNLYE5/0m45Pf989AGjRRRQBxP8Awhcuot4vh1ECBdT1GO70+5RgXhdLeFUlHoyyRk/h6Gud0jwn4v0jSfDWpy6fZ3mr6Zf6jNd2SXQjWRbp3O5HII43KcHtnvXZaj8QvD2l6rLYXM9yxt3CXVxDZyyQWrHBAllVSiHkdTxnJxWdpXja71r4qap4etBFFp+lRL5vm2U/mzORyVkOI1UEjAIJYZK8c0AZOheDvEFvqeiXeqW9uslv4h1HUroQzBlRJ4pgu3OCfmkA6A9yBVyHwjqqaU0BhjEh8WtquPMH/Huboybvrt7da2dV+I3hvRtSurG9urgzWLol6YrOaRLQMiurSuqlUUh1+YnHX0ONKbxPpEB1cS3e06LCJ7/9258lChcHgfN8oJ+XNAHA6X4T8WPpNh4b1DTrG206DWm1OS/S53P5a3bXCxiML98nb82cBT68VRg+GOoW2qvYSaNHfWb6o14NSm126SMRNP52GtUcKZFJwMfKSAx7g91qfxE8OaTcJFc3Nw/7pJ5pILOWVLaNxlHmZVIjB/2scc9Kp2nxAt4P7dfWyAllrLabYxWcEkstyPIilACLuLt87fdAGB7E0AX/AAPot5oenapFqEao9zrF7dx7WDZjlnZ0PHfaRxXRSyeVC8m1n2qTtUZJx2A9a5tfGmn38Wly6bfJALrUhYywXlnMs3meU7mHZwYnwobLjG0f7QNdJNEs8EkMm7ZIpVtrEHBGOCORQB454W1a78P2ttqHiu18V2urXVjPPD/aeotJaTzLE0rxCESt5ZAB2hlU4U4weK0NJn1Lw7J4P1e41vUtSPiC2k/tGC6uDJEZPsrXAeJDxHgxlcLgYbpxmul07wBJFfWb67r97rlrpyOljbXccY8vchjLSMoBlbYzLk/3icEnNN0H4fHSdR0+a+1271S10iF4NLtZ4o1FsrLsyzKMyME+UE9ieMnNAHM2c+o+HbHwf4mm1vU799dZU1K1ubkvCxltZJgY0PEe1kAAXHyk5z1qbSP7S0ceCdfk1zU76TxFLHDqNtc3JkgJmtnlBjQ8R7XQABcfLnOetb+kfD1tP1DTWv8AXrvUtO0bd/ZdhNDGq2+UMYLMBmQqjFVz0B7nml0b4fPpupaZJe6/d6jp+i7v7LsZYo1W3yhQFmUZkKoxVSegPc80AZPxC1nSp/FXgqBNStHkg1798i3C7osQSg7gDkc8c12K6lo/2pydStsbFwftQ9W965r4jceI/Any7v8AifD5R3/0eb1rsFb/AEyT/RH/ANWv9z1b3oAqQalo4V92pWw+dv8Al6Hr9ajGo6R9hhH9o224eXkfahxyM96v27fK/wDojn9439z1+tRhv+JfB/or/wDLPn5fUe9AFKXUdIOsWzDUbYoIZQW+1DAOUxzn61OupaP50h/tK2xgY/0se/vT5m/4nVr/AKK/+ol4+X1j96sK37+T/RH6D+57+9AGedR0j7DMP7Rttx8zA+1Dnk471JLqWjmSHGpWxw5z/pQ4+U+9TFv+JfP/AKK//LTn5fU+9Syt+9g/0R/vn+5/db3oAyxqGk/8JAz/ANoW/l/ZQN32kYzuPGc1ai1LRw0udSth8/H+lD0HvQG/4qR/9Fb/AI9F4+X++fercLfNL/oj/f8A9j0HvQBQOo6R9jiH9o227KZH2oeo96fJqWj+fFjUrbHOf9KHp9asFv8AQof9FfrHz8vqPenyN/pEX+iP3/uen1oAy7fUNJGtXzNqFuEaOLa32kYP3s855qU6jpH2Gcf2jbbj5mB9qHPJx3qW2b/ie3/+it/q4ePl4+971KW/4l8/+iv/AMtOfl9T70ARPqWj+ZFjUrX73P8ApY9D70p1LRvtCH+0rXG1uftY9R71bkb95F/oj/e/2P7p96Gb/SU/0R/uN/c9R70AcfrGi+GPFK6jb6nfRQyJdLJZ3sN2Emt38mMeZE+cggj6HGDWJoXjU6BcweGvHeoW0ksm0adrUUuIbtQR8kuDiOUDseD29+/09v8AiY6r/orH/SV4+Xj9zH71HqGn2Wr+HfsOqaWt1azRoskUqoysOPegB8mpaOZosalbYDHP+lDjg+9C6lo/2qQ/2lbY2Lg/ah6t71whfWPhbdRpPa3uteDQxMcv+uu9LGD8rAEmSEdj95R1zgV3ml6rY6zCt/pWy8tJ4kaOaF0ZWGW7g0AVrLUNJWynD6hbhjNMQDdAZBdsd6mfUtH+zRgalbZymR9qH94e9SWLf6Bcf6Kx/fz8/L/z0b3qd2/0WP8A0V/vR/3f7w96AKzalo/2qM/2lbY2Nk/ah6r70sWpaOJJs6lbAF+P9KHPyj3q0zf6ZH/oj/6tv7nqvvRC37yf/RH/ANYP7n91fegDH02/0pfD8KSahbrIF5U3IBHPpmr8mpaNvixqVr97n/Sx6H3qHSm/4pyD/RmPydfl9frWjI37yL/RH+//ALH90+9AFJdS0f7VIf7StsbFwftQ9W96il1HSDZ3QGo2xYh9o+1Dnj61oK3+mSf6I/8Aq1/uere9Qyt/oN3/AKK3R+fl44+tAFK21DSRo9orajbhwkW5TdDI+7njNWG1LR/tUZ/tK2xsbJ+1D1X3p1q3/Elsv9FY/JDz8vP3ferLN/pcf+iP/q2/ueq+9AFaPUtG3y51K1+9x/pY9B71Q1bUNKfw7qCRahbtI0MoVRcgknnHGea2o2+eX/RH+/8A7H90e9Z+sN/xTOo/6My/uZvm+Xj73vQBJLqWjmSHGpW2A/P+lDj5T70g1LR/tbH+0rbGwc/ah6n3q3M37yD/AER/9Yf7v91vegN/pjf6I/8Aqxx8nqfegCpFqWjhpc6lbD5+P9KHoPeqtzqGknS7dV1C3LCSAkC5GRiRM8Z7DNasLfNN/oj/AH/9j0HvVS6b/iU23+isP3tvz8vP7xPegAfUtH8+IjUrbHOf9KHp9aF1LR/tTn+0rbGxcH7UPVvercjf6RD/AKI/f+76fWhW/wBMk/0R/uL/AHPVvegCgdR0j7DMP7Rttx8zA+1Dnk471FqWoaS0th5eoW7BboFsXIOBtbnrxV8t/wAS+f8A0V/+WnPy+p96i1Rv32n/AOisP9LH93n5G96AD+0tH+1Z/tK1xs6/ah6/WlTUtGDy51K1+9x/pY9B71a3f6V/x6P9z/Y9frSxt+8l/wBEf73+x/dHvQBnDUdI/s+If2jbbtqZH2oe3vUV3qGktqunsuoW5RWk3EXIIX5DjnPFaAb/AIlsX+iv91Ofl9veob1v+Jvpv+isPmk4+Xn5D70AIupaP9qc/wBpW2Ni4P2oere9MGo6R9jlH9o22cvgfah6nHeryt/pkn+iP9xf7nq3vTA3+hTf6K/WTn5fU+9AFe41LRzGNupWxO9P+Xof3h71Wk1DST4gtnGoW5jFrMC32kYBLx4Gc+x/KtS5b90P9Ef/AFif3P7w96qyt/xUlr/orf8AHpNx8vPzxe9ACRalo4kmzqVsMuMf6UOflHvUf9o6R/Zij+0bbd5YGPtQ64+tX4m/ez/6I/3x/c/ur71Hu/4lS/6K/wDqhz8vp9aAIJdS0cyQY1K2IDnP+lDj5T71DHqOkDWLhjqNtsMEQDfahgndJkZz7j860ZW/ewf6I/8ArD/c/ut71DE3/E7uf9Fb/j3h4+X+9J70ARQ6lo48zOpWw+c4/wBKH+NRjUdI+wwj+0bbcPLyPtQ45Ge9X4G/1n+iP/rD/d/xqMN/xL4P9Ff/AJZ8/L6j3oAgbUtH+1If7StsbG5+1D1X3qtZ6hpK6nqLPqFuFaRNhNyAG+QdDnnmtRm/0yP/AER/uNx8nqvvVWxb/iban/orH94nHy8fu196AIzqOkf2fIP7Rtt2xsD7UPf3p8upaOZIcalbEBzn/Shx8p96nLf8S2T/AEV/uNz8vv71JK37yD/RH++f7v8AdPvQBU/tLR/tRP8AaVtjYOftQ9T71W0zUNJVr3zNQt13XTFc3IGRheetagb/AEtv9Ef7g/uep96q6U3z3/8AorH/AEtv7vHC+9AEQ1HSPsMI/tG23Dy8j7UOORnvUx1LRvtCH+0rXG1uftY9R71Irf8AEvg/0V/+WfPy+o96nLf6Sn+iP9xv7nqPegCkupaP9qkP9pW2Ni4P2oere9S+H2R9I3RMHRri4KsDkEec+DnvUyt/pkn+iP8A6tf7nq3vUWg/8gs8Y/0m449P3z0AaVFFFAHmt/4d8VWtt4l8P6Vp1ld6d4huJ5U1GW62G0E6gSB49pLlfmK4PPAOK6Pw/oV3pnjLxJfTIBaXwtFtm3glhHFtbI7c109FAHnuseEdWvLD4kxQQxl/EEarYZkA3kWaRc/3fnUjn61T8ReGPFQvPFcOh6fZ3lv4l0yO38+W78s2rpC0ZBXad2Qwxgjnrgc16dRQB5vbaL4x8M32oP4d06wvjrEFsfOuboxixnjgWEl1AJkTCKwCnOcjjINZmq/DrWbu4vb+azjvpF1+W+W1jv5LM3MMlpFESskZyjB0JAJwQCD1r1uigDy3S/AmpW/9kXKaRDpzR+Ik1CeD+0pbuRIFtZIgXllY7nyw4XgDHXBNepUUUAFFFFABRRRQBwfxGz/wkngPbjP9vDGf+veauxX7R9sk/wBX/q19fVq474ignxJ4DAJU/wBvDkdv9HmrsVhf7ZJ/pEn+rXsvq3tQAW/2ja+PL/1jevrUQ8/+z4P9Xj936+oqW3hfa/8ApEn+sbsvr9KiET/2fB+/k/5Z9l9R7UANm8/+2rX/AFefIl9fWOrC/aPtEn+r6D196rzRP/bVqPPk/wBRLzhfWP2qwsL/AGiT/SJOg7L7+1AEJ8/+z5/9Xj956+pqWX7R5sH+r++fX+61RGJ/7Pn/AH8n/LTsvqfapZon82D/AEiT757L/db2oAqjz/8AhJH/ANXn7Ivr/fNW4ftG6XHl/f8Af0FUxE//AAkjjz5P+PRecL/fPtVyGF90v+kSff8ARfQe1AEZ8/7DD/q8Zj9fUU+T7R9oh/1ff19KYYn+ww/6RJ1j7L6j2p8kL/aIv9Ik79l9PpQBUtvP/t7UP9Xny4c9f9upj5/9nz/6vH7z19TUNrE/9vagPPk/1cPOF5+/7VMYn/s+f9/J/wAtOy+p9qAJ5PtHmRf6v7/v/dNDfaPtKf6v7jevqKJIX8yL/SJPv+i/3T7UNC/2lP8ASJPuN2X1HtQBS07z/wC0dVx5eftK56/88Y6mHn/2bF/q8bU9faodOic6jqv7+QYuV7Lz+5j9qmET/wBmxfv5Pupxhfb2oAll+0edD/q/vH19DXCan4P1vw/r11r3w7e2hmlCy32iSnba3xycsp/5ZSnH3hwTjPeu7lhfzof9Ik+8ey+h9qFhf7ZJ/pEn+rXsvq3tQBy/gzxfbeJNNu4I9tnqlvLKbzS7n5bi2YuThl7jnhhwa6aTz/ssf+r+9H6/3hXK614E03xTZG6nmuLPVLOec2epWhEc8B8xujAcqe6ng5NZdr4w1XwwsemfEktboJEW38QQoos7kbhjzOP3D47N8pIOD0oA9Ab7R9sj/wBX/q29fVaIftHmz/6v/WD1/urSBfMuIXjundWiZlZdpBGV6cUsML+bP/pEn+sHZf7q+1AFDSvP/wCEbgx5eNnfPrWjJ9o8yL/V/f8Af+6aztKiY+G4D58g+TphfX6VoyQv5kX+kSff9F/un2oAav2j7ZJ/q8+Wvr6tUMvn/Ybz/V4w+evpUyxP9sk/0iT/AFa9l9W9qhlif7Defv5Oj9l9PpQAy08/+xbLHl42Q46/7NWW+0fbI/8AV/6tvX1Wq1pE/wDYll+/kHyQ8YX/AGfarLQv9sj/ANIk/wBW3ZfVfagB0X2jfL/q/v8Av/dFZ+sef/wjOpbvLx5E2cZ/2q0I4X8yX/SJPv8Aov8AdHtWfrETDwzqR8+Q/uJuCF5+97UAXpvtHmwf6v8A1h9f7rUD7R9sb/V58sevqaJoX82D/SJP9Yey/wB1vagQv9sb/SJP9WOy+p9qACH7Rum/1f3/AH9BVO68/wDsi2z5ePNt8df+eiVchifdN/pEn3/RfQe1U7qJ/wCyLY+fJ/rbfjC/89E9qALkn2j7RD/q+/r6UL9o+2Sf6v8A1a+vq1EkL/aIf9Ik79l9PpQsT/bJP9Ik/wBWvZfVvagCI+f/AGfP/q8fvPX1NRap5/nadny/+PtcYz/capTE/wDZ8/7+T/lp2X1PtUWqROJtO/fyH/S16hePkb2oAt/6R9q/5Z/c9/Wlj+0eZL/q/ve/90Unkv8Aav8Aj4k+56L6/SljhfzJf9Ik+/6L/dHtQBAPP/s2L/V42p6+1Q3vn/2vpufLzukx1/uGphE/9mxf6RJ91Oy+3tUN7E/9r6b+/kOWk5wvHyH2oAtr9o+2Sf6v7i+vq1MHn/YZv9XjMnr6mnrE/wBsk/0iT7i9l9W9qYIn+xTfv5OsnZfU+1AD7n7R5Qz5f+sT1/vCqkvn/wDCS2v+rz9km9f78VW7mJ/LH+kSf6xOy/3h7VUlif8A4SW1Hnyf8ek3OF/vxe1AFuL7R5s/+r++PX+6tR/v/wCyl