Background pattern

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**Year 10 – Teacher Booklet B (TRIPLE & TRILOGY)**

Key Stage 4 Science:

**Energy**

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**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: Energy stores and energy changes within systems (by heating, forces and current) **& power**. Conservation of energy.

Lesson 2: Kinetic energy and associated changes to energy stores **& power**.

Lesson 3: Elastic potential energy and associated changes to energy stores.

Lesson 4: Gravitational potential energy and associated energy changes **& power**.

Lesson 5: Energy changes in systems – specific heat capacity **& power**.

**Lesson 6: Required Practical – specific heat capacity.**

Lesson 7: Efficiency & energy dissipation.

**Lesson 8: PHYSICS ONLY – Required practical – thermal insulators**

Lesson 9: Energy sources.

Lesson 10: Energy sources – patterns / trends and wider issues.

**Keystone words**

**Dissipate**

**Efficiency**

**Transfer**

**Power**

**Store**

**Conductivity**

**Conserved**

**Lesson 6: Teacher notes**

**AQA Content**

**Required practical activity 1:** investigation to determine the specific heat capacity of one or more materials. The investigation will involve linking the decrease of one energy store (or work done) to the increase in temperature and subsequent increase in thermal energy stored.

AT skills covered by this practical activity: AT 1 and 5.

**Chunking**

This is a required practical. Other than introducing the practical, retrieval practice and Connect, students need time to perform the practical. This can be as:

1. A slow practical.
2. Students given autonomy to work at their own pace.

**Key direct and explicit teacher explanations:**

See guidance for required practical.

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

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**Lesson 6: Required Practical – Specific Heat Capacity**

**Objective: To calculate the specific heat capacity of metals using experimental data.**

**Skills Drill / Retrieval**

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

2kg x 4200 x 80oC

= 672,000J

Text

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The quantity of heat (J) absorbed per unit mass (kg) of the material when its temperature increases 1oC. (or 1 °C)

**Catch-up**

1. Define ‘specific heat capacity’.

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

1. Which equation is used to calculate specific heat capacity?

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

1. Calculate the energy needed to heat 2kg of water from 100C to 900C. The specific heat capacity of water is 4200J/kgoC.

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

Gradient = Change in y / change in x

A straight line that touches a curve at a single point.

Remove the anomaly (24).

Add the remaining results together.

Divide by the number of results added together.

**Connect**

1. Explain how to calculate the mean of the following experimental results:

|  |  |
| --- | --- |
| Trial number | Result |
| 1 | 35 |
| 2 | 32 |
| 3 | 24 |
| 4 | 33 |

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

1. Explain what a tangent is.

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1. What equation is used to calculate the gradient of a straight line?

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Diagram

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Table

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**Lesson 7: Teacher notes**

**AQA Content**

**Students should be able to** describe, with examples, how in all system changes energy is dissipated, so that it is stored in less useful ways. This energy is often described as being ‘wasted’.

**Students should be able to** explain ways of reducing unwanted energy transfers, for example through lubrication and the use of thermal insulation.

The higher the thermal conductivity of a material the higher the rate of energy transfer by conduction across the material.

**Students should be able to** describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls.

Students do not need to know the definition of thermal conductivity

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**Chunking**

* Efficiency.
* Conduction and thermal conductivity.
* Applying ideas about thermal conductivity.

**Key direct and explicit teacher explanations:**

It is very rare for energy transfers to be 100% efficient. When energy transfers from one store into another, some energy dissipates and is stored in less useful ways. For example, a computer monitor gets warm when it is used; it is not designed to do this. This causes energy to be transferred into the thermal energy store of the surroundings; this energy is dissipated and is often called ‘wasted’ energy.

Text

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The higher the efficiency, the less energy is wasted. Scientists and engineers try to design products that are as efficient as possible. They try to minimise the amount of energy that is dissipated by, for example, using thermal insulation and lubricants; for example, engine oil in cars makes the engine more efficient.

