Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4463/01

SCIENCE A/PHYSICS

PHYSICS 1
FOUNDATION TIER

A.M. TUESDAY, 18 June 2013

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**6**	
3.	**6**	
4.	**9**	
5.	**8**	
6.	**12**	
7.	**12**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2. In calculations you should show all your working.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **7***(b)*.

Equations

$\text{density} = \dfrac{\text{mass}}{\text{volume}}$	$\rho = \dfrac{m}{V}$
energy transfer = power × time	$E = Pt$
units used (kWh) = power (kW) × time (h) cost = units used × cost per unit	
$\%\ \text{efficiency} = \dfrac{\text{useful energy [or power] transfer}}{\text{total energy [or power] input}} \times 100$	
wave speed = wavelength × frequency	$c = \lambda f$
$\text{speed} = \dfrac{\text{distance}}{\text{time}}$	

SI multipliers

Prefix	Multiplier	
m	10^{-3}	$\dfrac{1}{1\,000}$
k	10^{3}	1 000
M	10^{6}	1 000 000

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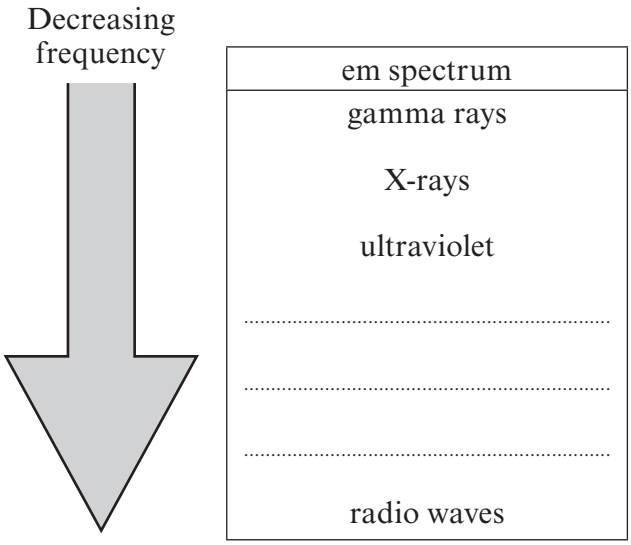
Turn over.

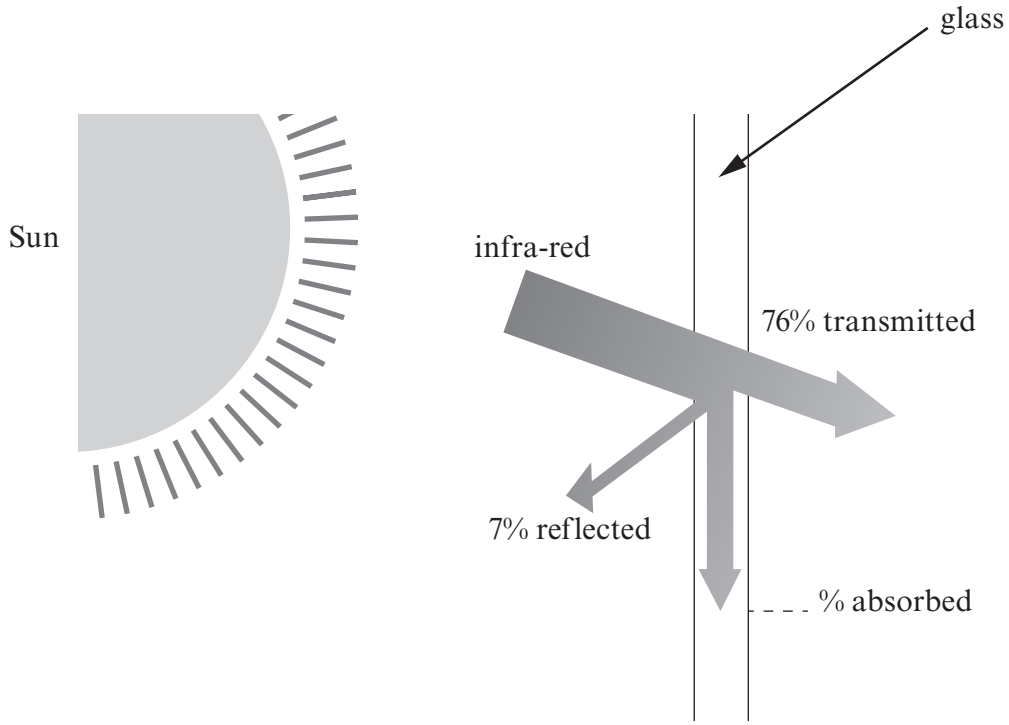
Examiner only

Answer **all** *questions.*

1. *(a)* **Microwaves, visible light** and **infra-red** are types of electromagnetic waves used in communication.
Complete the list below to show their position in the electromagnetic (em) spectrum. [2]



(b) Microwaves and visible light easily pass through glass. **Infra-red** radiation is reflected, absorbed and transmitted by glass as shown in the diagram below.