/1ePKHr6VJFC/mz/wCkSffHZf7q+1R+U/8AZSnz5P8AVDjC+n0oAkl+0ebB/q/9YfX+61QRef8A25c/6vP2eH1/vSVPLE/mwf6RJ/rD2X+63tUEUT/23cjz5P8Aj3h5wv8Aek9qAJ4PtH7z/V/6w+tRDz/7Pg/1eP3fr6ipYIn/AHn+kSf6w9l/wqIRP/Z8H7+T/ln2X1HtQBK32j7ZH/q/9W3r6rVWx8/+1tTx5efMjz1/55rVpoX+2R/6RJ/q27L6r7VVsYnOramPPkGJI+cLz+7X2oAmPn/2bJ/q8bG9fepJftHmwf6v759f7rVGYn/s2T9/J9xuML7+1SSwv5sH+kSf6w9l/ut7UAA+0fbG/wBX9wevqaqaV5++/wAeX/x9tnOfRatiF/tjf6RJ/qx2X1PtVTSonL3+J5B/pbdAvPC+1AEy+f8A2fB/q8fu/X1FTn7R9pT/AFf3G9fUVAsT/wBnwfv5P+WfZfUe1TmF/tKf6RJ9xuy+o9qAGr9o+2Sf6v8A1a+vq1Q6Fn+y2z1+03Gcf9dnqZYX+2Sf6RJ/q17L6t7VDoQxpbAnP+k3HJ7/AL56ANGiiigAooooAKKKKACiiigAqvqF/a6Xptzf6hMsFraxNNNK3REUZJ/IVYpskaSxskiq6MMMrDII9KAPF9F8fQX/AI71bWI9csZ5bnw/JLY6dFexyeUUdmWParHMpVd7DqN2Oi5q7pFp/wAIxJ4I1fT7i7nvNdtZBqnm3MkgvGNm0/mFWJAYOnBAGAxHSvQk8JaTH4lbW47ZVuGs/sflhEEezcWzjGdxyRnPTtWdoPw803QNTtruK+1K8WxiaHT7a8uBJFYo2AVjAUHoAuWLEDjNAHGWdmvhrTvBHifT5rubUtaZE1PzLqRxe+baSTElSSMh0BGAMDjpUukacmhR+AfEFlc3T6hr00UWqNJdSOt551rJKzFSSAVdARgDA46V1uj/AA703RtVtLxdQ1S7i08ONPsru4DwWQYbT5ahQeFJUbi2ASBijRvh3pujataXiahql3Fp4cafZ3VwHgsgw2ny1Cg8KSo3FsAkDFAGL8RNQt5fFHgmNo7g+Vr3z7rWQKcQSjglcN+Ga7BbvTvtT/6PJjYv/LlJ6t/s1zXxGJHiTwGQNx/t4cev+jzV2KySfbJP3Df6tf4h6t70AU4LvT9r5t5Pvt/y5Sev+7UYutP+wwj7PJn93n/Q39R/s1oW8km1/wBw3+sb+Iev1qISSf2fB+4b/ln/ABD1HvQBRlutP/ti2It5NohlyPsb9cp221YW707zpP8AR5MYH/LlJ7/7NSTSSf21a/uGz5EvG4esfvVhZZPtEn7hug/iHv70AZxutP8AsMw+zyZ/eY/0N/U/7NSS3eneZDi3k+/z/oUn90/7NTmST+z5/wBw3/LT+Iep96lllk82D9w33z/EP7re9AGSLqw/4SBj5Emz7KBj7I/Xee239atRXenbpc28n3+P9Ck9B/s04SSf8JK58ls/ZF43D++atwySbpf3Dff/ALw9B70AZ5utP+xxf6PJnKZ/0N/Uf7NPku9O8+LFvJjnP+hSen+7VkySfYYf3DdY/wCIeo96fJJJ9oh/cN3/AIh6fWgDJt7qwGtXxNvJtMcWB9kc4+9njbxUputP+wzj7PJn95j/AEN/U/7NTW0kn9vah+5bPlw8bh/t1MZJP7Pn/cN/y0/iHqfegCF7vTt8WLeT73P+hSeh/wBmg3enfaE/0eTG1v8Alyk9R/s1dklk8yL9w33v7w/un3oaWT7Sn7hvuN/EPUe9AGPYXVgL/Uy1vIQbhSv+iOcDyo/9njmpRdaf/Z8Q+zybtqZ/0N/bvtqbTpJP7R1X9yxzcr/EOP3MfvUwkk/syL9w2NqfxD296AIJLvTvOixbyfeOf9Ck9D/s0Ld6d9qk/wBHkxsX/lyk9W/2auSySedD+4b7x/iHofehZJPtkn7hv9Wv8Q9W96AMqyurAWU4a3kJ86bH+iOf42x/DTrt9Ju9N+z3NiZopNiyRyWLsrjIyCCuCKtWEkn2C4xCx/fz/wAQ/wCeje9TySSfZY/3Dfej/iH94e9AHmUmj6l4Bvhc+CIZ9Z0Q7ml0C7gk3wLkZ+zSMvH+43HXBBNdX4d8aeGfEElzHYlxdwsDPYy2brcW52gYePblecj09Ca6RpJPtkf7hv8AVt/EPVfeuZ8SeCNP8UXTXxiuNO1m1f8A0XVbKQRzwnaOM/xL6q2QcmgC5plzYjw/CHgkL7eSLRz39dtX5LvTt8WLeT73P+hSeh/2a4LSPGeueFNEhtfHumE2AXEWv2K7oCM8eenWE+/K5PUV6JBqEeoW9rd2JS5t5TujmhlV0cbTyCDgigCut3p32qT/AEeTGxf+XKT1b/ZqGW60/wCx3QFvJkh8f6G/p/u1pLLJ9sk/cN/q1/iHq3vUMskn2G8/cN0f+Ien1oAoW11YDR7QG3k3BIsn7I5z93PO3mrLXenfao/9Hkxsb/lyk9V/2afaySf2LZfuW+5DzuH+z71ZaST7ZH+4b/Vt/EPVfegCpHd6dvlzbyfe4/0KT0H+zVHVrmxbw7qCpBIHMMu0m0cY64528VtxSyb5f3Dff/vD+6Pes/WJJD4Z1IGFgPIm53Dj71ADpbvTvMhxbyff5/0KT+6f9mgXen/am/0eTGwf8uUnqf8AZq5NJJ5sH7hv9Yf4h/db3oEkn2xv3Df6sfxD1PvQBTiu9P3S5t5Pv8f6FJ6D/Zqpc3NgdLtwIJNwkgyfsjj/AJaJnnb/APrrXhkk3TfuG+//AHh6D3qndSSf2RbfuW/1tvzuH/PRKAB7vTvPi/0eTHOf9Ck9P92hbvTvtT/6PJjYv/LlJ6t/s1ckkk+0Q/uG7/xD0+tCyyfbJP3DfcX+Iere9AGcbrT/ALDMPs8mf3mP9Df1P+zUWpXNgZbDZBIMXQLZtHGRtb/Z5+laJkk/s+f9w3/LT+Iep96i1SSQzadmFh/pa/xDn5GoAT7Xp32n/j3kxs/58pPX/doS707fL/o8n3uP9Ck9B/s1c8yT7V/qG+5/eHr9aWOWTzJf3Dfe/vD+6PegDNF1p/8AZ8Q+zyZ2pn/Q39v9mobu6sDqunlbeQKGk3D7I4z8h7bea0RJJ/ZsX7hvup/EPUe9Q3skn9r6b+5YfNJxuHPyH3oARbvTvtT/AOjyY2L/AMuUnq3+zTBdaf8AY5f9HkzmTH+hv6n/AGavrLJ9sk/cN9xf4h6t70wSSfYZv3DdZP4h6n3oArXF3p3ljFvJ99P+XKT+8P8AZqrJdWH/AAkNsRbybBazAj7I/XfHjjb9ef8AGta5lk8ofuG/1ifxD+8Peqsskn/CS2p8ls/ZJuNw/vxUANiu9O8ybNvJ98Y/0KT+6P8AZqP7Vp/9mKPs8m7yhz9jf09dtaEUknmz/uG++P4h/dX3qPzJP7KX9w3+qH8Q9PrQBXlu9P8AMhxbyffOf9Ck/un/AGahjurD+2Lgm3k2mCLA+xv13Sdtv0rSlkk82D9w3+sP8Q/ut71BFJJ/blz+4bP2eHjcP70nvQBFDd6d+8zbyffP/LlJ/wDE1GLrT/sMP+jyZ/d5/wBDf1H+zWhBLJ+8/cN/rD/EP8ajEkn9nwfuG/5Z/wAQ9R70AV2u9O+1J/o8mNjf8uUnqv8As1Vs7mwGqaiWt5CpkTaPsjnHyDtt4rWaST7ZH+4b/Vt/EPVfeqtjJJ/a2p4hY/vI/wCIcfu1oAhN1p/9nyD7PJnY3/Lm/v8A7NSS3eneZDi3k++c/wChSf3T/s1YMkn9myfuG+438Q9/epJZJPNg/cN98/xD+63vQBTF3p32pv8AR5MbB/y5Sep/2aq6ZdWAe+328hzdMR/ojnAwv+zx9K1hJJ9sb9w33B/EPU+9VNKkkD3+IWP+lt/EOOF96AIlutP+wwj7PJn93n/Q39R/s1KbvTvtCf6PJja3/LlJ6j/ZqZZJP7Pg/cN/yz/iHqPepzJJ9pT9w33G/iHqPegCit3p/wBqk/0eTGxf+XKT1b/ZqTw+VbSMoMKbi4IBXGB5z9u1WFkk+2SfuG/1a/xD1b3qHQjnS2yMH7Tccen756ANGiiigAooooAKKKKACiiigAooooAKKYkscjOqSKzIcOA2Sp9D6UJNFI7pHIjtGcOqsCVPv6UAPopiTxSSPGkqM8f31DAlfqO1CTxSSPGkqM8f31DAlfqO1AHDfEbcfEngPaQD/bwwSM/8u81diq3H2yT97H/q1/5Zn1b/AGq434j7f+Ei8Cb22r/bwyd2Mf6PN3rrVa0+1yf6Rx5a/wDLwfVvegCW3W42viSP/WN/yzPr/vVEFn/s+D95Hj93/wAsz6j/AGqLdrTa+bj/AJaN/wAvB9frUYa1+wQf6Rz+7z+/PqPegB0yz/21a/vI8+RL/wAsz6x+9WFW48+T97H0H/LM+/8AtVTla1/tm1/0jjyZcnzz6p71OrWnnyf6R2H/AC8H396AEKz/ANnz/vI8fvP+WZ9T/tVLKtx5sH72P75/5Zn+63+1VYta/YJ/9I5/eY/fn1PvUsrWnmQf6R/Gf+Xg/wB0+9AEIWf/AISV/wB5Hn7IvPln++fercK3G6X95H9//nmfQf7VZ4Nr/wAJG37/AOX7IvPnnrvPfNW4WtN0ubj+P/n4PoPegBSs/wBhh/eR9Y/+WZ9R/tU+Rbj7RD+8j7/8sz6f71Vy1r9ih/0jnMf/AC3PqPepJGtPtEX+kev/AC8H0+tAEFss/wDb2oYkjz5cOf3Z/wBv3qYrP/Z8/wC8jx+8/wCWZ9T/ALVVbY2v9uX+Z+PLhwfPPP3vepi1r/Z8/wDpHP7zH78+p96ALci3HmRfvI/vf88z/dP+1Qy3H2lP3sf3G/5Zn1H+1UUjWnmRf6R/F/z8H+6fehmtPtCf6R/A3/LwfUe9AFfTln/tHVcSR5+0rn92f+eMfvUwWf8As2L95Hjan/LM+3+1VXTza/2hqmZ8D7SuP35Gf3MfvzUoa1/s2L/SOdqf8tz7e9AFqVbjzof3sf3j/wAsz6H/AGqFW4+2SfvY/wDVr/yzPq3+1UcptPOhxcfxH/lufQ+9Ctafa5P9I42L/wAvB9W96AIrBZ/sFxiSPHnz/wDLM/8APRvep5FuPssf7yP70f8AyzP94f7VU7FrX7DcZuMHzp8fvz/z0b3qd2tfssf+kfxJ/wAtz/eHvQBOy3H2yP8AeR/6tv8AlmfVf9qlhW48yf8Aex/6wf8ALM/3V/2qhZrT7XH/AKRxsb/lufVfelha08yf/SP4/wDn4P8AdHvQBS02KSXwvEjtE0bRkFWjzkZ6HmuVu/h7qHhq+OqfDa9g02aSQtLo86t/Z9wcHJ2AkxN7px7V1Glm2/4R2DdPhtnTziO/pmtCRrTfF/pH8f8Az8H+6fegDktK+IK/26mkeLbZvDesTIqxw3a7oLggn/VThtr9RwcN7V1Uqz/Ybz95HjD5/dn0+tU9W0bQvEFvcafrcMF9ZyRpuinkLKTluevBHqORXEN4f8Q+DIZz4Q1Rdb0YBlOjanelZYFx/wAsJ+/+6+RgdaAPQLRZ/wCxbLEkeNkOP3Z/2ferLLcfbI/3sf8Aq2/5Zn1X/arjfDPjvw/rUMGlSTXGmavCsW/T9QZoZSMj5kBOHXjqpNdazWn2uP8A0jjY3/LwfVfegCeJbjfL+8j+/wD88z/dH+1WfrCz/wDCM6lmSMjyJsgRn/a96txtab5c3H8f/Pwf7o96z9XNt/wjWo7Z8t5M2B55Ofvds0Aacy3HmQfvI/8AWH/lmf7rf7VAW4+2N+8jz5Y/5Zn1P+1UcrWnmQYuP4/+fg/3T70ga0+2N/pHGwf8vB9T70ASwrcbpv3sf3/+eZ9B/tVTuln/ALItsyR4823/AOWZ/wCeie9Twtabpf8ASP4/+e59B71UuTa/2TbYn58y3yPPP/PRPegDQkW4+0Q/vY+//LM+n+9Qq3H2yT95H9xf+WZ9W/2qjdrT7RF/pHr/AMvB9PrSK1p9rk/0jjYv/Lc+re9AAVn/ALPn/eR4/ef8sz6n/aqLVVn87TsyR/8AH2uMRn+43vQWtf7Pn/0jn95/y3PqfeotUNr5un7Z8/6WM/vycDY3vQBobbj7V/rY/uf88z6/71LGtx5kv72P73/PM/3R/tVDutPtX/Hxxs/5+D6/Wlja03y/6R/F/wA/B/uj3oAaFn/s2L95Hjan/LM+o/2qhvVn/tjTcyR53SY/dn+4fenA2v8AZsX+kc7U488+3vUN41r/AGtpuJ8jdJk+eePkPvQBfVbj7ZJ+9j+4v/LM+rf7VMCz/YZv3keMyf8ALM+p/wBqmq1p9rk/0jjYv/LwfVvemBrX7FL/AKRzmT/lufU+9AFm5W48oZkj/wBYn/LM/wB4f7VVJVn/AOEltf3kefsk3Pln+/F71NcNaeUMXH8af8vB/vD3qpKbX/hI7X9/8v2SbJ889d8XfNAF+JbjzZ/3sf3x/wAsz/dX/aqPbP8A2Uv7yPHlD/lmfT/eoia08yf/AEj+MY/0g/3R71Fm1/stf9I58oceefT60AWZVuPNg/eR/wCsP/LM/wB1v9qoIln/ALcuf3kefs8P/LM/3pPenStaeZB/pH8Zz+/P91veoYmtf7auf9I4+zxYPnn+9J70AW4FuP3n72P/AFh/5Zn/AOKqMLP/AGfB+8jx+7/5Zn1H+1SQtafvM3H8Z/5eD/jUYa1/s+D/AEjn93n9+fUe9AFlluPtkf7yPPlt/wAsz6r/ALVVbFZ/7W1PEkefMjz+7P8AzzX3qZmtPtkf+kcbG/5eD6r71Usja/2rqWZ8DzEwfPPP7tfegC2Vn/s2T95HjY3/ACzPv/tVJKtx5sH72P75/wCWZ/ut/tVXLWv9myf6Rzsb/luff3qSVrTzIP8ASP4z/wAvB/un3oAkC3H2xv3sf3B/yzPqf9qqmlLPvv8AEkY/0ts5jPovvU4a0+1t/pHGwf8ALwfU+9VNLa133264x/pbY/fkZGF96ALSrP8A2fB+8jx+7/5Zn1H+1U5W4+0p+9j+43/LM+o/2qqK1r/Z8H+kc/u/+W59R71MWtPtCf6Rxsb/AJeD6j3oAeq3H2yT95H/AKtf+WZ9W/2qh0LP9ltnk/abjOB/02elVrT7XJ/pHHlr/wAtz6t703Qcf2UdpyPtNxg5zn98/egDSooooAKKKKACiiigAooooAKiuigtJjLN5CbG3ShguwY5bJ4GOualpHRZI2SRQyMCGVhkEelAHjlzpFr4F8R6XeeHLS3is7nSruC0vrSbzZtTn8jz1e5OAG/1blWG/JPVQcU/SNKsfDv/AAr3VPD1rGmo6pZyreyxrh74GyaYvK38Z81UOTk/N713ei/D7w9oGoJeafbTl4UaO2Se7lmjtEb7ywo7FYwf9kDjjpxTtD8A6B4e1MX+m284ljjaK3Wa6kljtUYgskSMxWNSQOFA9OlAHAWmk2GgaP8ADzX9As4U1nUWRLueNcSX4ls5ZZDKRy/zqr5OcEcYqXSdF0zRbT4ba3o9rDDquqTRx31zGuJL1JrSSSUykcv86h8nOCOMV3GkfD/QNE1hNSsYLjzoQ4to5ruWWK0D/fEUbMVjz/sgccdOKXSPh/oGh6wmpWMFx50IcW0c13LLFaB/viKNmKx5/wBkDjjpxQBzfxB1J28VeCkOn3iiHXuGKLiTEEo+X5ufXnFdmuqt9rc/2bffcXjy19W965n4i5/4STwHtAJ/t4dTj/l3mrslab7ZJ+7T/Vp/GfVvagCnBqrBX/4lt8fnbpGvr9ajGqN9hhH9nXvHl8+WOeR71o27TbX/AHaf6xv4z6/Sog0v9nwfIn/LP+M+o9qAKMupsdYtm/s69GIZRt8sZPKe/tU66q3nSH+zb7oP+Wa+/wDtVJM0v9t2vyJnyJf4z6x+1WFab7RJ8idF/jPv7UAZx1RvsM4/s6958znyxgcn3qWXVWMkH/EtvuH7xrz8p96mJl/s+f5E/wCWn8Z9T7VNM03mwfIn3z/Gf7re1AGSNTb/AISFn/s+8/49VG3yxn75569KtRaqwaX/AIlt8cv/AM819B70oaX/AISV/kTP2Rf4z/fPtVuFpt0v7tPv/wB8+g9qAM86o32OIf2de8GPnyxzyPepJNVbz4j/AGbfcZ48teePrVgtL9hh+ROsf8Z9R7VJI032iH92nf8AjPp9KAMm31Nhrd8/9n3h3RxDaIxkY3dealOqN9gnH9nXvPmc+WMDk+9S2pl/t7UPkTPlw5+c/wC37VMWl/s+f5E/5afxn1PtQBFJqrGSL/iW333v+ea88H/aoOqt9oQ/2bffdbjy19R71ckabzIv3aff/vn+6fahmm+0p+7T7jfxn1HtQBkWGpsuoamf7PvG3XCnAjGV/dRjB59s/jUo1Rv7OiH9nXvCpz5YwenvU2nNL/aOq4RP+Plc/Of+eMftUoaX+zIfkTG1P4z7e1AEEuqsZoT/AGbfDDH/AJZr6H3oXVW+1SH+zb77i8eWvq3vV2VpvOh/dp94/wAZ9D7UK032yT92n+rX+M+re1AGVZamy2M4/s+9OZpjkRjjLt71M+qN9mjH9nX3VOfLX+8PepbBpfsFxhE/18/8Z/56N7VPI032WP5E+9H/ABn+8PagCq2qt9qjP9m333G48tfVfeli1VhJN/xLb45f/nmvHyj3q4zTfbI/3af6tv4z6r7UQtN5s/7tP9YP4z/dX2oAxdM1Jk8Pwp9gvGwv3ljGDz9avyaq2+L/AIlt9w//ADzXng/7VRaUZf8AhG4MImNn98+v0rRkabzIv3aff/vn+6fagCkuqt9rkP8AZt99xePLX1b3qGXVGNldj+zr0ZD8+WOOPrWkrTfbJP3af6tf4z6t7VBK0v2G8+ROj/xn0+lAHM6xpGjeKvDVnZ694envEjSPy5TEA8Z+X5kcMGU+4IrEt4vG3g+6RdFF54p0tVOyy1ZhHdxLkcJOMhx04cA+9d9aNL/YllhExsh/jP8As+1Wmab7ZH+7T/Vt/GfVfagDj9E+KOj6nqsmlT2d/pus5BbTL6JYpugHygthxx1UnitbVtSZ/DmoJ9gvF3Qyjc0YwM5681JrvhbSfFlrLaeIdItL6IPlDITujO0cqwG5T7giuOvPDfjLwvoWoLoOuQ6vo4hlH9nawzGaJcHIjuFGT7Bwfr3oA7uXVWMkP/Etvhh/+ea8/KfekGqt9rY/2bffcHHlr6n3rlrb4paeuqW+meK7KbwtqXmELDqjbYpflIzHOAY3HIHUH2rtUeRrosqxsDGCCJDgjJ9qAKcOqsGl/wCJbfHL/wDPNfQe9VbnU2OlWy/2feDElucmMYOJE9+9a8LTbpv3aff/AL59B7VSujL/AGRa/ImPNt/4z/z0T2oAV9Vbz4j/AGbfcZ/5Zrzx9aRdVb7U5/s2++4vHlr6t/tVdkab7RD+7T+L+M+n0pFab7ZJ8if6tf4z6t7UAZ51RvsE4/s6958znyxgcn3qLUtTZ5bD/iX3i7boHmMc/K3A561oEy/2fP8AIn/LT+M+p9qi1VpfO07KJ/x9rj5z/cb2oAT+1W+1Z/s2++508tfX60seqsHl/wCJbffe/wCea8cD/aq3um+1f6tPuf3z6/SljabzJf3afe/vn+6PagDNGqN/Z8Q/s694VOfLGO3vUV3qbNqunN/Z94NrScGMZb5D05rRDS/2bF8ifdT+M+o9qgvTL/bGmfImd0mPnP8AcPtQALqrfanP9m333F48tfVveoxqjfY5R/Z17yZOfLHqfetBWm+2Sfu0+4v8Z9W9qjDTfYZvkTrJ/GfU+1AFe41VjGP+JbfD506xr/eHvVWTU2PiG2f+z7zi1mG3yxk5ePnr04/UVrXLTeUP3af6xP4z/eHtVSVpf+EltfkTP2Sbjef78XtQA2LVWEk//Etvjlx/yzXj5R71H/ajf2Yq/wBnXv8AqgM+WMdPrWjE03mz/u0++P4z/dX2qLdL/ZS/ImPKH8Z9PpQBXl1VjJB/xLb7hz/yzXn5T71DHqbDWbhv7OveYIht8sZGGk56+/6VpStN5sH7tP8AWH+M/wB1vaoYml/ty5+RM/Z4f4z/AHpPagCGHVWHmf8AEtvj856Rr/jUY1RvsMI/s6948vnyxzyPetGBpv3n7tP9Yf4z/hUQaX+z4PkT/ln/ABn1HtQBA2qt9rQ/2bffcbjy19V96q2Wpsuqai39n3h3SIcCMZX92vXmtZmm+2R/u0/1bfxn1X2qpYtL/a2p4RM+ZHn5z/zzX2oAiOqN/Z8g/s69+43PljHf3p8uqsZIP+JbfDDn/lmvPyn3qwWl/s2T5Exsb+M+/tUsrTebB+7T75/jP91vagCkNVb7Ux/s2++4OPLX1PvVbTNTZHvv+JfeNuumPyxjjheDz1rWDTfbG/dp9wfxn1PtVTSml33+ET/j7b+M+i+1AEI1RvsEI/s6948vnyxzyPepjqrfaEP9m333W48tfUf7VTK0v9nwfIn/ACz/AIz6j2qYtN9pT92n3G/jPqPagCiuqt9qkP8AZt99xePLX1b3p/h9t+k79rLuuLg7WHI/fPwatK032yT92n+rX+M+re1V9Cz/AGY2ev2m4z/3+egDRooooAKKKKACiiigAooooAKKKKACis+y1/R9TvZ7PTdVsbu6tv8AXwW9ykjxdvmUHI/Glstd0nUry4tNO1Syu7m1OJ4ILhHeE9MMoOV/GgC/RWfZ6/o+oahPYWGq2N1eW3+vtoLlHki7fMoOR+NFnr+j6hqE9hYarY3V5bf6+2huUeSLt8yg5H40Acn8RgT4k8BgMVP9vDkdv9HmrsVhf7ZJ/pEn+rXsvq3tXG/EfZ/wkXgTzACv9vDIIz/y7zV1qiy+1yfu48bF/wCWfu3tQBLbwvtf/SJP9Y3ZfX6VGIn/ALPg/wBIk/5Z9l9R7UluLLa+Y4/vt/yz9/pUYFn9gg/dx5/d5/d+49qAHTRP/bVqPtEn+ol5wvrH7VYWF/Pk/wBIk6Dsvv7VSlFn/bNrhI9vky5/d+6e1WF+xefJ+7j6D/ln9fagBDE/9nz/AOkSf8tOy+p9qllhfzYP9Ik++ey/3W9qrEWf2Cf93Hn95j937n2qSUWXmwfu4/vnP7v/AGT7UARCJ/8AhJXHnyf8ei84X++farcML7pf9Ik+/wCi+g9qzwLP/hI3+SPb9kX+DvvPtVuEWW6XMcf3/wDnn7D2oAUxP9hh/wBIk6x9l9R7U+SF/tEP+kSd+y+n0quRZ/Yof3cecx/8s/ce1PkFl9oixHH3/wCWft9KAIbaJ/7e1AefJxHDzhefv+1TGJ/7Pn/0iT/lp2X1PtVW2+yf25f5SPb5cOPk/wB72qY/Y/7Pn/dx5/eY/d+59qALckL+ZF/pEn3vRf7p9qGhf7Sn+kSfcbsvqPaopPsXmRfu4/vf88/9k+1BFl9oT93HjY3/ACz9x7UAV9Oic6jqv7+QYuV5wvP7mP2qYRP/AGZEftEn3U4wvt7VV0/7J/aGqbkjx9pXHydvJj9qlAs/7Ni/dx52p/yz+ntQBalhfzof9Ik+8ey+h9qFhf7ZJ/pEn+rXsvq3tUUosvOhxHH94/8ALP2PtQosvtcn7uPGxf8Aln7t7UAR2ETmwuP38g/fz9l/56N7VPJE/wBlj/0iT70fZf7w9qp2Is/sNxuSPPnz4+T/AKaN7VO/2P7LH+7jzuT/AJZ/7Q9qAJ2hf7ZH/pEn+rbsvqvtSwwv5k/+kSf6wdl/ur7VCwsvtcf7uPGxv+WfuvtRELLzJ8xx/fGP3f8Asj2oAq6VE58NwHz5B8nQBfX6VoyQv5kX+kS/f9F/un2rK0v7J/wjsG5I92znKe/0rQkFlvixHH9//nn/ALJ9qAJFhf7ZJ/pEn+rXsvq3tUEsT/Ybz/SJOj9l9PpSr9i+1yfu48bF/wCWfu3tUMv2P7Dd4jjzh8fu/b6UAOtYn/sWy/0iT7kPGF4+77VZaF/tkf8ApEn+rbsvqvtVG1+x/wBi2eUjzshz8n+77VZYWX2uP93HjY3/ACz919qAJ4oX3y/6RJ9/0X+6Pas/WInHhnUiZ5CPIm4IXn73tVuMWW+XMcf3/wDnn/sj2rP1f7J/wjWo7Uj3eTNjCf73tQBa1bSLXVrZLPVEW8tpXw8NxEjo3yt1BXFcanw2v/Dt0zfDzxNd6QgUN/Z16v2uzPJ+VUYhox/ut+FdtKLLzIMRx/fOf3f+yfagCy+2N+7jxsH/ACz9z7UAcUfGmveG2ceNPD18lur4k1TRtt3bjgZZk2iVB/wE/U1t6dr+keI/D9vcaDrcOoRLLbhvIkRih8xOGGMqfY1tQ/Yt0uY4/v8A/PP2HtXG+Ifh74T1e1gvksRpuqb4QNR00m2nUs6gncvDHn+IGgDt5IX+0Q/6RJ37L6fShYX+2Sf6RJ9xey+re1cG+l+MvD3l/wBl6rp/iiFM4t9VtxbXBA7CeMbSfdk/GktvifpFlemHxrod54WmIVPMvYBJbM2Tws6ZX8TtoA7gxP8A2fP/AKRJ/wAtOy+p9qi1WJxNp37+Q/6WvULx8je1QWd/o+p6LLc6dPaXcL+ZtlgKup5PQjinan9j87T9qR/8fYz8nbY3tQBoeS/2r/j4k+56L6/SljhfzJf9Ik+96L/dHtUOLL7V/q48bP8Ann7/AEpYxZb5f3cf3v8Ann/sj2oAQRP/AGbF/pEn3U4wvqPaoL2J/wC2NN/fyctJzhePkPtTgLP+zov3cedqf8s/p7VDefZP7W03CR43SZ+T/YPtQBfWF/tkn+kSfcXsvq3tTBE/2Gb/AEiTrJ2X1PtTVFl9rk/dx42L/wAs/dvamD7H9il/dx5zJ/yz9z7UAWbmF/KH+kSf6xOy/wB4e1VJYn/4SW1Hnyf8ek3OF/vxe1S3H2LyxiOP76f8s/8AaHtVWUWf/CR2vyR7fsk2fk774vb60AX4oX82f/SJPvjsv91fao/Jf+yl/wBIk/1Q4wvp9KSIWXmT5jj++Mfu/wDZHtUeLP8Astf3cefKH/LP2+lAFmWF/Ng/0iT/AFh7L/db2qCKJ/7cuR9ok/494ecL/ek9qdKLLzIP3cf3zn93/sn2qGP7H/bVzmOPb9nix+7/ANqT2