Energy can travel through materials by conduction and convection. Scientists say that good conductors have a high conductivity. Insulators have a low conductivity. Scientists and engineers use thermal conductivity when designing products. For example, the first iPhones had an aluminium case. This meant that energy could be transferred through the case of the phone and into the thermal energy store of the surroundings; this prevented the phone from overheating.

Buildings are usually built from materials that have a low thermal conductivity; this prevents some energy from transferring into the thermal energy store of the surroundings.

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

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**Lesson 7:**

**Objective:**

**Skills Drill / Retrieval**

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

**Catch-up**

A required practical was completed in the last lesson.

Catch-up work is not required.

**Connect**

Name an object with a lot of energy in the following stores:

1. Chemical energy store: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Kinetic energy store: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Elastic potential energy store: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Gravitational potential energy store: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Thermal energy store: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Magnetic energy store: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In the UK electricity is generated in power stations that often use fossil fuels. If you turn on a radio, energy from the chemical store of the fossil fuels is transferred into the kinetic energy store of the radio (the speaker moves). Some energy is wasted when it is transferred to the thermal energy store of the surroundings.

Q1. 100J of energy is transferred from the chemical store of the fossil fuel. 70J is transferred to the kinetic store of the radio. The rest is transferred into the thermal store of the surroundings. **Represent this in the energy accounts diagram below.**

Table

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Q2. Which energy store(s) contain useful energy?

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

Q3. Which energy store(s) contain wasted or dissipated energy?

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

Q4. Calculate the efficiency of the radio.

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

Most cars still use petrol and diesel that are obtained form crude oil. They contain energy in the chemical energy store. When a vehicle is driven, some energy is transferred into the kinetic energy store of the vehicle (it moves). Some is transferred into the thermal energy store of the car.

Q1. 200J of energy is transferred from the chemical store of the fuel. 30J is transferred to the kinetic store of the car. The rest is transferred into the thermal store of the car. **Represent this in the energy accounts diagram below.**

Table

Description automatically generated

Q2. Which energy store(s) contain useful energy?

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

Q3. Which energy store(s) contain wasted or dissipated energy?

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

Q4. Calculate the efficiency of the radio.

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

**Q1.**

**Figure 1** shows a hot water tank made of copper.

**Figure 1**

**Diagram

Description automatically generated**

(a)  Copper has a higher thermal conductivity than most metals.

How does the rate of energy transfer through copper compare with the rate of energy transfer through most metals?

Tick **one** box.

|  |  |
| --- | --- |
| Higher |  |
| Lower |  |
| The same |  |

**(1)**

(b)  The tank is insulated. When the water is hot, the immersion heater switches off.

Complete the sentences.

Compared to a tank with no insulation, the rate of energy transfer from the

water in an insulated tank is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

This means that the water in the insulated tank stays \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

for longer.

**(2)**

**Figure 2** shows how temperature varies with time for water in a tank heated with an immersion heater.

**Figure 3** shows how temperature varies with time for water in a tank heated with a solar panel.

**Figure 2**

**Chart

Description automatically generated**

**Figure 3**

**Chart

Description automatically generated**

(c)  Give **one** advantage and **one** disadvantage of heating the water using solar panels rather than an immersion heater.

Use only information from **Figure 2** and **Figure 3**.

Advantage of solar panels \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

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

Disadvantage of solar panels \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

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

**(2)**

(d)  During one morning, a total of 4 070 000 J of energy is transferred from the electric immersion heater.

4 030 000 J of energy are transferred to the water.

Calculate the proportion of the total energy transferred to the water.

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

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

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

Proportion of total energy = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(e)  Write down the equation that links energy transferred, power and time.

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

**(1)**

(f)  The power output of the immersion heater is 5000 W.

Calculate the time taken for the immersion heater to transfer 4 070 000 J of energy.

Give the unit.

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

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Time = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Unit \_\_\_\_\_\_\_\_\_\_\_\_

**(4)**

**(Total 12 marks)**

**Q2.**

A student investigated the thermal conductivity of different metals.

