AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

GCSE

SCIENCE A
PHYSICS

H

Higher Tier Unit Physics P1

Wednesday 24 May 2017 Afternoon Time allowed: 1 hour

Materials

For this paper you must have:
- a ruler
- a calculator
- the Physics Equations Sheet (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 2 should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

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ANSWER IN THE SPACES PROVIDED

Answer **all** questions in the spaces provided.

1 A laser emits light waves in the visible region of the electromagnetic spectrum.

1 (a) What type of wave are all electromagnetic waves?

[1 mark]

_____

1 (b) The light from a laser has a wavelength of 6.5×10^{-7} m

The speed of light is 3.0×10^{8} m/s

Calculate the frequency of the light from the laser.

Give your answer to 2 significant figures.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

_____

_____

_____

Frequency = _____ Hz

1 (c) What is the approximate range of wavelengths of the electromagnetic spectrum?

Tick (✓) **one** box.

[1 mark]

Range of wavelengths in metres	**Tick (✓)**
10^{-10} to 10^{8}	
10^{-8} to 10^{6}	
10^{-15} to 10^{4}	

5

2 **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

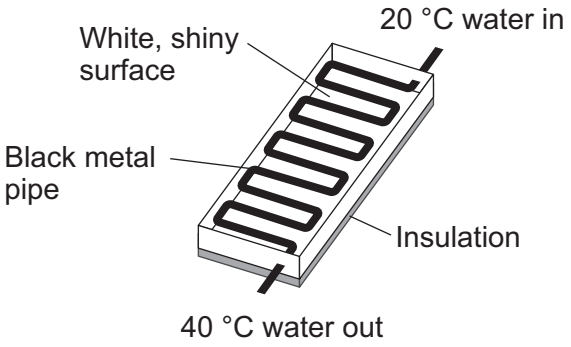
Solar panels use energy from the Sun to heat water.

Two different designs of solar panel are shown in **Figure 1**.

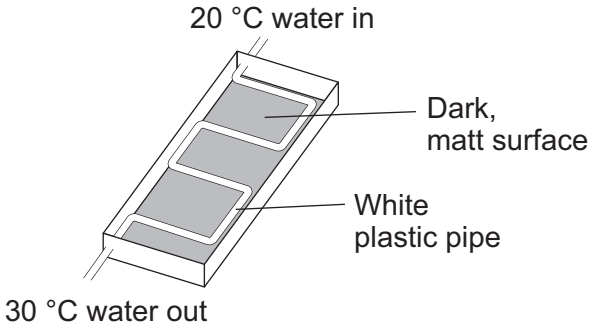
Both designs have the same water flow rate.

Figure 1

Design A



Design B



Explain why **Design A** is better than **Design B** at heating water.

[6 marks]

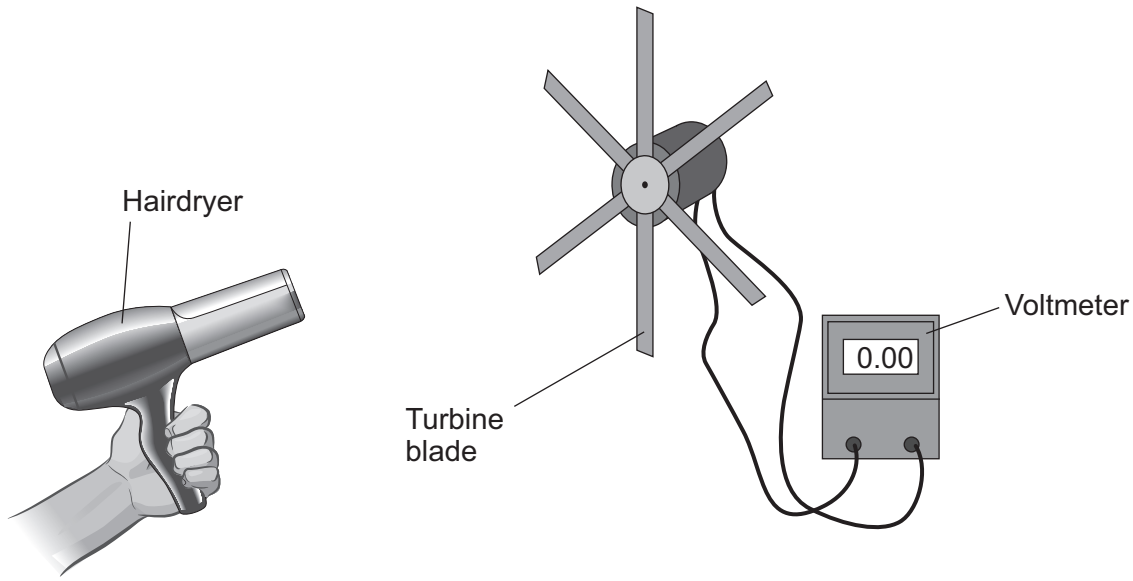
Extra space _____

6

Turn over for the next question

3 A student investigated how the output voltage of a model wind turbine was affected by the number of turbine blades. The equipment he used is shown in **Figure 2**.