(i) What percentage of infra-red is absorbed by the glass in the diagram? [1]

..... %

(ii) What effect does the absorbed infra-red have on the temperature of the glass? [1]

.....

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(c) Tick (✓) the boxes next to the **three** correct statements about infra-red. [3]

Black surfaces are poor emitters of infra-red	
Black surfaces are poor reflectors of infra-red	
Shiny silver surfaces are good reflectors of infra-red	
Shiny silver surfaces are poor emitters of infra-red	
Shiny silver surfaces are good absorbers of infra-red	

7

2. The table shows the powers of three different kettles.

Kettle	Power (W)	Power (kW)
X	1 000	1.0
Y	2 200	.....
Z	1 600	1.6

(a) **Complete** the table. [1]

(b) In one week, each kettle is used for a total of 30 minutes.

(i) Which kettle, **X**, **Y** or **Z** is cheapest to use? ..... [1]

(ii) The energies transferred by the kettles during this time are:

1 800 000 J 2 880 000 J 3 960 000 J

Underline the correct energy transfer for kettle **Y**. [1]

(iii) Use an equation from page 2 to calculate the units used (kWh) by kettle **Z** in one week. [2]

units used = ... kWh

(iv) Use an equation from page 2 to calculate the cost of using kettle **Z** for one week if one unit of electricity costs 15 p. [1]

cost = ... p

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Turn over.

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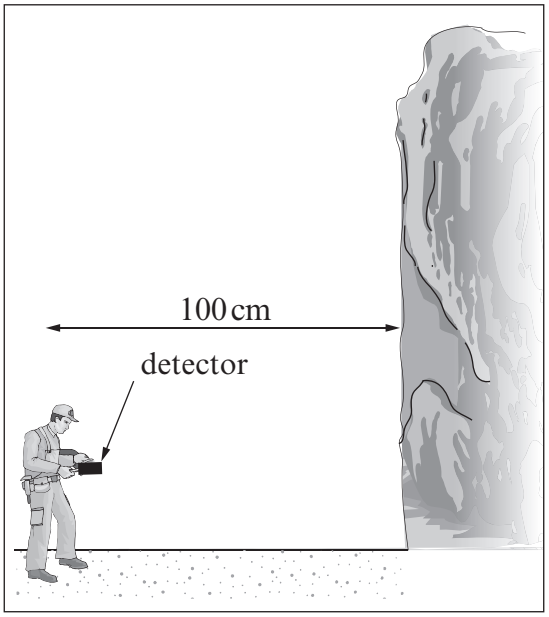
3. The count rate from a radioactive quarry wall is measured at different distances.



The results are shown in the table below. (Background radiation has been taken away from the results.)

Distance between quarry wall and detector (cm)	Counts in one minute
5	105
20	100
40	96
60	93
80	89
100	0

(i) The quarry wall only emits one type of radiation. State whether it is alpha, beta or gamma. [1]

.....

(ii) Give **two** reasons for your answer. [2]

1. .....

2. .....

(iii) Suggest **two** ways in which the strength of evidence from the experiment could be improved. [2]

1. .....

2. .....

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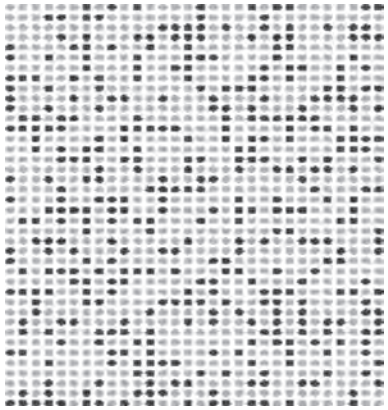
(iv) The grey spots in the diagram below show undecayed nuclei in the radioactive quarry wall. The black spots are nuclei that have decayed.



