OCR
Oxford Cambridge and RSA

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Thursday 23 June 2022 – Morning

GCSE (9–1) Combined Science (Physics) A (Gateway Science)

J250/06 Paper 6 (Foundation Tier)

Time allowed: 1 hour 10 minutes

You must have:
- a ruler (cm/mm)
- the Data Sheet for GCSE (9–1) Combined Science (Physics) A (inside this document)

You can use:
- a scientific or graphical calculator
- an HB pencil

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **24** pages.

ADVICE
- Read each question carefully before you start your answer.

SECTION A

Answer **all** the questions.

You should spend a maximum of 20 minutes on this section.

Write your answer to each question in the box provided.

1 Which type of wave is light?

A Electromagnetic

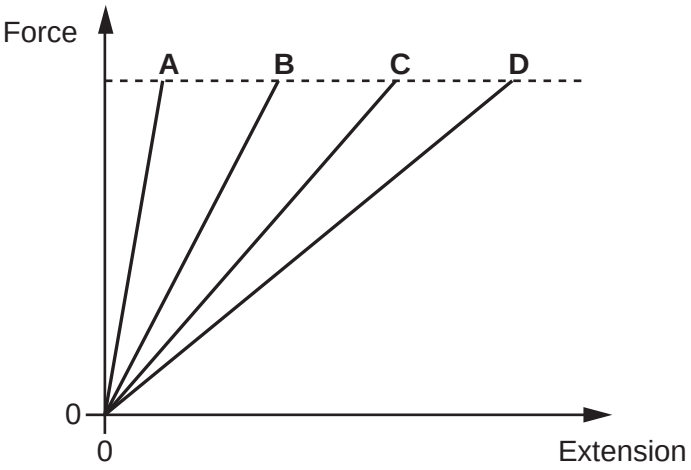
B Longitudinal

C Sound

D Water

Your answer ☐ **[1]**

2 The graph shows the extension of four different springs, **A**, **B**, **C** and **D**.



Which spring stores the most energy?

Your answer ☐ **[1]**

3 What is the function of the neutral wire?

A To bring current into an appliance

B To carry current if there is a fault

C To complete the circuit

D To melt if the current is too large

Your answer ☐ **[1]**

4 Some radioactive elements give out beta radiation.

What is beta radiation stopped by?

A Aluminium

B Thin cardboard

C Thin paper

D Skin

Your answer ☐ **[1]**

5 The wavelength of a water wave is 10 cm. The frequency of the wave is 5 Hz.

What is the **speed** of the water wave?

Use the equation: wave speed = frequency × wavelength

A 0.5 cm / s

B 2.0 cm / s

C 10 cm / s

D 50 cm / s

Your answer ☐ **[1]**

6 A teacher measures their reaction time in an experiment.

Their results are shown in the table.

	Try 1	**Try 2**	**Try 3**	**Try 4**	**Try 5**
Reaction time (s)	0.7	0.4	0.2	0.5	0.2

What is the **mode** of their reaction time?

A 0.2 s

B 0.3 s

C 0.4 s

D 0.5 s

Your answer ☐ **[1]**

7 In an experiment, 80 waves are produced in 20 s.

What is the frequency of the waves?

A 0.25 Hz

B 4 Hz

C 16 Hz

D 1600 Hz

Your answer ☐ **[1]**

8 A student stands near a wall and claps their hands.

The sound echo takes 0.2 s to return to the student. The speed of sound is 330 m / s.

What is the **distance** between the student and the wall?

Use the equation: distance travelled = speed × time

A 33 m

B 66 m

C 1650 m

D 3300 m

Your answer ☐ **[1]**

9 A remote control can be used to operate a television.

Remote control

Television

Which row in the table describes how energy is transferred?

	Remote control	Television
A	3 V a.c. from batteries	230 V d.c. from domestic mains supply
B	3 V d.c. from batteries	230 V a.c. from domestic mains supply
C	230 V a.c. from domestic mains supply	3 V d.c. from batteries
D	230 V d.c. from domestic mains supply	3 V a.c. from batteries

Your answer ☐ **[1]**

10 What is a typical acceleration of a car driving along a road?

A $3\,m/s^2$

B $10\,m/s^2$

C $60\,m/s^2$

D $80\,m/s^2$

Your answer ☐ **[1]**

SECTION B

Answer **all** the questions.