Figure 2



3 (a) Suggest **two** factors, other than the number of turbine blades, that will affect the output voltage of the model wind turbine.

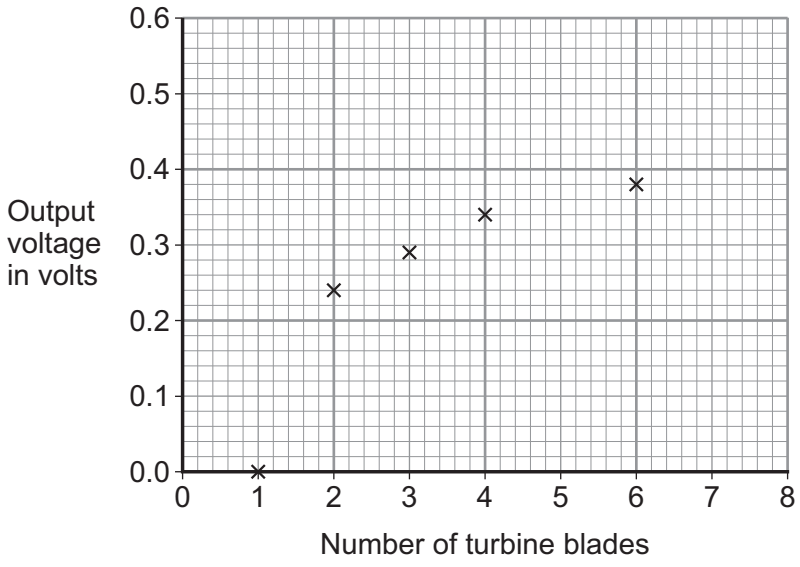
[2 marks]

1 _____

2 _____

3 (b) Some of the student's results are shown in **Figure 3**.

Figure 3



3 (b) (i) Plot the remaining results in **Figure 3** using the data in **Table 1**.

[2 marks]

Table 1

Number of turbine blades	Output Voltage in volts
5	0.39
7	0.50
8	0.56

3 (b) (ii) The output voltage for 6 turbine blades is lower than expected. The low value was caused by a measurement error.

State the name of this type of measurement error.

[1 mark]

_____

3 (b) (iii) What **two** conclusions can be made from the student's results as the number of blades is increased from 1 to 4?

[2 marks]

1 _____

_____

2 _____

_____

3 (c) Commercial wind turbines can be manufactured with a number of blades between 2 and 8.

Suggest **two** factors that manufacturers would need to consider when designing and constructing commercial wind turbines.

[2 marks]

1 _____

_____

2 _____

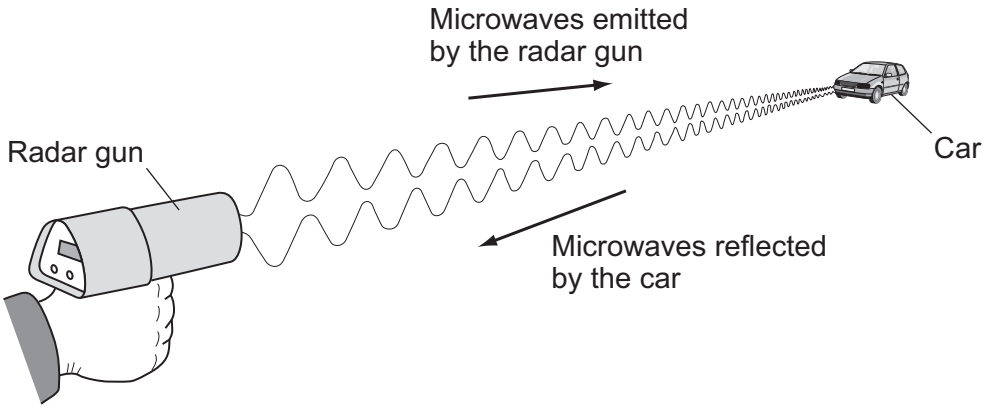
_____

9

4 A radar gun can be used to measure the speed of a car.

Microwaves are emitted by the radar gun and reflected by the car, as shown in **Figure 4**.