Give a reason why it is **not** possible to predict which nucleus will decay next. [1]

.....

6

Turn over.

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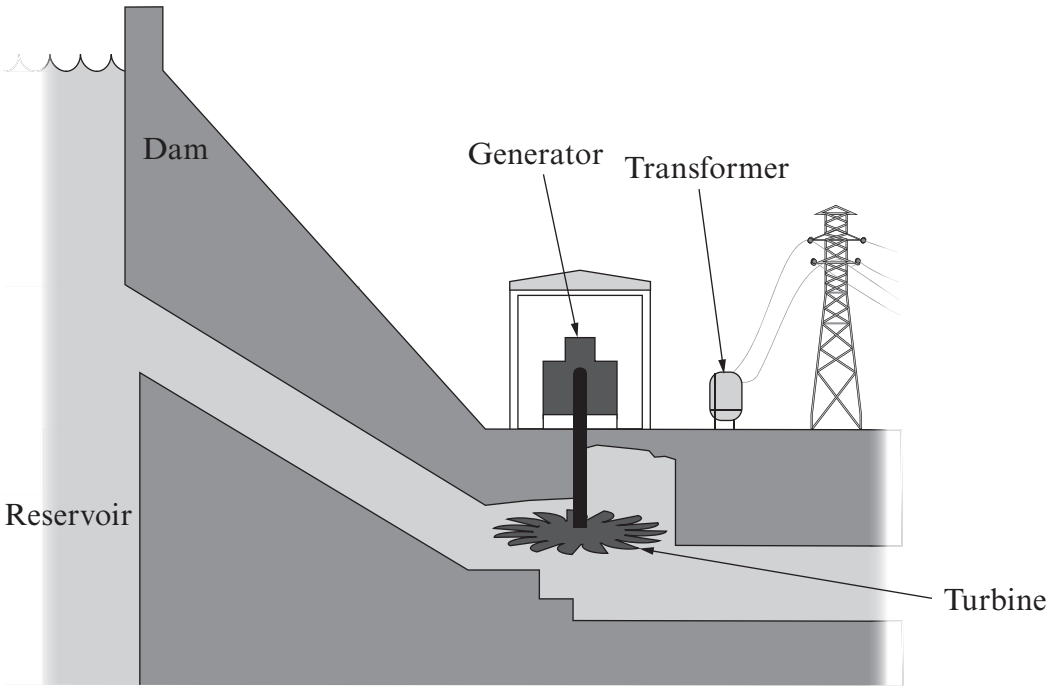
4. The diagram shows a hydroelectric power station.



(a) The volume of water that flows past the turbine every second is 25 m^3.

(i) The density of water is 1 000 kg/m^3.

Use the equation:

mass = density × volume

to calculate the mass of water flowing past the turbine every second. [1]

mass = ... kg

Examiner only

(ii) Every 1 kg of water loses 120 J of energy as it flows down the pipe to the turbine. Calculate the **total energy lost** every second by this falling water. [2]

energy = ... J

(b) The generator provides 2 MW of power to the transformer. The output power of the transformer is 1.8 MW.
Use an equation from page 2 to calculate the % efficiency of the transformer. [2]

% efficiency = ...

(c) Explain how hydroelectric power stations help to keep a reliable supply of electricity to the National Grid. [2]

.....

.....

(d) (i) Give a reason why electrical power is transmitted (sent) at high voltages across the National Grid. [1]

.....

(ii) Give a reason why electrical power is supplied at low voltages to consumers. [1]

.....

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Turn over.

Examiner only

5. *(a)* The distances to stars and solar system planets are very large. Astronomers make their lives easier by using a number of different units.

1 light year = distance travelled by light in one year
1 AU = distance between the Earth and Sun
(1 AU = 8.3 light minutes)

(i) The centre of our galaxy is 30 thousand light years away. How long does light take to travel to us from the centre of the galaxy? [1]

..... years

(ii) How long does light take to travel from the Sun to Earth? [1]

..... minutes

(iii) Light takes 13 hours to travel from Pluto to Earth. What is the **distance** between these planets? [1]

..... hours

(iv) Mercury is 0.4 AU from the Sun. Venus is further than Mercury from the Sun but not as far as Earth. Estimate the distance between the Sun and Venus. [1]

..... AU

(b) The spectrum of light from the Sun is crossed with dark lines.