11 (a) Uranium-238 is a radioactive isotope.

When uranium decays, it gives out an alpha particle forming thorium-234.

Complete the radioactive decay equation using the symbols below:

$^{4}_{2}\alpha$ $^{234}_{90}Th$ $^{238}_{92}U$

You must write **one** symbol in **each** box.

[2]

(b) Atoms can give out different types of electromagnetic radiation.

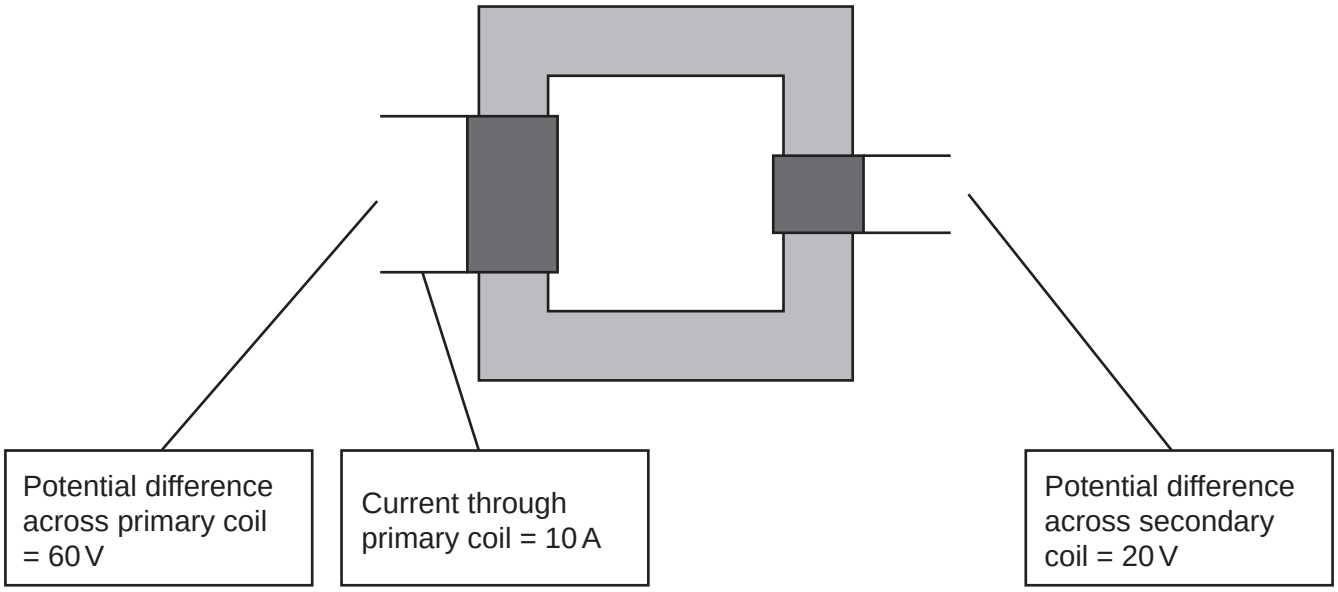
Draw lines to connect each **question** with its correct **answer**.

Question	Answer
Which radiation is given out by atoms?	Radiation with a large range of frequencies
	Radiation with a small range of frequencies
Which radiation is detected by our eyes?	Only gamma radiation
	Only infra-red radiation

[2]

12 **(a)** Transformers are used to transfer energy efficiently.

This is a diagram of a transformer:



Calculate the current through the secondary coil.

Use the information in the diagram **and** the Data Sheet.

Current = ... A **[3]**

(b) Energy use can be measured in kilojoules (kJ) or kilowatt hours (kWh).