oAtwQv+8/0iT/WHsv8AhUYif+z4P9Ik/wCWfZfUe1JCLL95mOP75/5Z/wD1qjAs/sEH7uPP7vP7v3HtQBZaF/tkf+kSf6tuy+q+1VbGJzq2p/v5BiSPnC8/u19qlYWX2uP93HjY3/LP3X2qrZCz/tXUspHjzEx8n/TNfagC2Yn/ALNk/wBIk+43GF9/apJYX82D/SJPvnsv91vaqxFn/Z0n7uPOxv8Aln9fapJRZeZBiOP75z+7/wBk+1AEohf7Y3+kSfcHZfU+1VNKicvf4nkH+lt0C88L7VMBZfa2/dx42D/ln7n2qrpf2Pffbkj/AOPtsfJ2wvtQBaWJ/wCz4P8ASJP+WfZfUe1TmF/tKf6RJ9xuy+o9qqKLP+z4P3cef3ef3fuPapiLL7Qn7uPGxv8Aln7j2oAesL/bJP8ASJP9WvZfVvaodCGNLYE5/wBJuOT3/fPSqLL7XJ+7jxsX/ln7t7U3Qcf2UdvC/abjGPTznoA0qKKKACiiigAooooAKKKKACo7iJLi2khlz5ciFW2sVOCMHkcj6ipKiuraK9s5rW5TfDPG0ci5I3KRgjI9jQB5ZFpFnqDwal4EsIbLSfDdhdQ2V9CuH1CYwtHsQ9WjU8lyTucDGcEmHTrSzsbb4YT+HYIEvZ7CVS8SgNLEbFnbcRy370Rk5/iPvXb6N8OfCvh/UIL3R9KFrcW4IiZZ5CEBUqflLEdCR0q3pHgvw5oGpz6ho2j2tndzgq8saYIBOSq/3QTzgYFAHnkVpaWfhv4YXegQQLqsxUK8aDfKjWMrTbj1PzBSc/xY71Lp9np9ppHwqutJggS/mljVpIlAeWNrKVp9x6n5gCc/xY713ul+CfDei6xLqmlaPa217Lu3TIvI3HLbR0XJ64xmjS/BPhvRdYl1XStHtba9l3bpkXkbjlto6Lk9cYzQByfxBvrtvFXgpDpVwgj175HaSLbL+4lHGGJGevIFdmt9ffanP9ky52Lx50fq3vXM/EbcfEngPaQD/bwwSM/8u81diq3H2yT97H/q1/5Zn1b/AGqAKkF9fBXxpMp+dv8AltH6/WoxfX32GEf2VLgeXg+dHzyPer9utxsfEsf+sb/lmfX/AHqjCz/2fB+8jx+7/wCWZ9R/tUAUpb29OsWzHSpQwhlAXzo+eU56/wCc1Ot9fefJ/wASmXoOPOj9/enzLP8A23a/vI8+RL/yzPrH/tVYVbjz5P3sfRf+WZ9/9qgDPN7ffYZh/ZUuD5mT50fHJ96klvr7zIc6TKMPx++j5+U+9TFZ/wCz5/3kf/LT/lmfU/7VSyrcebB+9j++f+WZ/ut/tUAZYvb3/hIWb+y5d32VRs86PpvPOc1aivr4NLjSZT8//PaPjge9AWf/AISV/wB5Hn7IvPln++fercK3G6X97H9//nmfQf7VAFA3199jiH9lS4zHz50fPI96fJfXxni/4lMvfjzo+ePrVgrP9hh/eR9Y/wDlmfUf7VSSLcfaIf3sff8A5Zn0/wB6gDKtr29Gt3zDS5SxjiyvnR/L973qU3199gnH9lS4PmZPnR8cn3qS2Wf+3tQxJHny4c/uz/te9TFZ/wCz5/3keP3n/LM+p/2qAIpL6+8yL/iUy/e/57R88H3pTf332hD/AGTLna3HnR+o96tyLceZF+9j+9/zzP8AdP8AtUMtx9pT97H9xv8AlmfUf7VAGTYXt6uoamV0uVi1wpYCWP5T5UfHX8fxqUXt7/Z0Q/sqXG1OfOj56e9Sacs/9o6riSPP2lc/uz/zxj96mCz/ANmRfvI8bU/5Zn2/2qAIZL6+M0OdJlHzHH76Png+9C3199qkP9ky52Lx50fq3vVuVbjzof3sf3j/AMsz6H/aoVbj7ZJ+9j/1a/8ALM+rf7VAGZZXt6LGcLpcrAzTZPnR8fO2R17VM99ffZox/ZMuNyc+dH/eHvUlgs/2C4xJHjz5/wDlmf8Ano3vU8iz/ZY/3kf3o/8Almf7w/2qAKzX199qjP8AZMudjcedH6r70RX18JJsaTKfn5/fR8fKPerbLcfbI/3kf+rb/lmfVf8AapYVuPMn/ex/6wf8sz/dX/aoAxtMvLxfD8Krpkrrs4cSoM8+mavyX98Xi/4lMo+b/ntHzwfeodKWf/hG4MSR42dPLPr9a0ZVuPMi/ex/f/55n+6f9qgCmt9ffapD/ZMudi8edH6t71DLe3v2K6B0qUAh8nzo+OPrWiq3H2yT97H/AKtf+WZ9W/2qglWf7DefvI8YfP7s+n+9QBStr29Gj2YGlylQkWG86Pn7vvVhr6++1Rn+yZc7G486P1X3p1qs/wDYtliSPGyHH7s/7PvVlluPtkf72P8A1bf8sz6r/tUAVo7++Dy/8SmU/N/z2j44HvVDVry8bw5qCvpkqKYZcuZUO3rzjNbUS3G+X97H9/8A55n+6P8AarP1hZ/+EZ1LMkZHkTZAjP8Ate9AD5b6+MkOdJlGH4/fR8/KfegX199rY/2TLnYOPOj9T71cmW48yD97H/rD/wAsz/db/apAtx9sb97H/qx/yzPqf9qgCpDfX26XGkyn5/8AntHxwPeqtze3p0q3B0uUASW+G81OcSJjv3rVhW43TfvY/v8A/PM+g/2qp3Sz/wBkWuZI8ebb/wDLM/8APRPegBXvr7z4v+JTLxnjzo+ePrTXubqeWaObRXkR41Vo3ljIIy3UE81dkW4+0Q/vY+//ACzPp/vUKtx9sk/ex/6tf+WZ9W/2qAPO774b6TJ59/oukah4cviX3XWi3qW24ZPDIDsYfVabdw/EnR3shFcWevxLcApHqKJbTEhWwPMiJU8Z5KDp1r0ErP8A2fP+8jx+8/5Zn1P+1UWqrP52nZkjP+lrjEZ/uN70AcVc/Fa40Gdf+E08Iatoh2Ya4QC6thz182POPxArpNC8X23iK3kutBSLUISwJa2vIn28Dg4bg/WtwrP9q/1kf3P+eZ9f96uU1X4YeGtb1CS9n023tb9Xyt7YB7WYHA53xuCfxzQBti+vv7PiH9lS42pz50fPT3qK8vb06rpxOlyqVaTC+bH83yH3rnD4W8ZaTpcbeHPGZu4wqFbTXLUTr2485CsmPruqjd+M/Fui6pY/8Jh4Qm2RM+LzQz9tjf5Tk+XkSKB15BoA7pb6++1SH+yZc7F486P1b3pgvr77HKP7KlxmTnzo+OT71l+H/Hvh7xLeumj6/Yy3BVVNtIpimBBbIMbkNkfSt8LP9hm/eR9ZP+WZ9T/tUAQXF9fGMZ0mUfOn/LaP+8Peqst7e/8ACQ2zHS5QwtZgE86Pkb4+c59h+datytx5QzLH/rE/5Zn+8P8AaqpKs/8Awktr+8jz9km58s/34vegBIr6+8ybGkynLjP76Pj5R71H9uvv7MUf2VLjyh83nR+n1q/Etx5s/wC9j++P+WZ/ur/tVHtn/spf3kePKH/LM+n+9QBBLfX3mQZ0mUYc4/fR8/KfeoY729Gs3Df2VKWMEQK+dHwN0nPX/OK0ZVuPNg/ex/6w/wDLM/3W/wBqoIln/ty5/eR5+zw/8sz/AHpP9qgCOG+vh5mNJlPzn/ltH/jUYvr77DCP7KlwPLwfOj55HvV+Bbj95+9j/wBYf+WZ/wDiqjCz/wBnwfvI8fu/+WZ9R/tUAQNfX32tD/ZMudjcedH6r71Wsr29GqaiV0uVi0iZXzo/l/dr71qstx9sj/ex/wCrb/lmfVf9qqlis/8Aa2p4kjz5kef3Z/55r70ARm+vv7PkH9lS42Nz50fv70+W+vvMhzpMow5x++j5+U+9TlZ/7Nk/eR42N/yzPv8A7VSSrcebB+9j/wBYf+WZ/ut/tUAVBfX32pj/AGTLnYOPOj9T71W0y9vVe+26XK+bpicSxjacLx1rVC3H2xv3sf3B/wAsz6n/AGqp6Us++/xJGP8AS2zmM+i+9AEa3199ghH9lS4/d4PnR88j3qY3999oQ/2TLna3HnR+o96kVZ/7Pg/eR4/d/wDLM+o/2qnK3H2lP3sf3G/5Zn1H+1QBSW+vvtUh/smXOxePOj9W96f4fZm0nc6FGNxcEqTnafOfirCrcfbJP3sf+rX/AJZn1b/aqHQs/wBltnk/abjOB/02egDRooooAKKKKACiiigAooooAKKKKACiqsOp2U+qXOnQ3Mb3lpHHJPCpy0avu2E+mdjflWbpHjPw7r2pz6do+r2t3dwAs8Ub8kA4LL/eAPBIyM0AblFYWmeNvDetaxLpWl6xa3N7Fu3Qo3J2nDbT0bB4OM4o0vxt4b1rWJdK0vWLW5vYt26FG5O04baejYPBxnFAGB8RRu8SeAxkj/ifDkf9e81dksI+2SfvJP8AVr/F7tXGfEfb/wAJF4E3ruX+3hkbc5/0ebtXWqLT7XJ/o/Hlr/ywPq3tQBNbwja/7yT/AFjfxe9RCEf2fB+8k/5Z/wAXuKS3FptfNvn52/5dz6/SowLX7BB/o/P7v/lgfUe1AD5of+J1ajzJP9RL/F7x1YWEfaJP3knRf4vrVGUWv9s2v+j8eTLkeQfVParCi08+T/R+w/5dz7+1AAYf+JfP+8k/5afxe5qWWEebB+8k++f4v9lqqkWv2Cf/AEfn95/ywPqfapJRaeZB/o/8Z/5dz/dPtQBEIR/wkrje/wDx6Lzu/wBs1bhhG6X95J9/+97Cs8C1/wCEjb/R/l+yLx5B67z2xVuEWm6XNv8Ax/8APufQe1ACmH/QYf3knWP+L3FSSQj7RD+8k7/xe1ViLX7FD/o/OY/+WB9R7U+QWn2iL/R/X/lgfT6UARW0P/E+1Ab34jh/i/36mMP/ABL5/wB5J/y0/i9zVS2Ft/bl/mDjy4cDyDx972qYi1/s+f8A0fn95/ywPqfagC3JCPMi/eSff/vf7JoaEfaU/eSfcb+L3FRSC08yL/R/4v8An3P90+1BFp9oT/Rv4G/5dz6j2oAg06EHUdV+d+Llf4v+mMdTCH/iWRHzJPup/F9KqaeLb+0NUzb5H2lcDyCcfuY/bipQLX+zYv8AR+dqc+Qfb2oAtywjzof3kn3j/F7GhYR9sk/eSf6tf4vdqhlFp50OLf8AiP8AywPofahRafa5P9H42L/y7n1b2oAjsIc2Fx88n+vn/i/6aNU8kP8Aosf7yT70f8X+0Kp2ItfsM+bfJ86bH7g/89G9qncWv2WP/R/4k/5YH+8PagCw0I+2R/vJP9W38XutEMI82f8AeSf6wfxf7K1CwtPtcf8Ao/Gxv+Xc+q+1EItPMnzb/wAY/wCXc/3R7UAVdKiz4bgO9/uf3vetGSEeZF+8k+//AHv9k1laWLb/AIR2DdBltnXySe/ritCQWm+L/Rv4/wDn3P8AdPtQBIsI+2SfvJP9Wv8AF7tUMsP+g3n7yTo/8XtSqLT7XJ/o/Gxf+Xc+re1QSi1+w3f+j84fH7g8cfSgB1pCP7Esj5j/AHIf4v8Adq00I+2R/vJP9W38XutULUWv9i2ebfJ2Q5PkHn7vtVlhafa4/wDR+Njf8u59V9qAJ4oRvl/eSff/AL3+yKz9Zix4Z1I73OIJuC3+9VuMWm+X/R/4/wDn3P8AdHtWfq4tv+Ea1HbBhvJmwfIIx97vigDUmhHmwfvJP9Yf4v8AZagQj7Y37yT/AFY/i9zUUotPMgxb/wAf/Puf7p9qQC0+2N/o/Gwf8u59T7UATQwjdN+8k+//AHvYVTuof+JRbHe/+tt/4v8ApolTQi13S/6P/H/zwPoPaqlyLb+ybbEGD5tvk+Qf+eie1AGjJCPtEP7yTv8Axe1Cw/6ZJ+8k/wBWv8Xu1QuLT7RF/o/r/wAu59PpQotftcn+j8bF/wCXc+re1ACtD/xL5/3kn/LT+L3NQ6pCBNp3zvzdr/F/sNQRa/2fP/o/P7z/AJYH1PtUWpi183T9tvj/AEsZ/cEZGxvagDR8kfav9ZJ9z+970RwjzJf3kn3/AO9/siocWn2r/j342f8APufX6UsYtN8v+j/xf8+5/uj2oAQQj+zYv3kn3U/i+lQ3sP8AxONNG9+Wk/i/2DSgWv8AZ0X+j87U58g+3tUN4Lb+1tNxBxukyPIPPyH2oAq654H8N+KLiRPEGk21+fLXEksY8xeW6P8AeH4GsRPh3PpenSjwr4s1vSlXeEt5pheQKATxslBYD6MK69Rafa5P9H42L/y7n1b2pgFr9il/0fnMn/LA+p9qAOMuLn4l6Gv+naZpfia2DriTTrlrS4xuHJjkyhPsGFQr8UfD8XiO0XxGmq+GZfs8se3WbZoVLFo8YkGUI4PO7Fd7cC08sYt/40/5dz/eHtVK5hsptet45bRXiazmDRtbkhvni6jHNAFnS7ux1WKa50zUI7yBnG2W3nEin5R3GRUnkj+yl/eSf6ofxe1cfd/CzwTe3013b6PJpV2r/Lc6UZbR1+Uf888D8xVZ/CXiDTtMVvD/AIvupEEYIt9Z01LpTx08xVRwPqTQB30sI82D95J/rD/F/stUEUP/ABPLkeZJ/wAe8P8AF/tSVwr63480iWIax4M07Wow+fO0Scxt90/8splH5Bj0pI/ip4WstWnPiaw1Lw2WhiVU1XTHQEhnzhlDLjkc55x7UAehQQj95+8k/wBYf4qiEI/s+D95J/yz/i9xWXofiTwxryO2i39jqALk/wCjESED6DpV8C1+wQf6Pz+7/wCWB9R7UAWmhH2yP95J/q2/i91qpYwg6tqY3vxJH/F/0zWpWFp9rj/0fjY3/LufVfaqtkLX+1dSzb5HmJgeQeP3a+1AFwwj+zZP3kn3G/i+tSSwjzYP3kn3z/F/stVUi1/s6T/R+djc+Qff2qSUWnmQf6P/ABn/AJdz/dPtQBMIR9sb95J9wfxe5qppUIL3/wA7/wDH238X+ytSgWn2tv8AR+Ng/wCWB9T7VV0sW2++3W+f9LbH7gnAwvtQBbWH/iXwfvJP+Wf8XuKmMI+0p+8k+438XuKqKLX+z4P9H5/d/wDLA+o9qmItPtCf6N/A3/LufUe1AEiwj7ZJ+8k/1a/xe7VBoQxpjDr/AKTcdf8Ars9KotPtcn+j8bF/5dz6t7U3Qcf2UdowPtNxgYxj98/agDSooooAKKKKACiiigAooooAKKKKAPNLPRo9M8aePrTQIWinn0S0kVg7M8kzfa/mLElmbOOSc8CszT7uyv7X4Y2/h2eBryGwlYrC4LQxCxZGDAcqPNMY5/iHqK9YSzto7yW7jt4luZkVJZlQB3Vc7QW6kDc2AemT61WstC0jTby4u9O0uytLm6OZ5oLdEeY9cswGW/GgDy6K7tL7w18MbPQLiBtViKFUicb4UWxlWbcOoAYqDn+LHeptPvdPu9H+FVrpM8D38MsRaOJwXijWylWcMByBuIU5/ix3r0qz0DR9O1Ce/wBP0mxtby5/19xBbIkkvOfmYDJ/Giz0DR9O1Ce/0/SbG1vLn/X3EFsiSS85+ZgMn8aAOG+IM2q/8JV4KEllZiNde/cst2xZ/wBxLjcPLG3jngt6c9a7RZ9X+1v/AKBZ52LkfbG9W/6Z1zHxGBPiTwGAxU/28OR2/wBHmrsVhf7ZJ/pEn+rXsvq3tQBVgn1fa+LCzPzt1vG9f+udRCfVvsMH+gWm393g/bG55GP+WdX7eF9r/wCkSf6xuy+v0qMRP/Z8H+kSf8s+y+o9qAKUs+q/2xbE2Npv8mXA+1tgjKZ58v6VOs+r+dJ/xL7POBn/AExvf/pnT5on/tq1H2iT/US84X1j9qsLC/2iT/SJOi9l9/agDPM+rfYZ/wDQLTb+8yftjccnP/LOpZZ9X8yDOn2f3zj/AExuflP/AEzqUxP/AGfP/pEn/LTsvqfapZYX82D/AEiT757L/db2oAyxNqv/AAkLH7Da+Z9lX5ftbYxvPOfL/TFWoZ9X3S40+zPz8/6Y3oP+mdAif/hJXHnyZ+yLzhf759qtwwvul/0iT7/ovoPagCgZ9W+xxf6BaYzHg/bG9R/0zqSSfV/Pizp9nnnH+mN6f9c6nMT/AGGH/SJOsfZfUe1Pkhf7RD/pEnfsvp9KAMu3m1X+274rY2pcxxblN2wA+9jB8vmpTPq32Cf/AEC02/vMn7Y3HJz/AMs6kton/t7UB58n+rh5wvP3/apjE/8AZ8/+kSf8tOy+p9qAI5J9X8yLOn2f3uP9Mb0P/TOgz6v9oT/iX2edrf8AL43qP+mdW5IX8yL/AEiT73ov90+1DQv9pT/SJPuN2X1HtQBk2E+qjUNT2WNqWNwu8G7YYPlR8D93zxj0qUT6t/Z0Q+wWm3amD9sb27eXUmnRP/aOq/v5Bi5XnC8/uY/aphE/9mRf6RJ91OML7e1AEUs+r+dDnT7PO44/0xvQ/wDTOhZ9X+1Sf8S+zzsXI+2N6t/0zq1LC/nQ/wCkSfePZfQ+1Cwv9sk/0iT/AFa9l9W9qAMyyn1UWM+yxtSvnTZJu2GDvbP/ACzqZ59W+zR5sLTGUwftjf3h/wBM6ksInNhcfv5B+/n7L/z0b2qeSJ/ssf8ApEn3o+y/3h7UAVmn1f7VH/oFnnY2B9sb1X/pnSxT6v5k2NPs/v8AP+mNx8o/6Z1aaF/tkf8ApEn+rbsvqvtSwwv5k/8ApEn+sHZf7q+1AGNpk2qDw/CI7K1aPbwxu2B6+nl/1q/JPq++LOn2f3+P9Mb0P/TOodKic+G4CJ5ANnTC+v0rRkhfzIv9Ik+/6L/dPtQBTWfV/tcn+gWedi5H2xvVv+mdQyz6t9iu82FpjD7j9sbjj/rnWgsL/bJP9Ik/1a9l9W9qhlif7Def6RJ0fsvPH0oApW0+q/2PZhbG1KbItpN2wJ+7jjy+KstPq/2qP/iX2edjYH2xvVf+mdLaRP8A2LZf6RJ9yHjC8fd9qstC/wBsj/0iT/Vt2X1X2oArRz6vvlxp9n97n/TG9B/0zqhq02qHw5qAksrVYzDLuZbtiQOc4HljP51tRQvvl/0iT7/ov90e1Z+sROPDOpEzyEeRNwQvP3vagCSWfV/Mhzp9n9/j/TG5+U/9M6BPq/2tv9As87Bx9sb1P/TOrc0L+bB/pEn+sPZf7re1IIX+2N/pEn+rHZfU+1AFSKfV90uNPsz8/P8Apjeg/wCmdVbmbVP7Ktg1jahfMt8EXbEn94mOPL9cfT3rVhhfdN/pEn3/AEX0HtVO6if+yLb9/J/rbfjC/wDPRPagBzz6v58WbCzzzj/TG9P+udIs+r/an/0CzzsXI+2N6t/0zq3JC/2iH/SJO/ZfT6ULE/2yT/SJP9WvZfVvagCgZ9W+wTf6Babf3mT9sbjk5/5Z1Fqc2qmWw8yxtVIuhtxdscna3B/d8fWr5if+z5/9Ik/5acYX1PtUWqROJtOzPIf9LXsvHyN7UAHn6v8Aav8AkH2ednT7Y3r/ANc6VJ9X3y40+z+9z/pjeg/6Z1a8l/tX/HxJ9z0X1+lLHC/mS/6RJ970X+6PagDOE+rf2dF/oFpt2pg/bGz27eXUV3Nqv9q6cWsbUMGk2gXbEH5D1Pl8frV8RP8A2bF/pEn3U4wvqPaob2J/7Y039/J96TnC8fIfagBVn1f7U/8AxL7POxcj7Y3q3/TOoxPq32OX/QLTGZMn7Y3qf+mdXlhf7ZJ/pEn3F7L6t7UwRP8AYZv9Ik6ydl9T7UAQXE+r+WM2FmBvTpeN/eH/AEzqrJNqv/CQ2xNja+Z9lmwv2tsEb48nPl/TjHf251LmF/KH+kSf6xOy/wB4e1VZYn/4SW1HnyZ+yTc4X+/F7UAEU+r+ZPjT7PO8Z/0xuPlH/TOovP1b+zF/0C02+UOftjZxj08ur8UL+bP/AKRJ98dl/ur7VH5T/wBlL/pEn+qHGF9PpQBBLPq/mQZsLP75x/pjc/Kf+mdQLLqjavchtPs2LW8QZDdtjG6THPl89+K0pYX82D/SJP8AWHsv91vaoIon/ty5H2iT/j3h5wv96T2oA5a98AaJrEkkt/4K0GWXecyrJ5b/APfSxA/rWe3w8uIbGL+xb3VtHT5NqWviCZ0ByOdksbqPwr0CCF/3n+kSf6w9l/wqMRP/AGfB/pEn/LPsvqPagDgB4e+KVjeJ/Z/jCyu1Ctsi1S0WTjIyC8aIfTtT7HUfihYX9+bjQPD2ryb08wWWoSWxJ2DGPMRh0969AaF/tkf+kSf6tuy+q+1VbGJzq2p/v5BiSPnC8/u19qAOHm+IPi2ysnTUfhjqyqVYGS0vIbkDrz8vNMk+MkELxHVvD2q6TsYk/bbK6XHBHVYD616CYX/s2T/SJPuNxhff2qSWF/Ng/wBIk++ey/3W9qAPP4PjT4WnuzjWNHibaBi4vJIccn+/CKuaR8RdEla7+z654bcvcs2DraKeQOg28jjrXXzWEd1cMlyfOXyxxJGjDqfVawrPwZ4evZL43ejadMRdMo8yxhbjC+qUALD4qhmsYRDdaJIP3eCurA9CP9iry63cS3C+WulOQh4XUs9x/wBM6xz8MfBb2MLt4Y0fLeXkjToB1I9EpH+EngZrhQfDOmYKseLOIdx/s0AbJ1i6S4kZ49MX5FznUcDq3fy6teHJPO0USfId1xOf3bbl/wBc/Q9x71zS/CPwKLpx/wAI1puAikZtI/Vv9muh8K2Vtpvh6OysYUgtreaeOKKNQqoomcAADpQBsUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUVzWkeP9A1vWE02xnuPOmDm2kmtJYorsJ98xSMoWTH+yTxz05oAx/iPtHiLwJ5hAX+3hnJ4/495q65Ws/tcnzw48tf4h6tXJfEYkeJPAZClj/bw4Hf/R5q7FZX+2Sf6PJ/q17r6t70AR27We18vD99v4h61GGs/wCz4Pniz+7z8w9RVi3lfa/+jyf6xu6+v1qISv8A2fB/o8n/ACz7r6j3oAhmaz/tq1w8WPJlz8w9UqwrWfnyfPD0H8Q96jmlf+2rU+RJ/qJeMr6x+9WFmf7RJ/o8nQd19/egCsWs/sE/zxZ/eY+YepqSVrPzIMPD985+Yf3WpDK/9nz/AOjyf8tO6+p96lmmfzYP9Hk++e6/3W96AKIa0/4SN/ni2/ZF/iGM7zVuFrLdLl4fv/3h6Cq4lf8A4SRz5En/AB6Lxlf7596uQzPul/0eT7/qvoPegCuWs/sUPzxZzH/EPUU+RrP7RF88Pf8AiHpSmV/sMP8Ao8nWPuvqPenyTP8AaIf9Hk7919PrQBRtmtP7dv8ALxbfLhx8w/2qlLWf9nz/ADxZ/eY+YeppttK/9vagfIk/1cPGV4+/71MZX/s+f/R5P+WndfU+9AD5Gs/Mi+eH7394f3TQWsvtCfPDjY38Q9RT5Jn8yL/R5Pv+q/3T70rTP9pT/R5PuN3X1HvQBn6e1p/aGqbnix9pXGWHTyY6lDWf9mxfPFnan8Q9qbp0r/2jqv7iQ5uV7rx+5j96mEr/ANmxD7PJ91Ocr7e9ACytZ+dDh4fvH+IehoVrP7XJ88ONi/xD1apJZn86H/R5PvHuvofehZn+2Sf6PJ/q17r6t70AUrFrT7DcZeLPnz4+Yf8APRqndrP7LH88Wd0f8Q/vCo7CVxYXH7iQ/v5+6/8APRvep5JX+yx/6PJ96Puv94e9ACM1n9rj+eHHlt/EPVaIms/Mny8P3xj5h/dWpGlf7ZH/AKPJ/q27r6r70QzP5s/+jyf6wd1/ur70AZultaf8I7BueLds5ywz1rQkay3xYeH7/wDeH901S0qVx4bgHkSH5OoK+v1rRkmfzIv9Hk+/6r/dPvQBCrWf2uT54cbF/iHq1QytZ/YbvDxZw+PmHpVpZn+2Sf6PJ/q17r6t71DLK/2G8/cSdH7r6fWgCC1a0/sWzy8WdkOfmH+zVlms/tcfzw42N/EPVahtJX/sWy/cSfch5yv+z71aaZ/tkf8Ao8n+rbuvqvvQA2NrLfLl4fv/AN4f3RWfq7Wn/CNajteLd5M2MMM/xVpxzPvl/wBHk+/6r/dHvWfrErnwzqQMEg/cTckrx973oAtzNZ+ZBh4f9Yc/MP7rUBrP7Y3zw42D+IepqSaZ/Ng/0eT/AFh7r/db3oEr/bG/0eT/AFY7r6n3oAjhaz3S5eH7/wDeHoKqXLWn9k22Hiz5tvn5h/z0TNX4ZX3Tf6PJ9/1X0HvVO6lf+yLb9xJ/rbfnK/8APRPegCxI1n9oi+eHv/EPShWs/tcnzw42L/EPVqkkmf7RD/o8nfuvp9aFmf7ZJ/o8n+rXuvq3vQBWLWf9nz/PFn95/EPU1FqjWnnafteL/j7GcMOmxqsmV/7Pn/0eT/lp3X1PvUOqSuZtO/cSD/S17rz8je9AFjdZfavvw42f3h60sbWXmS/PD97+8P7op/nP9q/495Pueq+v1pY5n8yX/R5Pveq/3R70AVA1n/ZsXzxZ2p/EPaorxrT+1tNw8WN0mfmH9w1ZEr/2bF/o8n3U7r6j3qG9lf8AtfTT5Eg+aTjK8/IfegCdWs/tcnzw42L/ABD1amBrP7FN88WcyfxD1NTrM/2yT/R5PuL3X1b3qMSv9im/0eTrJ3X1PvQAXDWfljDw/fT+If3hVWVrT/hI7X54tv2SbPzDGd8X/wBer1zM/lD/AEeT/WJ3X+8Peqksr/8ACS2p8iT/AI9JuMr/AH4vegCeJrPzJ8vD98Y+Yf3VqPdZ/wBlr88WfKH8Q9KsRTP5s/8Ao8n3x3X+6vvUXmv/AGUv+jyf6oc5X0+tACytZ+ZB88P3zn5h/daoY2s/7aufni2/Z4sfMP70lWpZX82D/R5P9Ye6/wB1veoIpX/ty5/cSf8AHvDxlf70nvQA+FrP95l4fvn+IVGGs/7Pg+eLP7vPzD1FWIJn/ef6PJ/rD3X/ABqISv8A2fB/o8n/ACz7r6j3oAVms/tcfzw42N/EPVaq2TWn9q6ll4seYmPmH/PNavNM/wBsj/0eT/Vt3X1X3qpYyuNW1P8AcSH95HxleP3a+9ADy1n/AGbJ88WdjfxD3qSVrPzIMPD985+Yf3TQZX/s2T/R5PuN3X396klmfzYP9Hk/1h7r/db3oAjDWf2tvnhxsH8Q9TVXS2tN9/ueL/j7bGWHTC1eEz/bG/0eT/VjuvqfeqmlSuHv/wBxIf8AS27rxwvvQA9Ws/7Pg+eLP7vPzD1FTFrL7Qnzw42N/EPUUxZX/s+D/