Figure 4



4 (a) The microwaves reflected by the moving car have a different frequency from the microwaves emitted by the radar gun.

What is the name of the effect causing this change in frequency?

[1 mark]

_____

4 (b) The data in **Table 2** are measurements taken from three different cars on the same piece of road.

Table 2

Car	Frequency of emitted microwaves in kHz	Frequency of reflected microwaves in kHz
A	27 000 000	27 000 002
B	27 000 000	27 000 000
C	27 000 000	26 999 997

4 (b) (i) State which car in **Table 2** is moving towards the radar gun. Give a reason for your answer.

[2 marks]

Car _____

Reason _____

_____

4 (b) (ii) State which car in **Table 2** is moving the fastest. Give a reason for your answer.

[2 marks]

Car _____

Reason _____

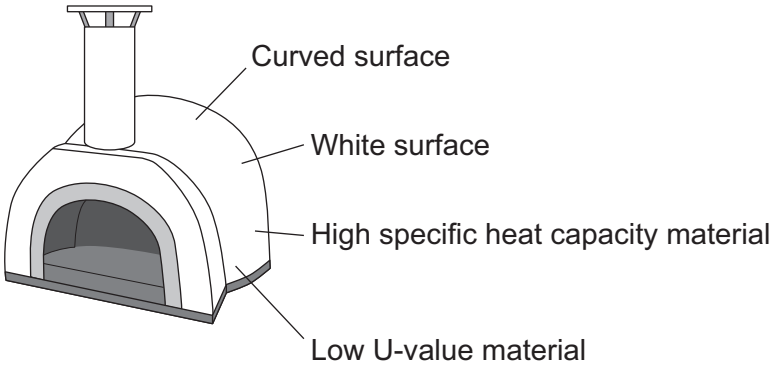
_____

5

Turn over for the next question

5 **Figure 5** shows an outdoor pizza oven.

Figure 5



5 (a) A solid biofuel is used to heat the oven.

Name **one** solid biofuel.

[1 mark]

_____

5 (b) The pizza oven is made of concrete. The mass of the concrete is 250 kg

Calculate the temperature increase when 8.36×10^7 J of energy are transferred to the concrete.

Concrete has a specific heat capacity of 880 J/kg °C

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Temperature increase = _____ °C

5 (c) The pizza oven is designed to stay hot for at least two hours.

Describe how each of the four labelled design features helps to ensure that the pizza oven stays hot for at least two hours.

[4 marks]

White surface _____

_____

Curved surface _____

_____

High specific heat capacity material _____

_____

Low U-value material _____

_____

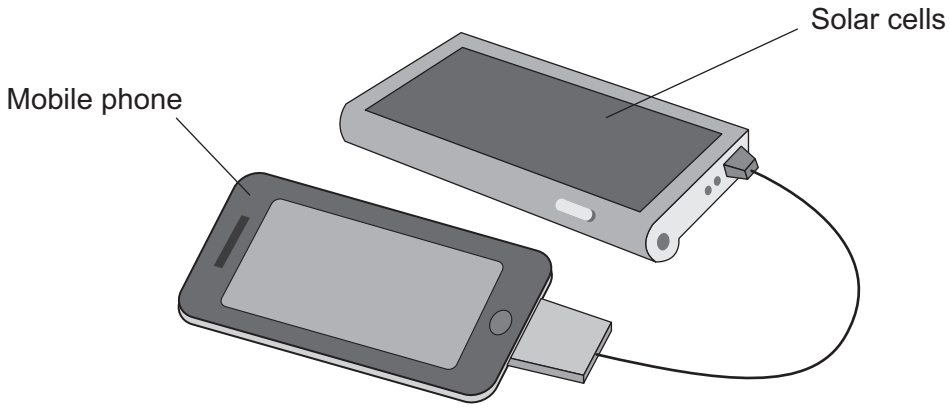
7

Turn over for the next question

6 **Figure 6** shows a mobile phone battery being charged using solar cells.

The useful power output of the solar cells is 2.5 W

Figure 6



6 (a) The efficiency of the solar cells is 40%.

Calculate the total power input to the solar cells.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Total power input = _____ W

6 (b) The mobile phone battery can store 36 kJ of energy and was initially uncharged.