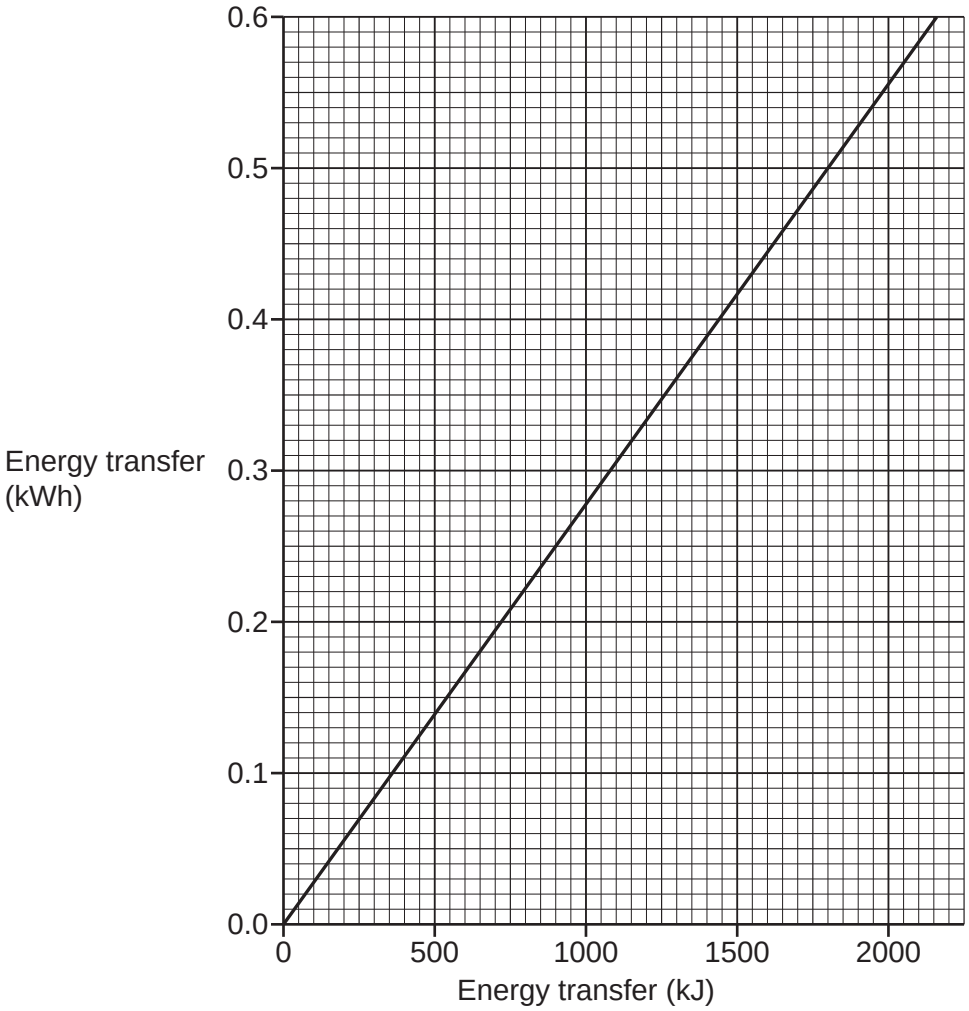
(i) An electric shower has a power of 8.5 kW.

1 kW = 1000 W.

What is the power of the shower in watts (W)?

Power = ... W **[1]**

(ii) The graph shows the relationship between energy transfer in kJ and energy transfer in kWh.



A kettle transfers 1800 kJ of energy.

Use the graph to find the energy transfer in kWh.