Complete the sentences below by **<u>underlining</u>** the correct word(s) in brackets. [2]

(i) The dark lines are caused by atoms of gas (**reflecting / absorbing / transmitting**) light.

(ii) The dark lines in the spectrum from a distant galaxy moving away from us would be (**blue shifted / red shifted / green shifted**).

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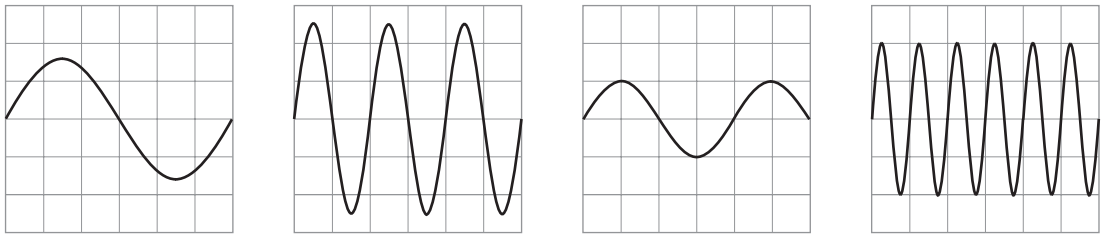
(c) Four wave patterns of light from a star are shown below. Each pattern is produced in the same time interval.



A **B** **C** **D**

(i) Which wave pattern has the lowest frequency? ..... [1]

(ii) Which wave pattern has the largest amplitude? ..... [1]

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Turn over.

Examiner only

6. Electricity is generated using many different sources.

(a) The table below shows the pollutant gases produced by burning fossil fuels to generate electricity.

Fossil fuel	Pollutant (unit)			
	Carbon monoxide	Carbon dioxide	Sulfur dioxide	Nitrous oxide
Coal	90	94 600	765	292
Oil	16	77 400	1 350	195
Gas	15	56 100	1	93

Use information in the table above to answer the following questions.

(i) Explain which fossil fuel will have the least impact on global warming. [2]

.....

.....

(ii) Explain which fossil fuel will cause the least acid rain. [2]

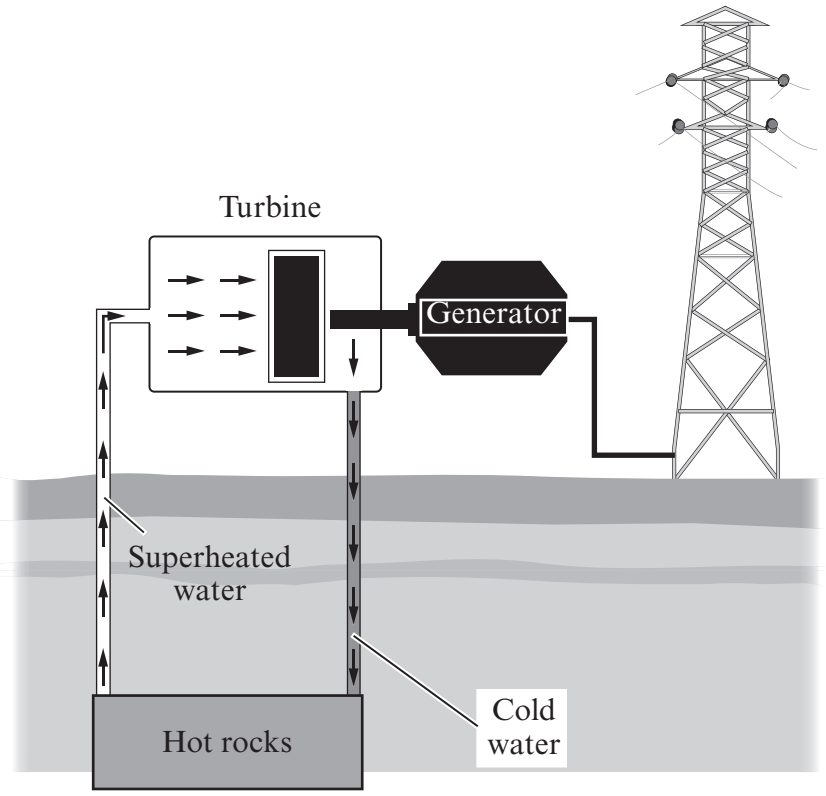
.....

.....

Examiner only

(b) Plans have been revealed for what will be the first geothermal power station to be built in the UK. A 3 MW geothermal power station will be built at the Eden Project in Cornwall.

