

Please write clearly in block capitals.

Centre number

Candidate number

Surname \_\_\_\_\_

Forename(s) \_\_\_\_\_

Candidate signature \_\_\_\_\_

# GCSE SCIENCE A PHYSICS

# F

Foundation 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 9 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.

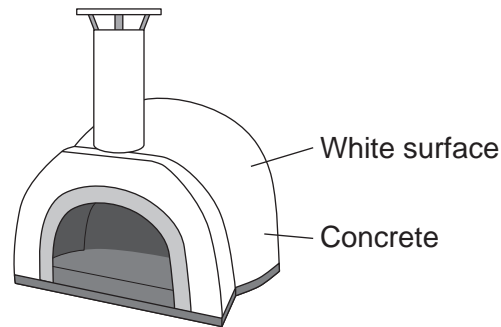
For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
<b>TOTAL</b>	



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

1 **Figure 1** shows an outdoor pizza oven.

**Figure 1**



1 (a) The pizza oven is designed to stay hot for a long time.

Use the correct answer from the box to complete each sentence. Each answer may be used once, more than once or not at all.

[2 marks]

<b>conduction</b>	<b>convection</b>	<b>radiation</b>
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The white surface reduces energy transfer by \_\_\_\_\_.

The concrete has a low U-value which means energy is transferred slowly by \_\_\_\_\_.

1 (b) The pizza oven is heated by burning wood.

What type of fuel is wood?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
biofuel	
fossil fuel	
non-renewable fuel	



- 1 (c)** The concrete used to make the pizza oven has a specific heat capacity of  $880 \text{ J/kg } ^\circ\text{C}$   
The mass of the concrete is  $250 \text{ kg}$

Calculate the energy transferred to the concrete to increase its temperature by  $380 \text{ }^\circ\text{C}$

Use the correct equation from the Physics Equations Sheet.

**[2 marks]**

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Energy transferred = \_\_\_\_\_ J

5

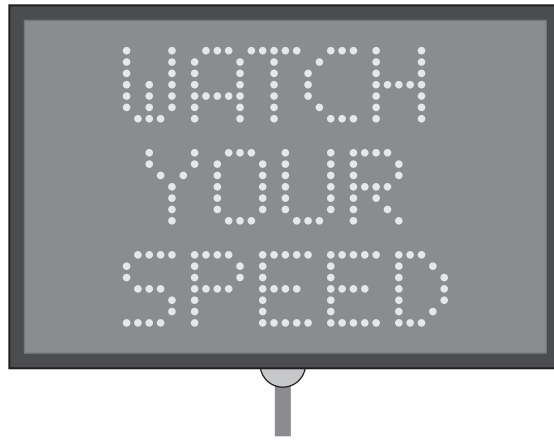
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2 Figure 2 shows an electric road sign.

Figure 2

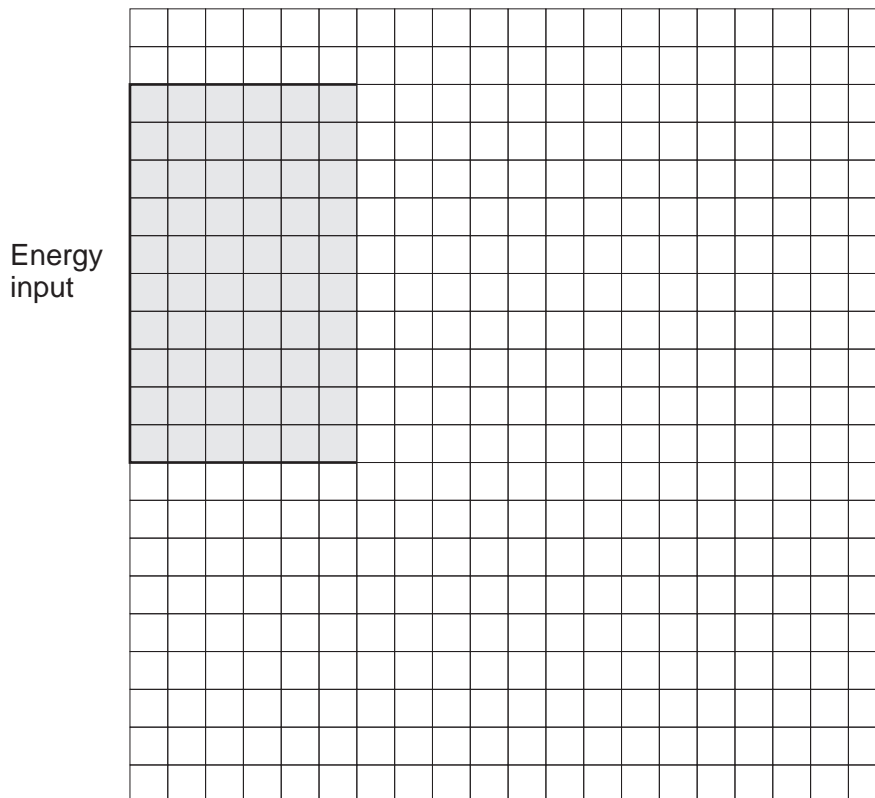


2 (a) The road sign is powered by an electrical generator which has an efficiency of 40%.