R5P+WfdfUe9TmZ/tKf6PJ9xu6+o96AIVaz+1yfPDjy1/iHq1M0HH9lnbjb9puMY9POep1lf7ZJ/o8n+rXuvq3vUOhHOlsSMf6TccHt++egDRooooAKKKKACiiigAooooAKKKKACiiigCG8jeaxnihbZI8bKrehI4NeVaXq1hrVl8N9F0idJdU0uaKS/t4z+8sVis5I5BKBynzMFwcZzxmvW6KAPPPH+j+J9S1Xw3LpNxpKzWurGa2FzHLtOIJjh9pyeAemOamEXxZErP5vgzLKB/q7rtn396j1vWvE1/rviJfDuoWljb+GooyYZrTzjeTNF5xVm3DYu1kHHOST2xXb6Xfx6ro9nqEIKx3cCToD1AZQw/nQBxiRfFlAQJfBnLE8x3Xf8aaLf4sCFIvN8G4Tbg+XddiPf2rv6KAPP2tfiu13HcGXwbujRkA8u6xhiCe/+yKeIviyHZvN8GZbH/LO6/wAa72igDgPs/wAWPJeLzfBuH3ZPl3Xcn396c0XxZZkJl8GfIcj93dehHr713teeXmr+MdG1jSrrVL6wePVNVFmuhxW+WSBmIEiy7ssyoBI2RtxkccUAQK3xTPiSWMP4P89bRGJ8u627S7Y75zlTV1YviyhYiXwZ8xyf3d1/jVKbxN4kt7ceLTf2j6GdW+wtpn2T51t/tX2YSiXdkvuw+MYwce9E3ifxLBajxYdQtH0M6v8AYW0z7J8ywfavswlEu7JfOHxjGOPegC35HxY8lY/N8G4Xbj93ddjn19qc0XxZZ1Yy+DMrnH7u6/xrvaKAPPo7P4rx3k1ys3g3fMqqwMd1gbc4xz7077P8WDC8Xm+DcPuyfLuu5Pv7139FAHBNF8WWZSZfBnynI/d3Xpj196Ux/FkyBvM8GZAI/wBXdd8e/tXcyyxwQvNO6xxRqWd3OAoHJJPYV57Y/EK+k1PxRf3dqI9F03Ro9TsIyu2SaLM4MjZ5G/ycqOylSeSRQBDpx+Kb6hqohfweHS6VZd0d1gt5MZ+XnptK9e+aufZvix9nWLzfBu1QAD5d1nj8faqa+KfEfhW2ttT8VX1rqNvqGmXF6be3tPJ+yyxQ+dsVtxLKUDjLc5UHviruga14mstf0K28TX9pfReILSSZEt7XyfscyKsmwHcd6FWYZPOVHrigBWi+LLMrGXwZlTkfu7r0x60CL4siRn83wZlgB/q7rtn39672igDz6G0+K8MLxrL4NId3c5juurEk9/enmD4sNGqeb4MwpBH7u67HPr7V31FAHBGL4smVX83wZlVI/wBXdd8e/tQsXxZVnIl8GfO2T+7uvQD19q1/H3iZ/C3h2O4gkhhuLu6is4ZrhS0cTO3Lso5baoY7R1IA71ytp441aLwzqRj1Wz1a7F/a2FjcyWT2sqSXDqg8+3bBXaW3AjAcDtzQBJow+Kdz4ftWt5PB4hkiDL5kd1uAPPODitBo/iyxUmTwZ8pyP3d16Y9feqNx4m8SeH7zUfDd7f2l9qbCxOnX5tPLXbczmE+ZGrYJQqW4IyMCt3wzqWs23irUvDXiK+h1Ka3tIb62vI7cQmSORnRlZQSMq0fUdQw9KAM8RfFkSs/m+DMsAP8AV3XbPv70xrb4rtDLGZfBuJM5/d3XGfxr0CigDz6O0+K8VpFbrL4NKxBQCY7rJ24x39qkMXxZMqv5vgzKgj/V3XfHv7V3tFAHBrF8WVLES+DPmOT+7uvTHr7Vn64Pinb+G9Se5k8HmBLaV5BHHdbiu0k4ycZ9K1viF4kvdDutFtLfVbfRLXUJJVn1Oe387yiiBkQKSAC3PzHgbcdSKy7bxZr+vaX4Z07T760t73WWvHfU/su9Wtrd9olSJjwZA0RwSQoY8HigC60XxZZkJl8GfI2R+7uvQj196PK+LPml/N8GZIx/q7r/ABqjH4q8R6hc6f4Xt7+1ttYa9vLe71L7JuXy7YId6RFsBnE0XUkDLdeK6jwVrV7q+k3cermJ7/Tb6awuJYU2JKY2+VwuTjcpUkZ4JNAGKsXxZQsRL4M+Y5P7u6/xqKSy+K0ltHAZvBoWNkYER3WfkYMO/tXoVFAHBGL4ss6sZfBmVzj93df40CL4siVn83wZlgB/q7rtn39672obyeS2sZ54beS6kijZ0giKh5SBkKu4gZPQZIHPWgDhjb/FgwPF5vg3D7sny7rvn396qam3xTSfThO/g8l7sLHsjuuG2OecnpgH9KW08e67beDfGer63Z20d9o9+9vbWcb7kTMMLRoz8bvml+Y/XHGKTV/EvibwLDejX7+z1ySTSpr2zZLT7OEnjkijMZwxyhM6YPXAagC75XxZ8zf5vgzOMf6u6/xpVj+LKsxEngz5jk/u7r0x6+1VL7xVr3gdtTj8TX9vrJTRJ9Vt3itfs+14WVXiwCcqTJHg9RznNaGian4l0rxdp+jeKtQtdRXVrGW5ie3tfJ+zzRGPfH947kxKCCeflOetAFf7P8WBAsXm+DdqgAHy7rPH4+1Nls/ivNdQTtN4NDQFioEd1g5GOea9BooA4IRfFkSs/m+DMsAP9Xdds+/vTfs/xY8lo/N8G4bdn93ddzn1967+qGtXd/Z6W8mkaedQvCQkUJkEa5JxuZj0UdTjJx0BNAHIyRfFmRQDL4M6g8R3XY59faqUp+KY8SWkbP4P897SdkIjutu0PFuzznOWXH41o6HrPijxN8LNA1LS5LSPVdSjia5uZY8pbo2S7rHkbiMABc98npWSnizxEjXeg/2hZ3d//bMOlWutJa4T54TNJmMNguiowIBAyVyBgigDSWL4sqzkS+DPnOT+7uvQD19qb9n+LH2cQ+b4N2hdufLus/zqo/inxLZm+8NS3tpNrcep2tlb6kbXahinTzPMaINguqpKMAgEhfet/wAKapq41/WfDviC7hv7nTVgnivIoPJ86KYPgMgJAYNG4yOCMcUAZrRfFlmQmXwZ8hyP3d16EevvTFtfiut3JcCXwbukRUI8u6xhSxHf/aNegUUAcEkXxZTdiXwZ8zZP7u6/xpv2f4seSkXm+DcJtwfLuu2Pf2rv64z4oeJdd8L+Db2+8N6ek88VtLM93M6iK1CAclersc/KAMcHJA4IBVMXxZMofzfBmVBH+ruu+Pf2qlYN8U5NT1QRP4PEkc6JLujusE+UhGOemGHXvmun8YeJJtD0fZpcS3OsXSOLOBvugquWlf0RByT34UcsK5uz8Q+IvEcfhjTNK1G3028vtBj1e/vmtBMSSI1ComQBlmYknoFwKALBt/iwYGi83wbtYEZ8u6zz+NOaL4ssyEy+DPkOR+7uvQj196pWni3xB4mXQtH0y8ttM1K5ivZNRvPs3mhPsswgYRoxx88hzyTgDvXVeCtbutc8PtJqfl/b7O7uLG6aJSqPJDK0ZdQScBtobGeM4oAwvK+LPml/N8GZIx/q7r/Go7ez+K9sZik3g0+dKZGzHdcEgDjn2r0GigDgBb/FgQpF5vg3CbcHy7rtj39qeY/iyZA3m+DMgEf6u6749/au8rjvFPiXWtL8XeHNPsrFY9NvtRS2ubyVlJkLRSuERevHl5LHHYDOTgApiL4siVn83wZllA/1d12z7+9b3gl9Sfwyp1v7L9uF3dLL9jDCLIuJB8u7nHHeuM8W/EC/tvE+rWGma3Z6UNGWIbLiwkuFuZXjEh850/1EW1kG845Lc/Lirmr6/wCKLyfX7rw7fWVnD4dt43e0kt/PW9lMInZTJkFV2soBUZySfagD0aivOp/EHibxLLf3fhPUbTTrTTbGC4SC4tPON3LLF52xm3DYu0oPl5ySe2K7Tw9q6a/4Z0zWIk8tNQtIrkIT90OgbH4ZoA0aKKKACiiigAooooAKKKKACiiigAooooA4TXPC3iYa1rk3hi40tbXxBCiXZvTIJLaRY/KMkYUEP8m35SV5XrzXZ6fZRabplrY22RDawpDHnrtUAD9BViigAooooAKKKKACvO9E0LxzaeLJtY1my8O3k9zNsa7+3zmS2td3+qiQw7Rgcnkbm5J6Y9EooA88l8F+IrgjQZLjS18MDVf7QMimT7UyfaPtAg242AeZgbt33R0zRL4L8RXBGgyXGlr4YGq/2gZFMn2pk+0faBBtxsA8zA3bvujpmvQ6KACiiigAooooAz9e0Sz8SaFdaRqfmm1ulCyiKQxsQCDww5HSuNt/hZFF4i1meXVNSudP1LR107bd6lNcSZJmD7g5IKhZF28nB38DPPoVFAHnlt4J8QazFb2PjSfTGsrHTp7GF7AyGS4MsYiMrhwAmE3fKC3LHnjFWvD/AIX8S/25pF34rudNeLQrWS3tPsHmbrh3VUMsgYAIdikbRnljz2ruaKACiiigAooooAwPGPh6XxFo8CWU0UN9Y3kN9ZvMpaPzYm3AMBztIypI5Gc9q5ufwNrmsQ6vqesXGnW2uXj2T2iWu+S3tzaSGWLczBWbc7NuOBgHA6V6HRQB55L4L8RavJqWs6xcaXBrsgsxYR2xkkt4BbTGZQzMFZt7swbAGBjGa2vDOh61H4i1HxD4pexGoXdvDaRW9gzvFDDGXb77hSzM0jE8DGBXU0UAFFFcpd/EPTbLVE0+bTNc+0yF/KRdLmPmhMbivHIGRyPUUAdXRVPT9RTUY2ZLe6g2hDi5gaIncgbgH03YPoQR1FXKAOV8TaDrM3iPTPEPhtrCS9sYJ7VrbUWdYnjlKEsroGKsDGOdpyCRWOPBOv2EOl6rplxpsmvWl3eXM0M29LWRbpt0kasAWUAhCGwclSSOePQqgurpbXyd0U0nmyrEPKjL7Se7Y6L6k8CgDg18E+IbL+z9bsJ9Mk8RQ3l1c3UcxkW1lW4ADRqwBddojiw2DnZyOeOk8H6Dc6DpE41KaKfUL68mvbt4ARGJJGztTPO1QFUE8nGfat+igAooooAKKKKAOIk8CXF7ovjPTry5ijHiC+e5tpYssYcwxIpYEDkPFnAyMY59Kd74M8SeLYb7/hMLjS7aQ6ZLYWf9m+ZIFeR0dpm3gY+aGLCjPQ8816HRQB5/L4K1zxQdSk8bS6bFJPpE2lW40wyOqrKQXlO8DBykeFGcYPJzV3QfD3iWbxPZ6z4wn01n02yktLRNPMhEjSFDJK+8DaSI1AUZxk8muzooAKKKKACiiigDzxfCni7SvhDo/hjw/d6fFqdvFFb3k7XEka+UAd4icRlgx4AYqMAkjkCnp4W8RP4bsrVNP0DSrrRbyK60uG0uJpYGKhldZCY1YbldhuAY5OTnv6BRQB54fBPiG4t77WLm601PEtxqNvfQpGJGtYhAmxYixAcgqZMtgcvwOK3PCuhataavq2ueJHs/7S1MQxeTYs7RQRRBtihnALEl3JOB1HHFdPRQAUUUUAFYPjnQ7nxN4D1nRbB4o7m+tHhieYkIGI4yQCcfQGt6igDk/E3gCw8RXcuoNealaag1l9kV7PUZrdGUFiAwQjIyxzWJp3gXxB4YsPDtx4cubK61LTtKOm3kWp3EzRyqSj5SQKWAV1O0FcbTj5cCvR6KAPPYfA+uaHBod/4fuNPuNYsY7qO8W83xw3IuZBNJhlDMuJACvB4yDXTeENBm8PaB9mvZo5724uJry7liUhGmmkaR9oPO0FsDPYCtyigAooooAKwPE+hXWtXvh2a1eJF0vVlvZhISCyCGVMLgHLZkXrgYB5rfooA4PW/CPiAaxr03hmfTFtvEcKR3pvg++2dY/K8yMKCJMpj5WK8r15xVW98C+IdPh1DTPCd1pyadq1lDa3M18ZPOtykIgMiBRhyY1TglcEdwcV6NRQBwF74R8S6VcXsHgyfS0sdQsobWQ35kEls0cflCRAgIf5NvynbyvXmux0TSodC0DT9JtSWhsLaO2jLdSqKFBP5VeooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACuT1v8A5Kf4U/69r/8AlDXWUUAeM+Iof7S8eXWn3UsxtZvGNnFJGkrLujOkEsnB+6e475NUL3wxpWl6V4ovLC3aCfQvElpDpbJK2LJGa1ZljGcKGMz5A659hXutFAHz3qiX0njLU2u7vSLPxJ/bLfYZZVum1BYRKPJEaICGiMe3IAK4Lbuc16p8QpHjXwx5bsu7xFaK204yMtxXYUUAeK2uiWNppPhvxLAki6zN4oNvJemVjI0LXcsZi6/c24G3p3613/j9JrPS7LxDal/M0K7W8lVM/Pb4KTqR3/dszfVBXV1keJPD0PifS/7OvLy8trV2/fpayBPtEeCGickE7CDzjB96APGvEVtfNHomoa8bAaRrBu9Suf7ZaYWizSMnkRybOhWABVDfLkN3xUl9PFF4H8N2OvGx1Czmurtra41Ka5h0+OMH93G4Zd8pw2Iw3BC5BPFe7oqoiqihVUYAA4ApaAPAPCtjb6/J4U0XVR9o05dU1iJrRTKkTRoA8abHO8IMqyq3I+WrkQstL+L5kj+w61ezayQFzcW2qWiu2On3ZLZAfZSozzXudFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAf/2Q==)