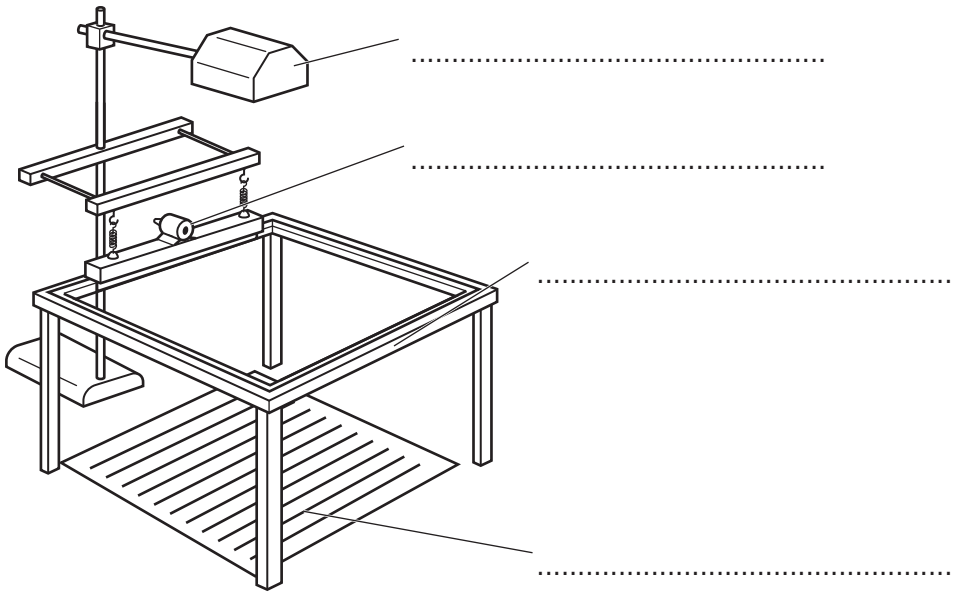
Energy transfer = ... kWh **[1]**

13 (a) A teacher uses the ripple tank in **Fig. 13.1** to show refraction of water waves.

Label **Fig. 13.1** using words from the list.

Lamp	**Pattern of waves**	**Tray of water**	**Vibration generator**

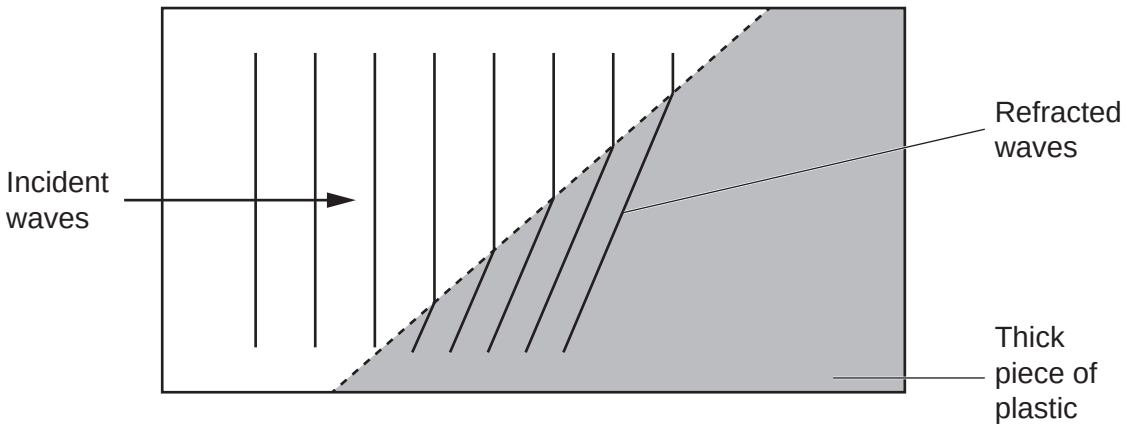
Fig. 13.1



[2]

(b) **Fig. 13.2** shows the pattern of the water waves when the teacher places a thick piece of plastic into the ripple tank.

Fig. 13.2



Explain why placing the plastic into the ripple tank causes refraction.