Calculate the minimum time, in hours, it would take to fully charge the mobile phone battery using these solar cells.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

Time = _____ hours

6 (c) Explain why the power **output** of the solar cells may be lower than 2.5 W

[2 marks]

6 (d) Explain why the time taken to recharge this mobile phone battery using these solar cells depends on whether the phone is switched on or off.

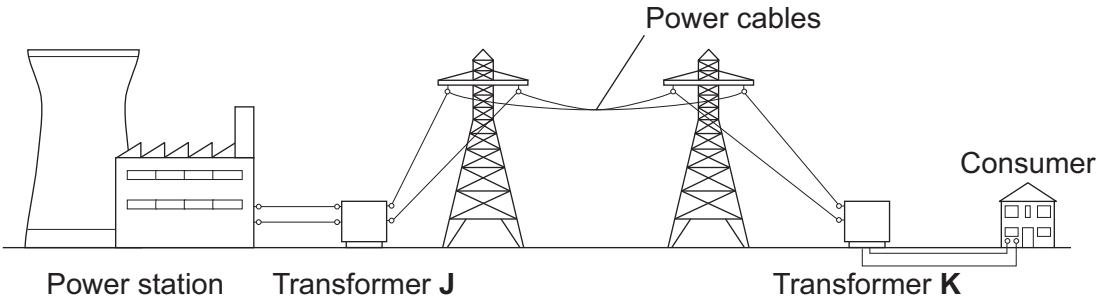
[2 marks]

9

Turn over for the next question

7 **Figure 7** shows how the National Grid connects power stations to consumers.

Figure 7



7 (a) Explain the role of the two transformers, **J** and **K**, in the power transmission process and the reasons for their use.

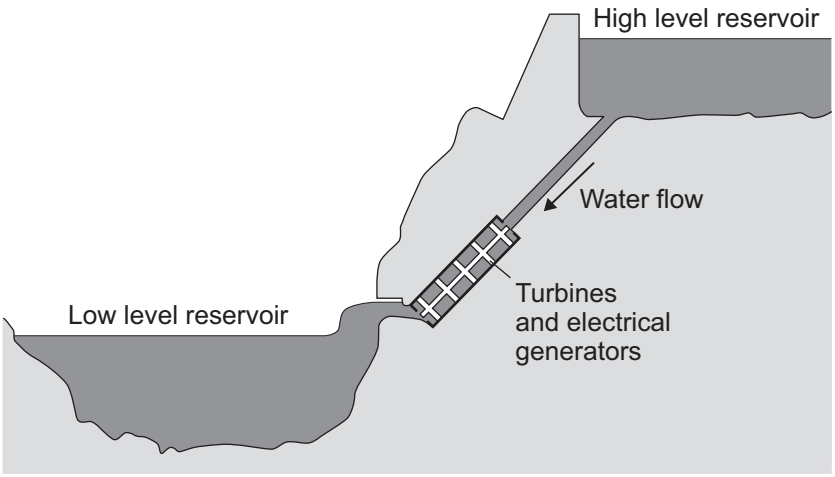
[4 marks]

7 (b) In a pumped storage power station, water flows from a high level reservoir to a low level reservoir turning turbines and generating electricity.

Pumped storage power stations do not supply electricity to the National Grid at all times of the day.

Figure 8 shows a pumped storage power station.

Figure 8



7 (b) (i) Explain how pumped storage power stations store energy for later use.

[4 marks]

7 (b) (ii) Explain why pumped storage power stations are able to meet sudden large demands for electricity.

[2 marks]

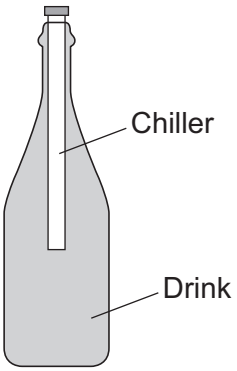
10

Turn over for the next question

8 **Figure 9** shows a drink chiller in use.

The cold drink chiller is inserted into a warm bottle of drink, so the temperature of the drink decreases.

Figure 9



8 (a) Explain how a convection current is formed in the drink in the bottle.

[4 marks]

8 (b) As the chiller warms, the drink cools.

State how the rate of energy transfer from the drink to the chiller changes as the chiller warms.

Give a reason for your answer.

[2 marks]

8 (c) As the drink bottle cools down, water vapour in the air condenses on the outside of the bottle.

Explain why.

[3 marks]

9

END OF QUESTIONS

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