Complete the Sankey diagram in Figure 3 for an electrical generator which has an efficiency of 40%.

[2 marks]

Figure 3



**2 (b)** The road sign uses high efficiency LED bulbs. What does high efficiency mean?

Tick (✓) **one** box.

[1 mark]

	Tick (✓)
the bulbs have a high energy input	
a high proportion of the energy output is useful	
a high proportion of the energy output is wasted	

**2 (c)** Some road signs are powered by batteries recharged by solar cells.

In one sign the solar cells have a total power output of 200 W

Calculate the energy that the solar cells will transfer in 3600 seconds.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

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Energy = \_\_\_\_\_ J

**2 (d)** Some road signs are powered by batteries recharged by **both** solar cells and wind turbines.

Give **two** advantages of having **both** solar cells and wind turbines available to recharge the batteries.

[2 marks]

1 \_\_\_\_\_

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2 \_\_\_\_\_

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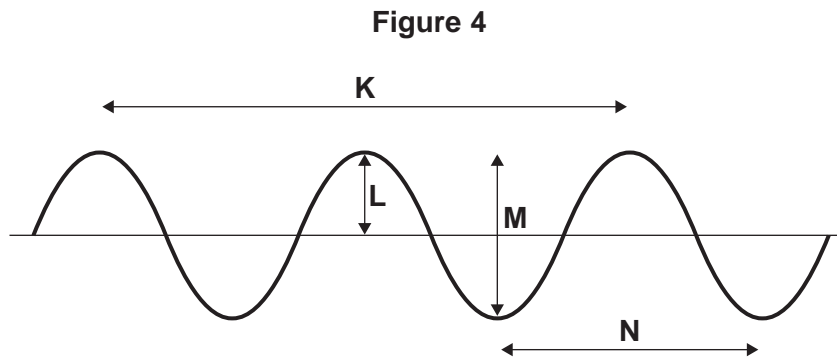


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3 (a) Figure 4 shows an electromagnetic wave.



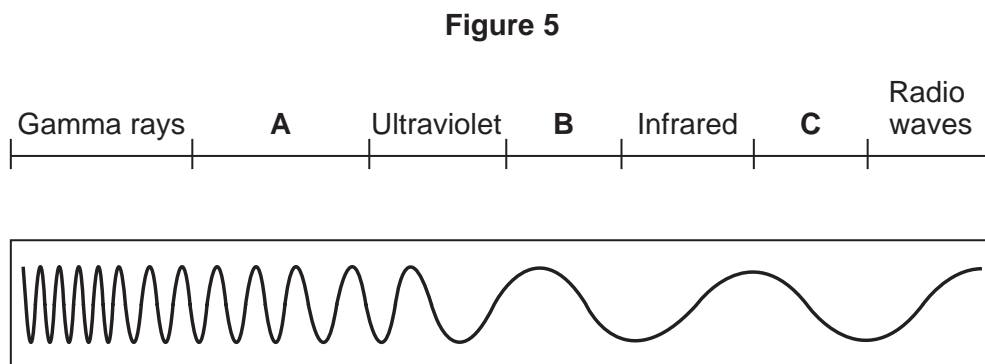
3 (a) (i) Which arrow, **K**, **L**, **M** or **N**, shows the wavelength of the wave?

[1 mark]

3 (a) (ii) Which arrow, **K**, **L**, **M** or **N**, shows the amplitude of the wave?

[1 mark]

3 (b) Figure 5 shows the electromagnetic spectrum.



A laser emits visible light.

Which letter, **A**, **B** or **C**, on **Figure 5** shows the position of visible light?