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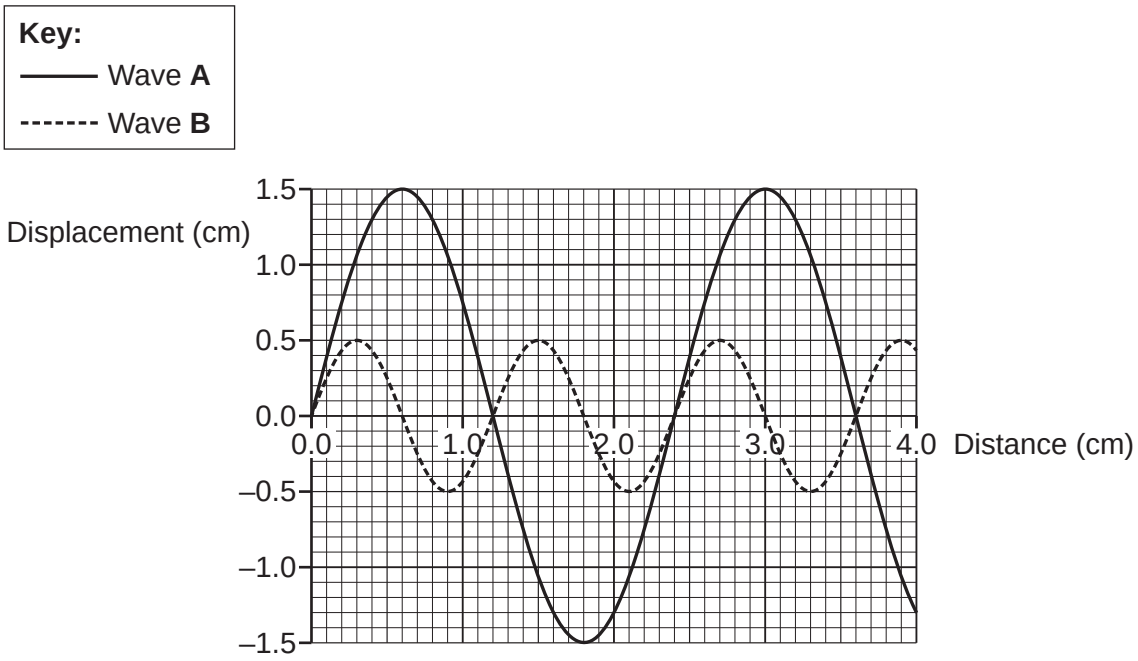
..... **[1]**

(c) **Fig. 13.3** shows two water waves.

Fig. 13.3



(i) The amplitude of wave **A** is bigger than the amplitude of wave **B**.

Calculate how many times bigger.

Answer = ... **[2]**

(ii) A student says, 'A wave with a high frequency has a long wavelength.'

Explain why the student is **incorrect**.

Use **Fig. 13.3** to explain your answer.

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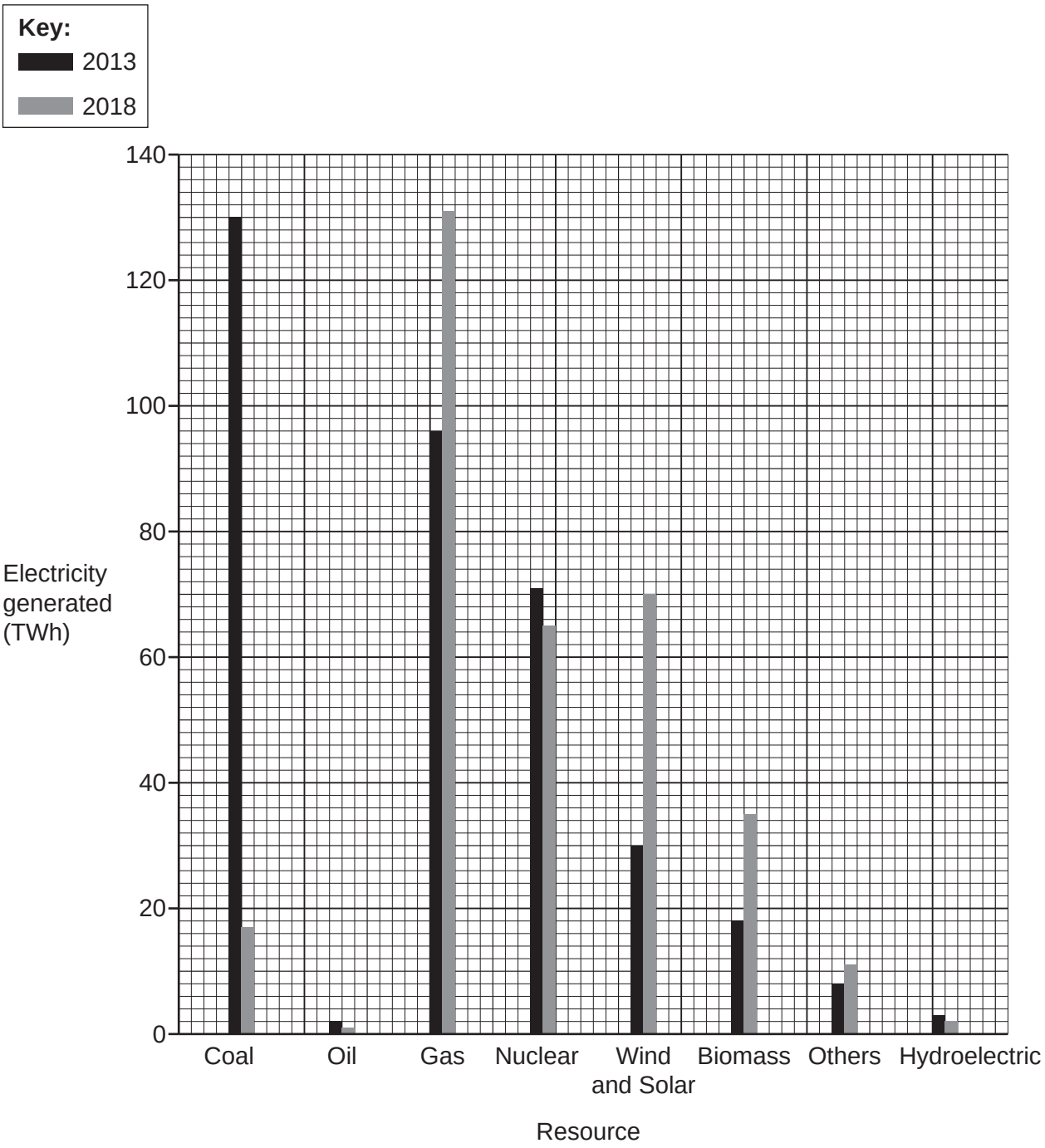
..... **[2]**