This is the method used:

1. Measure the mass of an ice cube.

2. Put the ice cube on a metal block which is at room temperature.

3. Measure the mass of the ice cube after one minute.

4. Repeat with other blocks of the same mass made from different metals.

A picture containing indoor

Description automatically generated

The following table shows the student’s results.

|  |  |  |  |
| --- | --- | --- | --- |
| **Metal** | **Initial mass of ice cube in grams** | **Final mass of ice cube in grams** | **Change in mass of ice cube in grams** |
| Aluminium | 25.85 | 21.14 | 4.71 |
| Copper | 26.20 | 20.27 | 5.93 |
| Lead | 25.53 | 21.97 | 3.56 |
| Steel | 24.95 | 19.45 | 5.50 |

(a)  The initial temperature of each ice cube was –15 °C

Why was it important that the initial temperature of each ice cube was the same?

Tick (**✓**) **one** box.

|  |  |
| --- | --- |
| Initial temperature was a continuous variable. |  |
| Initial temperature was a control variable. |  |
| Initial temperature was the dependent variable. |  |
| Initial temperature was the independent variable. |  |

**(1)**

(b)  Which metal had the highest thermal conductivity?

Give a reason for your answer.

Metal:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Reason:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

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

**(2)**

(c)  Suggest **one** source of random error in the student’s investigation.

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

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

**(1)**

(d)  An ice cube has a temperature of −15.0 °C

The total thermal energy needed to raise the temperature of this ice cube to 0.0 °C and completely melt the ice cube is 5848 J

specific heat capacity of ice = 2100 J/kg °C

specific latent heat of fusion of ice = 334 000 J/kg

Calculate the mass of the ice cube.

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

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

Mass of ice cube = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kg

**(5)**

**(Total 9 marks)**

Mark schemes

**Q1.**

(a)  higher

**1**

(b)  low(er)

**1**

hot(ter)

*allow warm(er)*

**1**

(c)  advantage:

•   water heated continuously (by the Sun)

**1**

**one** disadvantage from:

•   temperature of water is lower (for most of the time than water heated by immersion heater)

•   water may not be hot enough

*allow less control over water temperature*

•   it takes longer to heat the water

**1**

(d)  

**1**

0.99

*an answer of 99% scores* ***2*** *marks*

*an answer of 99 or 0.99% scores* ***1*** *mark*

**1**

*an answer of 0.99 scores* ***2*** *marks*

*allow an answer that rounds to 0.99 for* ***2*** *marks*

(e)  power = energy transferred / time

*allow P = E / t*

**1**

(f)  

**1**

****

**1**

*t* = 814

**1**

seconds

*other units of time must be consistent with numerical value*

**1**

*an answer of 814 seconds scores* ***4*** *marks*

*an answer of 13.57 minutes scores* ***4*** *marks*

**[12]**

**Q2.**

(a)  Initial temperature was a control variable

**1**

(b)  copper

**1**

greater change in mass (than the other metals)

*this mark is dependent on scoring the first mark*

*allow more ice melted (than the other metals)*

*allow the ice melted faster (than the other metals)*

**1**

(c)  variation in initial mass of ice cube

*allow variation in initial volume of ice cube*

**or**

surface area of the ice cube touching the metal

*allow melting of ice while handling*

*allow variation in room temperature*

*allow initial temperature of metal block*

**1**

(d)

*an answer of 0.016 (kg) scores* ***5*** *marks*

E = m × 2100 × 15

**1**

E = m × 334 000

**1**

5848 = 31 500 m + 334 000 m

**or**

5848 = 365 500 m

**1**

****

**or**

****

**1**

m = 0.016 (kg)

*allow* ***2*** *marks for an answer that rounds to 0.186 or 0.0175*

*if no other mark scored allow* ***1*** *mark for either*

*5848 = m × 2100 × 15*

***or***

*5848 = m × 334 000*

**1**

**[9]**

**Lesson 8: Teacher notes**

**AQA Content**

**Required practical activity 2 (physics only):** investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material.

AT skills covered by this practical activity: AT 1 and 5.