Chart, histogram

Description automatically generated

Days

90 / 30 = 3 half-lives elapse

1/23 = 1/8 or 0.125

1 x 0.0125 = 0.0125g

40.35 / 8.07 = 5 half-lives elapse

5 = 1 / 25 x X = 0.03125 X

X = 160g

2.8 x 1010 / 1.4 x 1010 = 2 half-lives elapse

25.0g = 1/22 x X = 0.25X

X = 100g

1/2x = 62.5 / 500 = 0.125 or 1/8

2x = 8 x = 3 half lives have elapsed

639000 / 3 = 213,000 years

62.0 / 12.4 = 5 half-lives elapse

1/25 = 0.03125

750 x 0.03125 = 23.44g

1/2x = 12.5 / 50 = ¼

2x = 4 x = 2 half lives elapse

14.4 / 2 = 7.2s

8.10 / 2.7 = 3 half=lives elapse

1/23 = 0.125

0.125 x 100 = 12.5g

Graphical user interface, text, application

Description automatically generated

**Lesson 9: Teacher notes**

**Key direct and explicit teacher explanations:**

**Chunking**

1. Ratios and converting fractions to ratios
2. Calculating net decline as a ratio
3. Synoptic

**AQA content**

**(HT only**) Students should be able to calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives.

**Teacher notes (e.g. key questions, examples, non-examples, explanations)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lesson 9: Half-lives & ratios**

**Objective: By the end of this lesson, you will be able to represent declines in radioactivity as a ratio.**

**Skills Drill / Retrieval**

|  |  |  |
| --- | --- | --- |
| Answer | | PA / SA |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

**Connect**

In some calculations related to radioactivity you might need to convert decimals into fractions. This can be done as follows:

* **Step 1:** Write down the decimal divided by 1, like this:   *decimal /* **1**
* **Step 2:** Multiply both top and bottom by 10 for every number after the decimal point. (For example, if there are two numbers after the decimal point, then use 100, if there are three then use 1000, etc.)
* **Step 3:** [Simplify](https://www.mathsisfun.com/simplifying-fractions.html) (or reduce) the fraction

Convert these decimals into fractions:

1. 0.75

0.75 / 1 Multiple top and bottom by 100

75 / 100 Simplify (divide by 5 and then divide by 5 again)

75/100 = 15/20 = 3/4

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. 0.50

0.50 / 1 Multiple top and bottom by 10

5 / 10= Simplify (divide by 5)

5/10 = 1/2

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Fraction = 1/128 (from last question) Fraction decayed / 127/128

Raton = 1:127 (remaining : decayed)

189 / 27 = 7 half-lives elapse

1/27 = 0.0078125 or 1/128

Fraction = ½ (from last question) Fraction decayed = 1/2

Ratio = 1:1

63 / 63 = 1 half-life elapses

1/21 = 1/2

Fraction remaining = 1/8 (from previous question) Fraction decayed = 7/8

Ratio 1:7 (Rhodium : Rubidium)

9.9 / 3.3 = 3 half-lives elapse

1 / 23 = 1/8 or 0.125

**Complete the questions. Express your answer as a ratio.**

1. Rhodium-101 has a half-life of 3.3 years. What fraction of rhodium-101 nuclei remain after 9.9 years?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Rhodium-101 has a half-life of 3.3 years. It decays to make rubidium-101. What is the ratio of rhodium-101 to rubidium-101 after 9.9 years?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Titanium-44 has a half-life of 63 years. What fraction of titanium-44 nuclei remain after 63 years?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Titanium-44 has a half-life of 63 years. After 63 years, what will be the ratio of titanium-44 to the new nuclei?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Dubnium-261 has a half-life of 27 seconds. What fraction of dubnium-261 nuclei remain after 189 seconds?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Dubnium-261 has a half-life of 27 seconds. What will be the ratio of dubnium261 nuclei to the decayed nuclei after 189 seconds?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Complete the questions. Express your answer as a ratio.**

1. Rhodium-101 has a half-life of 3.3 years. What fraction of rhodium-101 nuclei remain after 1.65 years?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Rhodium-101 has a half-life of 3.3 years. It decays to make rubidium-101. What is the ratio of rhodium-101 to rubidium-101 after 1.65 years?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Titanium-44 has a half-life of 63 years. What fraction of titanium-44 nuclei remain after 94.5 years?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Titanium-44 has a half-life of 63 years. After 94.5 years, what will be the ratio of titanium-44 to the new nuclei?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Dubnium-261 has a half-life of 27 seconds. What fraction of dubnium-261 nuclei remain after 77.5 seconds?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Dubnium-261 has a half-life of 27 seconds. What will be the ratio of dubnium261 nuclei to the nuclei after 77.5 seconds?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Fraction = 2000/11317

Ratio = 2000:9317

77.5 / 27 = 2.5 half-lives elapse

1/22.5 = 1 / 5.6585 = 2000/11317

Fraction = 250 / 707

Ratio = 250:457

94.5 / 63 = 1.5 half-lives elapse

1/21.5 = 1 / 2.828 = 250/707

Fraction = 500/707

Ratio = 500:207

1.65 / 3.3 = 0.5 half-lives elapse

1/20.5 = 1/1.414 = 500/707

**Lesson 10: Teacher notes**

**Key direct and explicit teacher explanations:**

1. Defining irradiation and contamination
2. Irradiation and types of radiation
3. Contamination and types of radiation
4. Comparing hazards associated with irradiation and contamination

Graphical user interface

Description automatically generated

**Chunking**

1. Defining irradiation and contamination
2. Irradiation and types of radiation
3. Contamination and types of radiation
4. Comparing hazards associated with irradiation and contamination

**AQA content** Radioactive contamination is the unwanted presence of materials containing radioactive atoms on other materials. The hazard from contamination is due to the decay of the contaminating atoms. The type of radiation emitted affects the level of hazard.