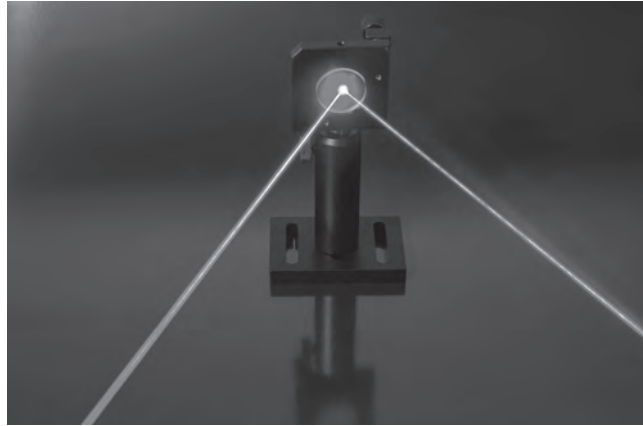
[1 mark]



**3 (c)** Laser light is used in some burglar alarms.

**Figure 6** shows laser light being reflected by a mirror. The light then reaches a detector.

**Figure 6**



**3 (c) (i)** How does the size of the angle of incidence compare with the size of the angle of reflection?

[1 mark]

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**3 (c) (ii)** When a burglar gets in the way of the laser light, the light no longer reaches the detector.

Suggest **one** reason why.

[1 mark]

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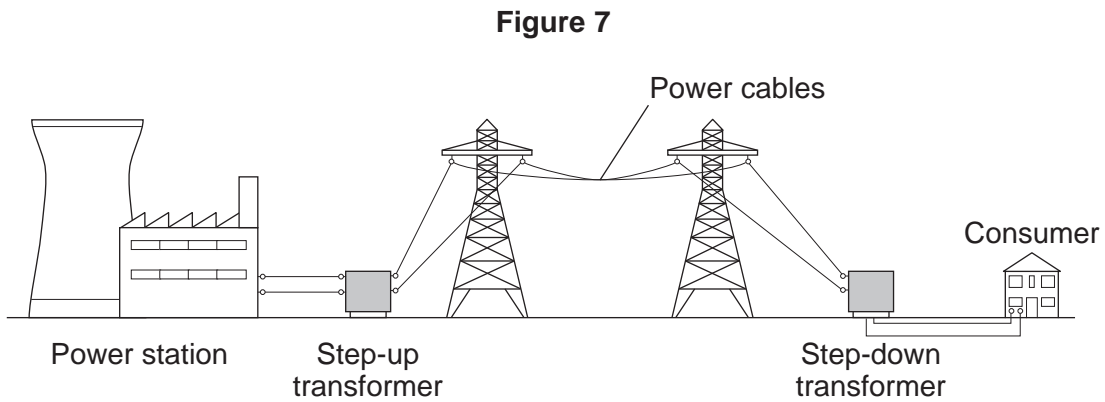
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- 4 **Figure 7** shows how electricity is distributed from power stations to consumers.



- 4 (a) Which parts of **Figure 7** form the National Grid?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
power station, transformers and power cables	
transformers and power cables	
transformers, power cables and consumer	

- 4 (b) The power cables in **Figure 7** are overhead power cables. Power cables can be buried underground.

Give **one disadvantage** of burying power cables underground.

[1 mark]

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**4 (c)** Use the correct answers from the box to complete each sentence.

Each word can be used once or not at all.

**[3 marks]**

<b>energy</b>	<b>current</b>	<b>efficiency</b>	<b>power</b>	<b>voltage</b>
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The step-up transformer increases the \_\_\_\_\_ which decreases the \_\_\_\_\_ .

Using a step-up transformer increases the \_\_\_\_\_ of the electricity distribution process.

**4 (d)** A householder reads his electricity meter at the start and at the end of a month.

**Start: 34 523 (kWh)**

**End: 34 713 (kWh)**

The cost of 1 kWh is 15 pence.

Calculate the cost of the electricity used that month.

**[2 marks]**

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Cost = \_\_\_\_\_ pence

7
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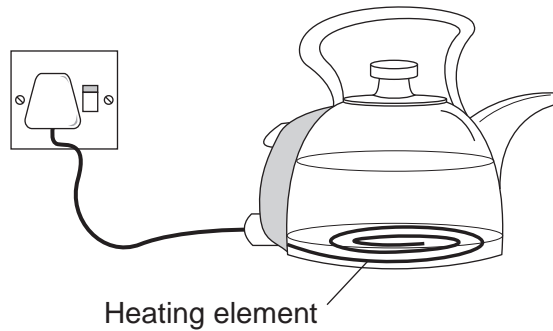
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- 5 **Figure 8** shows an electric kettle being used to heat some water.

**Figure 8**



- 5 (a) Complete the following sentences to describe how the water in the kettle is warmed by convection.

**[4 marks]**

When the kettle is switched on, the temperature of the water near the heating element increases.

As the temperature of the water increases, the water \_\_\_\_\_ and

becomes less \_\_\_\_\_ .

The heated water \_\_\_\_\_ towards the top of the kettle.