***14** Electricity in the UK is generated using renewable and non-renewable resources.

The graph shows how electricity was generated in 2013 and 2018.



13

Explain how and why electricity generation changed between 2013 and 2018.

Write about renewable and non-renewable resources.

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..... **[6]**

15 This question is about stopping a car.

(a) A driver presses the brakes to stop a car.

- The braking force is 6000 N.
- The work done stopping the car is 84 000 J.

Calculate the braking distance.

Use the equation: work done = force × distance

Braking distance = ... m **[3]**

(b) Braking efficiency can be measured using this equation:

$$\text{braking efficiency} = \frac{\text{braking force}}{\text{weight of car}}$$

- The weight of the car is 8000 N.
- The braking force is 6000 N.

Use the equation to calculate the braking efficiency of this car.

Braking efficiency = ... **[2]**

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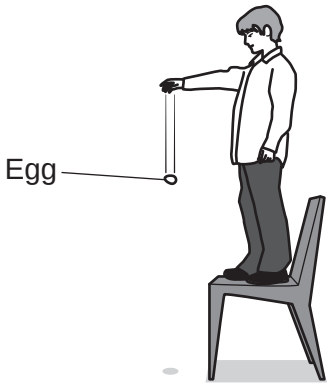
16 A student drops an egg onto a hard floor. The mass of the egg is 0.05 kg.



(a) The egg is dropped from a height of 1.5 m.

Calculate the potential energy of the egg before it is dropped. Use the Data Sheet.

Gravitational field strength = 10 N / kg.

Potential energy = ... J **[3]**

(b) Which energy store is at its maximum value just before the egg hits the ground?

..... **[1]**

(c) The egg stops moving when it hits the floor.

Describe the energy transfer when the egg hits the floor.