Irradiation is the process of exposing an object to nuclear radiation. The irradiated object does not become radioactive.

**Students should be able to** compare the hazards associated with contamination and irradiation.

Suitable precautions must be taken to protect against any hazard that the radioactive source used in the process of irradiation may present.

**Students should understand that** it is important for the findings of studies into the effects of radiation on humans to be published and shared with other scientists so that the findings can be checked by peer review

**Examples: A range of examples and non-examples.**

**Contamination examples:**

Doctors can deliberately contaminate a patient's body when it will help with diagnosis with a radioactive source, such as:

* drinking a radioactive mixture (barium meal) will make soft tissue such as your intestine show up on an x-ray
* technetium-99 is a radioactive isotope that can be introduced into the body to make soft tissue such as the brain or the thyroid show up on a scanner **(revisit prior examples)**

**Irradiation examples:**

* Radioactive beams can be used to preserve fruit by exposing the fruit to a radioactive source, typically Cobalt 60. The gamma rays emitted by the cobalt will destroy any bacteria on the fruit but will not alter the fruit in any significant way.
* The method can also be used to sterilise surgical instruments.

**Teacher notes (e.g. key questions, examples, non-examples, explanations)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Teacher notes (e.g. key questions, examples, non-examples, explanations)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lesson 10: Radioactive contamination**

**Objective: By the end of this lesson, you will be able to identify examples of irradiation and contamination and hazards associated with irradiation and contamination with different types of radiation.**

**Skills Drill / Retrieval**

|  |  |  |
| --- | --- | --- |
| Answer | | PA / SA |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

**Connect – use types of radiation and three main properties.**

**A. Which travels the greatest distance in air?**

**Alpha**

**Beta**

**Gamma**

**B. Which travels the greatest penetrating power?**

**Alpha**

**Beta**

**Gamma**

**C. Which travels the greatest ionising power?**

**Alpha**

**Beta**

**Gamma**

Radioactive substances can be used to kill bacteria on fresh, cooked and frozen foods. Killing the bacteria reduces the risk of food poisoning.

Diagram

Description automatically generated

1. Are the chickens in contact with the Cobalt–60 or are they exposed to the radiation being emitted?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Can the radiation be blocked from reaching the chickens?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Are the chickens radioactive once they have been exposed to the Cobalt-60?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Have the chickens been irradiated or contaminated with the cobalt-60?

Explain your answer by referring to the answers to questions a – c.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Irradiated.

The radioactive material is not inside or on the chickens.

It could be blocked from reaching the chickens and the chickens are not radioactive after the treatment.

No

Yes

Exposed / not in contact

Radioactive substances ae used to control the thickness of paper in paper mills.

Diagram

Description automatically generated

1. Is the paper in contact with the radioactive source or is it exposed to the radiation being emitted?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Can the radiation be blocked from reaching the paper?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Is the paper radioactive once they have been exposed to the radioactive source?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Has the paper been irradiated or contaminated by the radioactive source?

Explain your answer by referring to the answers to questions a – c.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **If you were the papermill manager, would you use a source with a long or short half-life?**

**Explain your answer.**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Long half life so the source could be used for a long period of time.

See answers for previous question.

Short. So the radioactive substance was active within the body for a short period of time. Less damage would be caused.

Contaminated.

The radioactivity was in contact with them. It could not be blocked or removed. The people were radioactive.

Yes, the radioactivity remained in their bodies.

No.

In contact.

Following the Chernobyl nuclear disaster, water supplies contained high concentrations of radioisotopes. Following the disaster, local residents had to wait 36 hours for the government to decide to evacuate them. In this time, they drank the water supply.

1. Were people in contact with the radioactive source or were they exposed to the radiation being emitted?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Could the people who drank the water block the radiation from reaching their tissues?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Were the people radioactive once they had been exposed to the radioactive source?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Were the people irradiated or contaminated by the radioactive source?

Explain your answer by referring to the answers to questions a – c.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **If you had drank the water, would you want the radioisotopes to have a long or short half-life?**

**Explain your answer.**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Following the Chernobyl disaster, fiefighters were irradiated.

1. Would it be better for the firefighters if the radiation travelled a long or short distance in air? Explain your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Would it be better for the firefighters if the radiation had a high or a low penetrating power?

Explain your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Would it be better for the firefighters if the radiation had a high or a low ionising power?

Explain your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Is alpha, beta or gamma radiation the most dangerous when it is outside the body?

Use your answers to parts a – c to explain your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Gamma.

Whilst it is least ionising, it has the highest penetrating power and greatest distance travelled in air. So, firefighters are more likely to be exposed and it is more likely the radiation will enter their bodies.

Low.

Less ionisation within the body.

Low. Less likely to enter the body / penetrate clothing.

Short distance. Reduces area exposed to irradiation.

Alpha. It is has low penetrating power and so is more likely to b absorbed by the body where it cause damage by ionisation.

High. More likely to leave the body without being absorbed.

Low so less ionisation of tissues (e.g. to tissues, DNA etc)

Short. Less likely to enter surrounding tissues.

Following the Chernobyl disaster, local residents were contaminated because they ingested food and water containing radioactive material.

1. Would it be better for the residents if the radiation travelled a long or short distance in air? Explain your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Would it be better for the residents if the radiation had a high or a low penetrating power?

Explain your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Would it be better for the residents if the radiation had a high or a low ionising power?

Explain your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Is alpha, beta or gamma radiation the most dangerous when it is inside the body?

Use your answers to parts a – c to explain your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lesson 11: Teacher notes**

**Chunking**

1. Background radiation.
2. Applying ideas about background radiation.

**AQA content**

**Triple only: Background radiation is around us all of the time. It comes from: • natural sources such as rocks and cosmic rays from space • man-made sources such as the fallout from nuclear weapons testing and nuclear accidents.**

**The level of background radiation and radiation dose may be affected by occupation and/or location.**

**Radiation dose is measured in sieverts (Sv) 1000 millisieverts (mSv) = 1 sievert (Sv) Students will not need to recall the unit of radiation dose.**

**Key direct and explicit teacher explanations:**

**Teacher notes (e.g. key questions, examples, non-examples, explanations)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lesson 11: Background radiation**

**Objective: By the end of this lesson, you will be able to identify sources of background radiation.**

**Skills Drill / Retrieval**

|  |  |  |
| --- | --- | --- |
| Answer | | PA / SA |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

**Connect**

**Imagine a city left deserted for thirty years. That's what happened to Chernobyl, in the Eastern European country of Ukraine, after a nuclear disaster.**

In 1986 a safety test at a nuclear power plant there went wrong and there was an explosion followed by fires. Many people were killed.

The accident left the area unsuitable to live in because of the radiation that leaked into the nearby area.

Radiation is impossible to touch, see or smell, but is very harmful. The area around the plant was evacuated and an no-go zone was put into place, so that no-one could come within 30 kilometres of the plant.

Following the disaster, a cloud containing radioactive substances was blown towards northern Europe. Governments ordered that fast-growing crops were destroyed because the radioactive substances might become concentrated in them.

Were the governments trying to avoid irradiation or contamination of its people?

Explain your answer.

Contamination.

The crops containing radioactive material would be eaten if they weren’t destroyed.

The source of radiation could not be removed from the person once it was eaten.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Diagram

Description automatically generated

Diagram

Description automatically generated

Chart, pie chart

Description automatically generated

2.5

Text

Description automatically generated

X

Graphical user interface, text, application, email

Description automatically generated

Table

Description automatically generated

**Lesson 12: Teacher notes**

Graphical user interface, text, application, email

Description automatically generated

**AQA Content**

**AQA content**

**Physics only: Nuclear fission is the splitting of a large and unstable nucleus (eg uranium or plutonium). Spontaneous fission is rare. Usually, for fission to occur the unstable nucleus must first absorb a neutron.**

**The nucleus undergoing fission splits into two smaller nuclei, roughly equal in size, and emits two or three neutrons plus gamma rays. Energy is released by the fission reaction.**

**All of the fission products have kinetic energy.**

**The neutrons may go on to start a chain reaction.**

**The chain reaction is controlled in a nuclear reactor to control the energy released. The explosion caused by a nuclear weapon is caused by an uncontrolled chain reaction.**

**Students should be able to draw/interpret diagrams representing nuclear fission and how a chain reaction may occur.**

**Chunking**

1. Nuclear fission
2. Chain reactions
3. Controlling chain reactions

**Key direct and explicit teacher explanations:**

**Teacher notes (e.g. key questions, examples, non-examples, explanations)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lesson 12: Nuclear fission**

**Objective: By the end of this lesson, you will be able to describe nuclear fission and chain reactions and explain how chain reactions are controlled in nuclear reactors.**

**Skills Drill / Retrieval**

|  |  |  |
| --- | --- | --- |
| Answer | | PA / SA |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

**Connect - https://www.edfenergy.com/energywise/what-are-advantages-nuclear-energy**

**Is there anything positive about nuclear power stations?**

Although nuclear power stations take considerable investment to build, they have low running costs and longevity. This means they are particularly cost-effective. Most of the carbon dioxide (CO2) emissions associated with nuclear power stations happen during construction and fuel processing, not when electricity is being generated.

Nuclear can help meet our country's demands

Uranium is the raw material used to create fuel – it comes from stable regions around the world and is widely available. This dependability means nuclear power is a long-term and low-carbon option.

However, we need enough power stations to process it. They last between 40 and 60 years after which they are decommissioned. Seven of the eight nuclear power stations in the UK are due to close by 2030. These create enough electricity to power 50% of the UK's homes (or around a fifth of all the electricity used in the UK).

Nuclear energy isn't only low-carbon, it's also reliable when compared to other low-carbon options. So when the sun doesn't shine or the wind doesn't blow, nuclear takes over keeping the lights on.

**What are advantages of using nuclear power stations to generate electricity?**

Low carbon dioxide emissions (lower contribution to global warming).

Uranium is widely available from stable regions.

Reliable compared to other low carbon options.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Diagram

Description automatically generated



Graphical user interface, text, application, email

Description automatically generated

A neutron

An unstable nucleus divides into two smaller nuclei which are roughly equal in size.

2 or 3 neutrons are released

As is gamma radiation

Each neutron collides with another unstable nucleus.

The process repeats itself.

A screenshot of a computer

Description automatically generated with medium confidence

(iii) Describe what happens during a chain reaction.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Diagram

Description automatically generated

Graphical user interface, text, application

Description automatically generated

Diagram

Description automatically generated

Chart, line chart

Description automatically generated

Text

Description automatically generated

**Lesson 13: Teacher notes**

**Chunking**

Nuclear fusion

Source of energy from nuclear fusion

**AQA content**

**Physics only: Nuclear fusion is the joining of two light nuclei to form a heavier nucleus. In this process some of the mass may be converted into the energy of radiation.**

**Key direct and explicit teacher explanations:**

**Teacher notes (e.g. key questions, examples, non-examples, explanations)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lesson 13: Nuclear fusion**

**Objective: By the end of this lesson, you will be able to describe nuclear fusion and explain why it releases large amounts of energy.**

**Skills Drill / Retrieval**

|  |  |  |
| --- | --- | --- |
| Answer | | PA / SA |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

**Connect**

Nuclear fusion is an alternative to nuclear fission. The following advantages are often cited:

**Less radioactive waste than fission.** There is no radioactive waste by-product from the fusion reaction. Only reactor components become radioactive; the level of activity depends on the structural materials used. Research is being carried out on suitable materials to minimise decay times as much as possible.

**Safety.** A large-scale nuclear accident is not possible in a fusion reactor. The amounts of fuel used in fusion devices are very small (about the weight of a postage stamp at any one time). Furthermore, as the fusion process is difficult to start and keep going, there is no risk of a runaway reaction (preventing meltdowns).

**Abundant fuels.** Deuterium can be extracted from water and tritium will be produced inside the power station from lithium, an element abundant in the earth’s crust and seawater. Even with widespread adoption of fusion power stations, these fuel supplies would last for many thousands of years.

**In your opinion, which advantage is the most persuasive in terms of persuading you that nuclear fusion is a better option than nuclear fission? Explain your answer.**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Answers will vary!

Explain what happens in the process of nuclear fusion.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Graphical user interface, text, application

Description automatically generated

Graphical user interface, text, application

Description automatically generated

Text, email

Description automatically generated

Fission reactors are used in nuclear power stations.

Engineers are developing fusion reactors for use in power stations.

Fusion uses isotopes of hydrogen called deuterium and tritium.

•        Deuterium is naturally occurring and can be easily extracted from seawater.

•        Tritium can be produced from lithium. Lithium is also found in seawater.

The table shows the energy released from 1 kg of fusion fuel and from 1 kg of fission fuel.

|  |  |
| --- | --- |
| **Type of fuel** | **Energy released from 1 kg of fuel in joules** |
| Fusion | 3.4 × 1014 |
| Fission | 8.8 × 1013 |

Suggest **two** advantages of the fuel used in a fusion reactor compared with the fuel used in a fission reactor.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