Cold water will be pumped down to hot rocks where its temperature will reach 150 °C. The superheated water will then be pumped back up, turn to steam, and turn turbines at ground level where electricity will be generated.



(i) This power station is similar to fossil fuel power stations because both types have turbines and generators. State **one** *other* way they are similar. [1]

.....

(ii) Give **one** advantage of geothermal power compared with solar power. [1]

.....

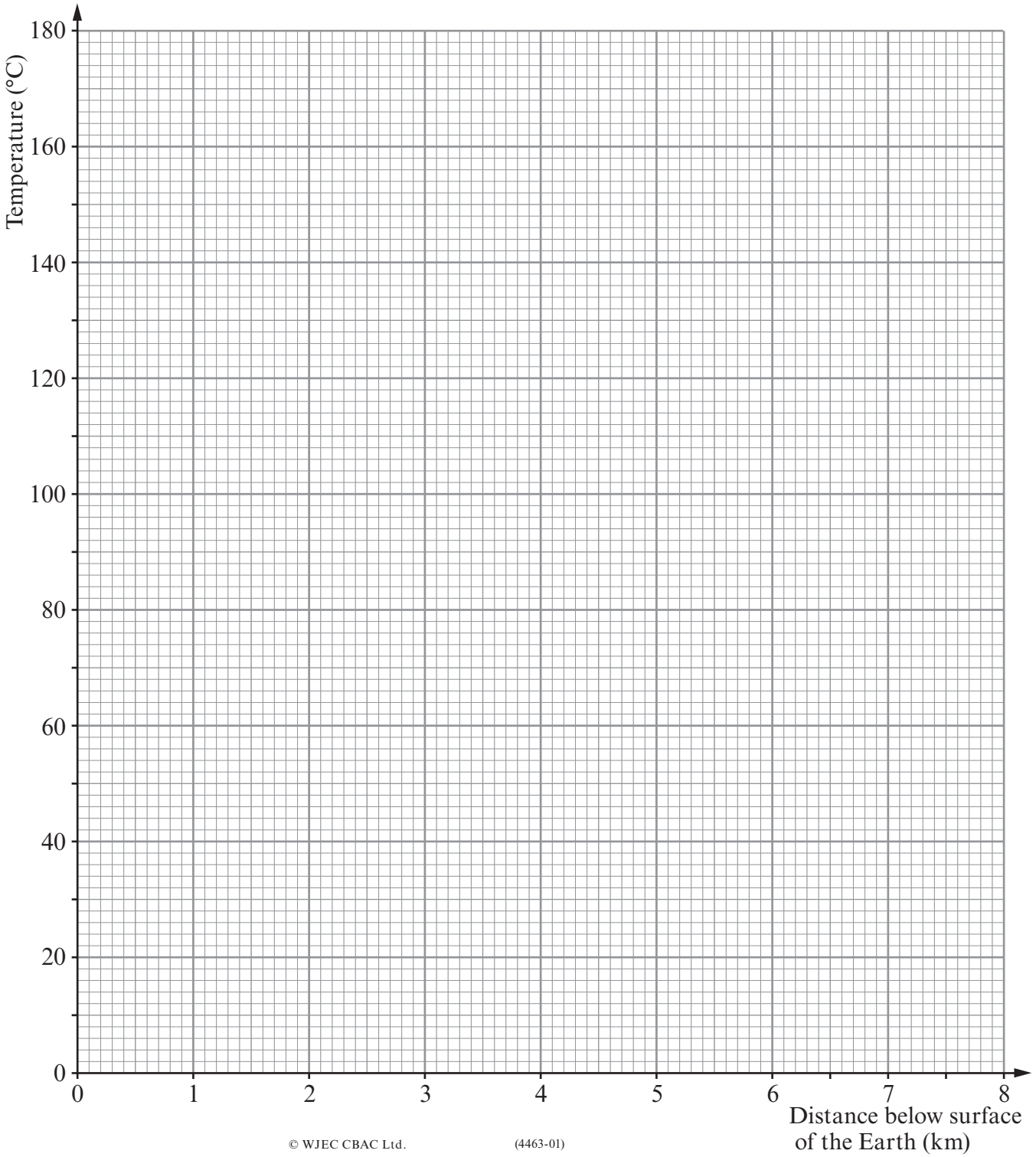
Turn over.

(c) The table below shows the temperature at different distances below the surface of the Earth.