**Chunking**

This is a required practical. Other than introducing the practical, retrieval practice and Connect, students need time to perform the practical. This can be as:

1. A slow practical.
2. Students given autonomy to work at their own pace.

**Key direct and explicit teacher explanations:**

See guidance for required practicals.

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

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

**Lesson 8:**

**Objective:** Investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material.

**Skills Drill / Retrieval**

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

You want heat to remain inside the house.

So, the house needs to be made of insulators.

Insulators have a low thermal conductivity.

Low

Thermal conductivity is a measure of how well a material conducts energy when it is heated.

**Catch-up**

1. Define ‘thermal conductivity’.

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1. Would you want the walls of a house to have high or low thermal conductivity?

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1. Explain your answer to question b.

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**Connect**

1. Define ‘independent variable’.

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1. Define ‘dependent variable’.

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1. Define ‘control variable’.

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1. Which variable is usually found on the x-axis of a graph?

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1. Which variable is usually found on the y-axis of a graph?

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**Lesson 9: Teacher notes**

**AQA Content**

The main energy resources available for use on Earth include: fossil fuels (coal, oil and gas), nuclear fuel, bio-fuel, wind, hydroelectricity, geothermal, the tides, the Sun and water waves.

A renewable energy resource is one that is being (or can be) replenished as it is used.

The uses of energy resources include: transport, electricity generation and heating.

Students should be able to:

• describe the main energy sources available

• distinguish between energy resources that are renewable and energy resources that are non-renewable

• compare ways that different energy resources are used, the uses to include transport, electricity generation and heating

• understand why some energy resources are more reliable than others

• describe the environmental impact arising from the use of different energy resources

• explain patterns and trends in the use of energy resources.

Descriptions of how energy resources are used to generate electricity are **not** required.

Students should be able to:

• consider the environmental issues that may arise from the use of different energy resources

• show that science has the ability to identify environmental issues arising from the use of energy resources but not always the power to deal with the issues because of political, social, ethical or economic considerations.

**Chunking**

* Renewable and non-renewable energy sources.
* Reliability.
* Environmental impact – habitats.
* Environmental impact – global warming, acid rain.

**Key direct and explicit teacher explanations:**

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

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**Lesson 9:**

**Objective:**

**Skills Drill / Retrieval**

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

**Catch-up**

The last lesson was a required practical.

Catch up work is not required.

**Connect**

**Connect**

You studied energy sources as part of the **KS3 Energy topic**.

Use the information to answer the questions:

**Generating electricity**

Much of the energy that is transferred in our homes is supplied by electricity. There are a wide range of energy resources used to generate electricity.

Energy resources are systems that can store large amounts of energy. Energy resources can be divided into two categories:

1. Renewable resources - energy resources that can be replenished. They do not run out although we are using them.
2. Non-renewable resources - energy resources that cannot be replenished. These resources will eventually run out because we are using them.

Not all energy resources are available everywhere and each one has its own advantages and disadvantages.

**Questions**

Classify the following as renewable or non-renewable:

1. Solar energy: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Wind energy: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Coal: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Tidal: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Nuclear: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Natural gas: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Geothermal: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Chunking**

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

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An energy resource is any energy store which we can release to transfer into another energy store in order to do useful work for us. The most common types of useful work we require are for transport, electricity generation and heating. There are a number of energy resources we can use to achieve these tasks. Each of these have their own advantages and disadvantages. In order for us to have a comprehensive energy solution to provide reliable energy for our needs we need to compare the energy resources to ensure an energy solution which is applicable to us either nationally or globally. National issues could include the availability of resources and global issues could include the contribution to global warming.

**Non-renewable energy resources**

Most of our energy resources come from fossil fuels (coal, oil and gas). They are a concentrated energy resource formed from the remains of plants and tiny sea creatures that lived millions of years ago. Fossil fuels are reliable and relatively cheap to use and can be transported to where they are needed. Problems, supplies are limited, non-renewable resources cannot be replenished. They produce carbon dioxide which contributes to global warming.