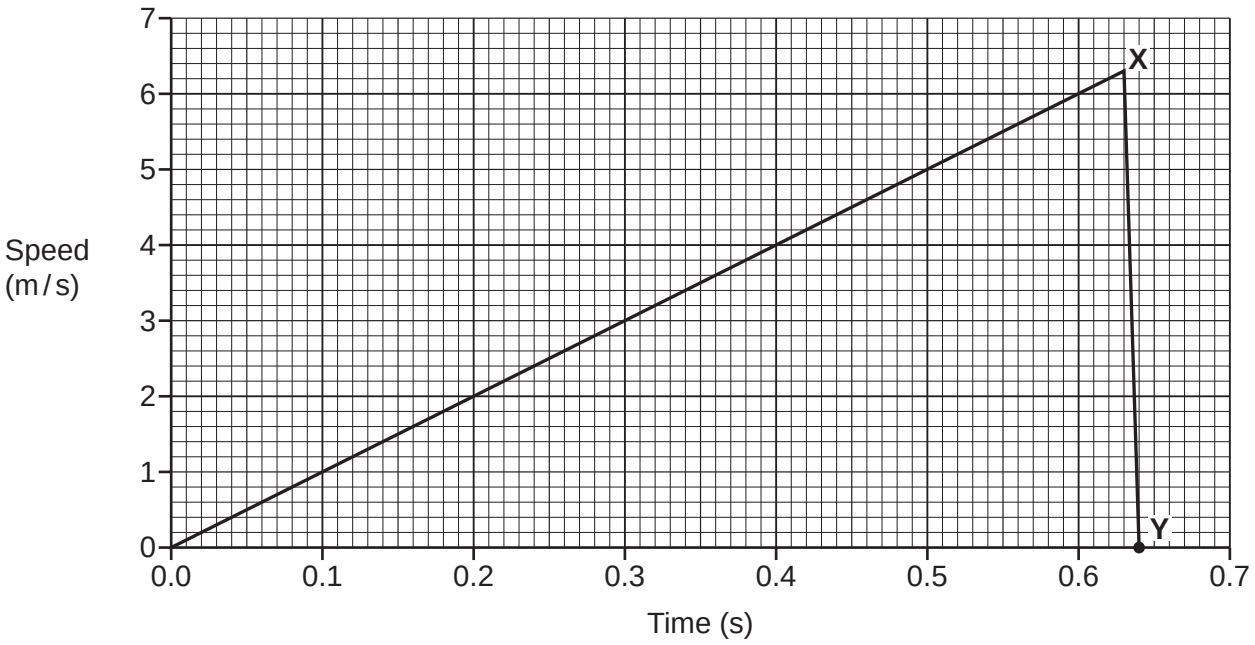
Name of the energy store that increases .....

Where the energy is transferred to .....

.....

[2]

(d) The graph shows the speed of the same egg as it falls.



(i) At which time does the egg have **maximum** kinetic energy?

Time = ... s **[1]**

(ii) Suggest what happens to the egg between points **X** and **Y**.
Explain your answer by writing about force and acceleration.

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..... **[2]**

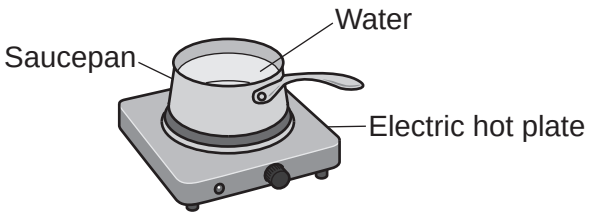
(iii) Calculate the kinetic energy of the egg when it moves at 4 m/s.

Use the equation: kinetic energy = 0.5 × mass × $(\text{speed})^2$

Kinetic energy = ... J **[2]**

17 **(a)** Student **A** uses the electric hot plate in **Fig. 17.1** to increase the temperature of water in a saucepan.

Fig. 17.1



(i) Student **A** wants to calculate the thermal energy transferred to the saucepan of water.

These are the steps in their method:

1 Measure the volume of water with a balance.
2 Measure the starting temperature of the water with a thermometer.
3 Use the equation:

change in thermal energy = mass × specific heat capacity × change in temperature

Student **A**'s method is **incorrect**.

Identify the **two** mistakes the student has made and write down the correction for each mistake.

Mistake **1** .....

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Correction **1** .....

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Mistake **2** .....

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Correction **2** .....

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[3]

(ii) Student **A** suggests wrapping insulation around the saucepan in **Fig. 17.1**.

Suggest **another** way student **A** can improve their experiment.