Examiner only

Distance below surface of the Earth (km)	Temperature (°C)
1	40
2	60
4	100
6	140
8	180

(i) **Plot the data** on the grid below and draw a suitable line. [3]



Examiner only

(ii) Use the graph to find the distance water will have to be pumped down to reach 150 °C. [1]

distance = ... km

(d) This power station will provide 2.4 MW (2 400 000 W) for supplying homes. Calculate how many homes this power station could supply. Assume each home uses 2 000 W of power. [2]

number of homes = ...

12

Turn over.

Examiner only

7. A semi-detached house is poorly insulated.
The owner has £3 200 available to spend on improving the insulation.
Information on each type of insulation is shown in the table below.

Part of house	Insulated or not	Heat energy lost per second (W)	Cost of insulation (£)	Payback time (years)	Expected annual saving (£)
LOFT	No insulation	4 200			
	Fibre glass laid on floor of loft	1 500	800	.....	200
CAVITY WALL	No insulation	3 000			
	Insulated with foam	1 300	1 200	10	120
DOORS	Wood	1 200			
	PVCu	1 000	1 200	60	.....
WINDOWS	Single glazed	1 500			
	Double glazed	1 200	2 400	96	25

(a) Complete the spaces in the last **two** columns of the table. [2]

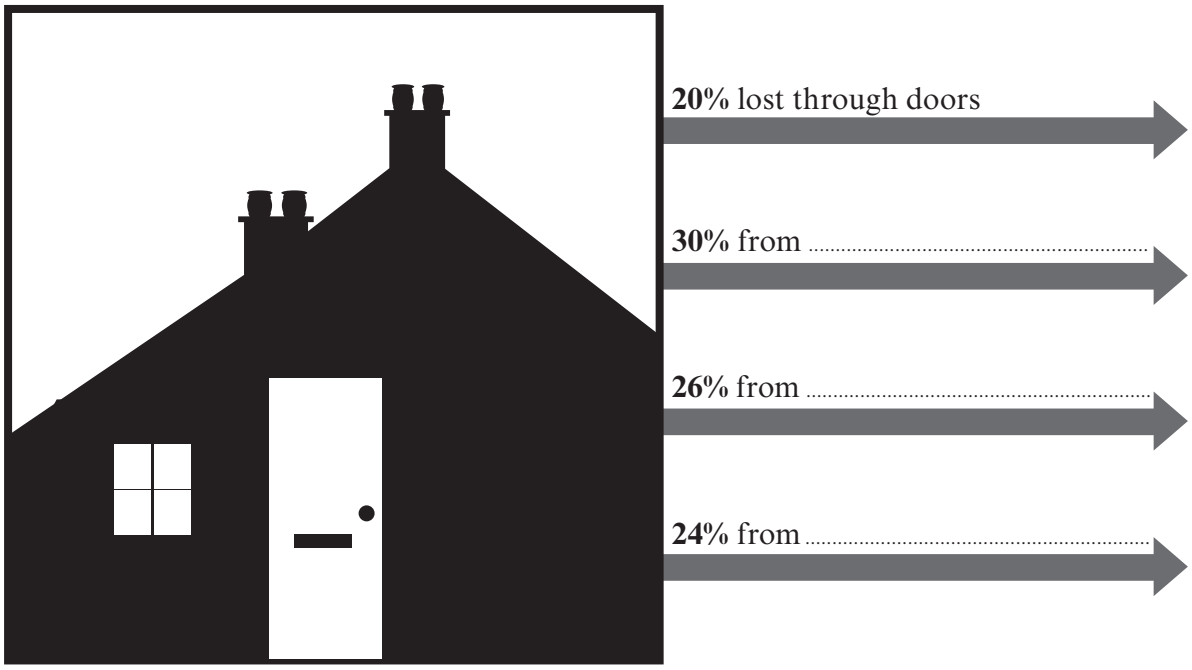
Examiner only

(b) Use information from the table opposite to advise the owner on how best to spend all the £3 200 on insulation. **[6 QWC]**

Turn over.

Examiner only

(c) The diagram shows the percentages of energy lost from the house if it is **fully insulated**. Label the arrows to show which part of the house each percentage comes from. *One has been done for you.* You should refer to the table on page 16. [2]



(d) Explain how convection currents are set up in a cavity wall with no insulation. [2]

.....

.....

.....

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END OF PAPER

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