Nuclear fuels are uranium and plutonium which are also non-renewable. They are reliable and can be transported to where they are needed. Problems include the waste being radioactive for thousands of years. Nuclear power stations are expensive to build and decommission (close down at the end of their working life)

**Renewable energy resources**

A renewable energy resource is one that is being (or can be) replenished as it is used. This is a major advantage over fossil fuels and nuclear fuels as they will not run out. Also they do not tend to produce atmospheric pollution in the form of carbon dioxide which adds to global warming.

Hydroelectric energy uses a dam to fill a lake and when water is released it turns turbines to generate electricity (generators). They are reliable and produce large quantities of electricity. Problems, they are expensive to build and few areas of the world have suitable rivers to dam. Flooding land behind the dam caused environmental damage.



**Task 3: Energy consumption**

Complete the questions below.

1. Which energy source is the still the biggest?

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1. Which are used more, renewable or non-renewable energy sources?

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1. What percentage, in total, comes from renewable energy sources?

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4. Suggest a reason why so little comes from renewable sources

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**Patterns and trends in use of energy resources**

During the Industrial Revolution, advances in automation and transport caused a significant increase in the amount of fossil fuels extracted and burnt.

In the 20th century, electricity became a convenient way of distributing energy. This powered a wide range of devices and applications such as lighting, heating, computing technologies and operating machinery.

Demand for energy varies with the time of year and the time of day. During early evening a lot of energy is needed for heating, lighting and cooking but overnight there is very little needed while people sleep. During winter there is more heating and lighting required than in summertime.



**Task 4: Energy changes.**

Complete the questions below.

1. Why is the planet continue to use more and more energy?

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1. What reasons are there for continuing to use coal, oil and gas?

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3. The average person in Britain uses 1930 kWh of electricity each year. Many people in the world’s poorest countries do not have access to electricity. Giving examples, explain why electricity is essential for both improving public health and for modern communications.

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Take some time to consider the information on the website <http://www.worldometers.info/> . The world population continues to increase as does the energy usage. We can see that only a small percentage of world energy is produced from renewable resources. One of the main reasons for this is due to the need for reliable energy. This is energy we can guarantee to be available as we need it, otherwise our industries and homes do not have power as we require. Fossil fuels along with nuclear fuel are the most reliable energy resources. However, looking at the environment section we can see the huge amount of carbon dioxide production associated with fossil fuels. In the long term fossils fuels also have a limited lifetime. In the case of oil approximately 46 years, which is within your lifetime.

We will still be dependent on fossil fuels to provide reliable energy into the future but the trend is showing the increase in the use of renewables. Renewables offer a solution to climate change in that they do not contribute to global warming. There are geo-political reasons (e.g recent U.S election where Mr Trump won the coal miners vote) as well as socioeconomic reasons why we will continue to use fossil fuels (e.g availability of cheap reliable energy to develop growing economies).

**Task 5:**

Complete the questions below.

Joule Island is a remote island, in the Pacific Ocean.  You are leading a team of scientists who will live on the environmentally sensitive island for 2 years. You must supply the energy needs of the group being careful to leave as small an impact on the island as possible when you leave. The island has sunny days but cold nights. The wind blows most days, but not in summer. The hot springs are close to the surface. There is a small coal mine.



 What energy resources will you use and where will you place them to ensure there is a reliable energy which has the least environmental impact.

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| --- | --- | --- | --- |
| Energy resource | Why is the location suitable? | Advantages | Disadvantages |
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**Task 6:**

Complete the questions below.

1. The pie charts show the relative proportions of electricity generated in Japan from different energy sources in 1975 and 2005.

 Describe and suggest a reason for **two** differences in the energy sources used in 2005 compared with 1975.

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2. Why is it important that countries agree to reduce/stop their use of fossil fuels? What will be the impact on the planet if we don’t make this agreement?

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