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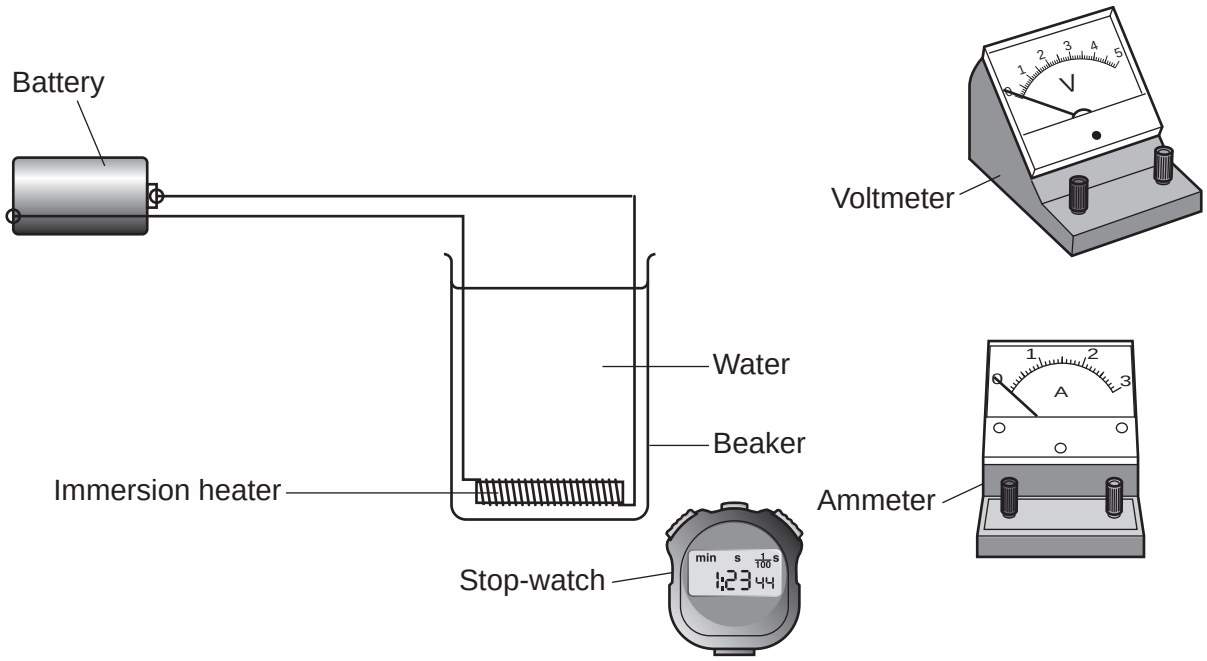
..... **[1]**

(b) Student **B** uses the immersion heater in **Fig. 17.2** to increase the temperature of water in a beaker.

Fig. 17.2



Describe an experiment to measure the **energy** transferred to the immersion heater, using the equipment in **Fig. 17.2**.

In your answer include:

- a method
- a circuit diagram
- an equation from the Data Sheet
- the symbol for a resistor to represent the immersion heater in your circuit.

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..... **[4]**

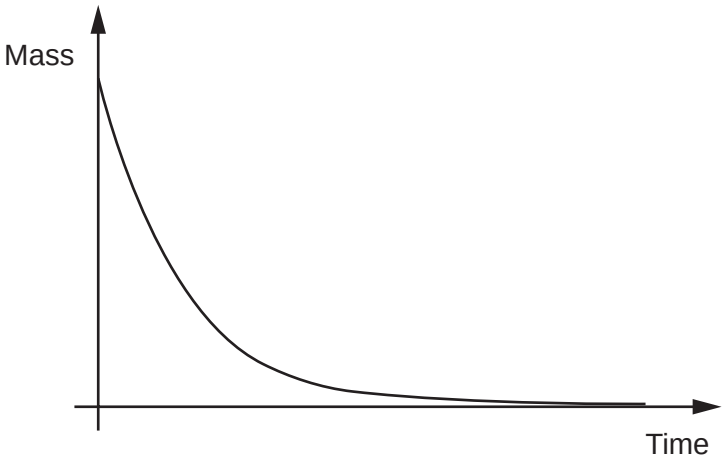
18 This question is about radioactivity.

(a) Which statements about the nucleus of an atom are correct?
Tick (✓) **two** boxes.

In radioactive atoms, the nucleus is stable.	☐
Most of the nucleus contains empty space.	☐
Scientists can say exactly when a nucleus will emit radiation.	☐
The diameter of a nucleus is approximately 1 nm.	☐
The mass of a nucleus is much less than the mass of an atom.	☐
The nucleus contains protons and electrons.	☐
The nucleus contains protons and neutrons.	☐
The nucleus has a positive charge.	☐

[2]

(b) The graph shows how the mass of a radioactive element changes with time.



Describe the trend shown by the graph.

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..... **[2]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).