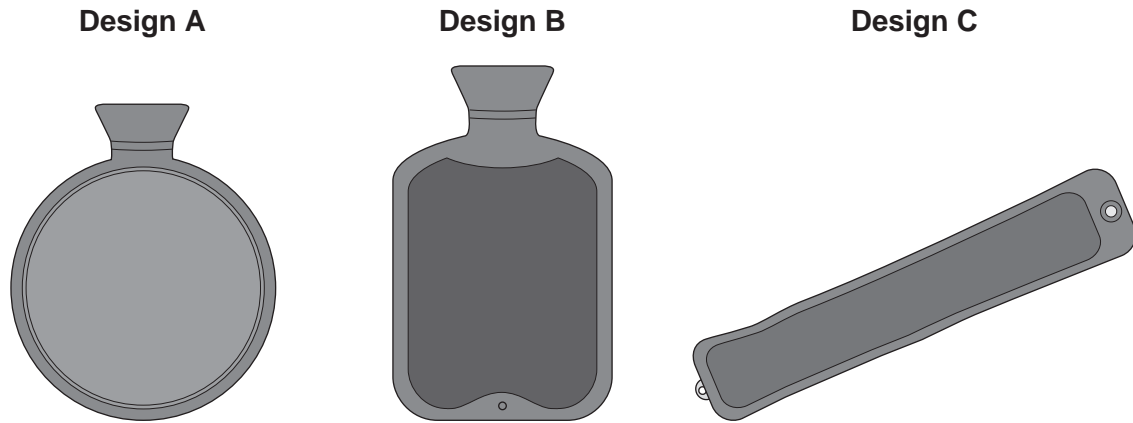
The movement of the water sets up a convection \_\_\_\_\_ .



- 5 (b)** Three different designs of hot water bottle are each filled with water at 90 °C from the kettle.

**Figure 9** shows the three different designs. Each hot water bottle is made from a different material but holds the same amount of water.

**Figure 9**



State **two** factors that would affect the time it would take the hot water bottles to cool down to room temperature.

**[2 marks]**

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_

6

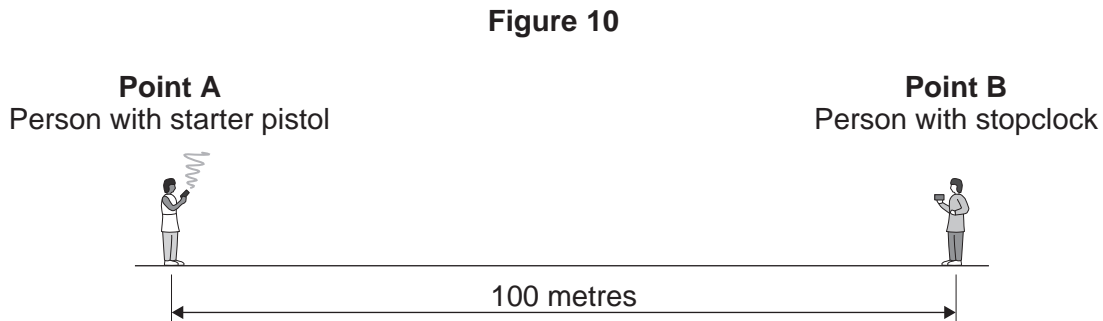
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- 6 Starter pistols are used in athletics events to start races. A starter pistol makes a loud bang and produces a puff of smoke.

**Figure 10** shows two people who investigated the speed of sound using a starter pistol and a stopclock.



**Figure 10** is not drawn to scale.

- 6 (a) The person at **Point B** sees the puff of smoke before hearing the bang from the starter pistol.

What does this tell you about the speed of sound compared with the speed of light?

[1 mark]

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- 6 (b) The frequency of the sound wave produced by the pistol was 800 Hz

The wavelength of the sound wave was 0.42 m

Calculate the speed of the sound wave.

Use the correct equation from the Physics Equations Sheet.

Choose the correct unit.

$\text{m/s}^2$        $\text{m/s}$        $\text{m}^2/\text{s}$

[3 marks]

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Speed = \_\_\_\_\_ unit \_\_\_\_\_



- 6 (c)** Complete **Table 1** to show the properties of the sound wave at **Point B** compared with the sound wave at **Point A**.

[3 marks]

Tick (✓) **one** box for each property comparison.

**Table 1**

Properties of the sound wave at Point B compared to Point A	greater than	less than	the same as
amplitude			
frequency			
speed			

- 6 (d)** A sound wave can be reflected. What name is given to a reflected sound wave?

[1 mark]

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- 6 (e)** Which **two** of these statements are true for sound waves?

[2 marks]

Tick (✓) **two** properties.

	Tick (✓)
Sound waves can travel through a vacuum.	
Sound waves are transverse waves.	
Sound waves are longitudinal waves.	
Sound waves transfer energy.	
Sound waves are electromagnetic waves.	

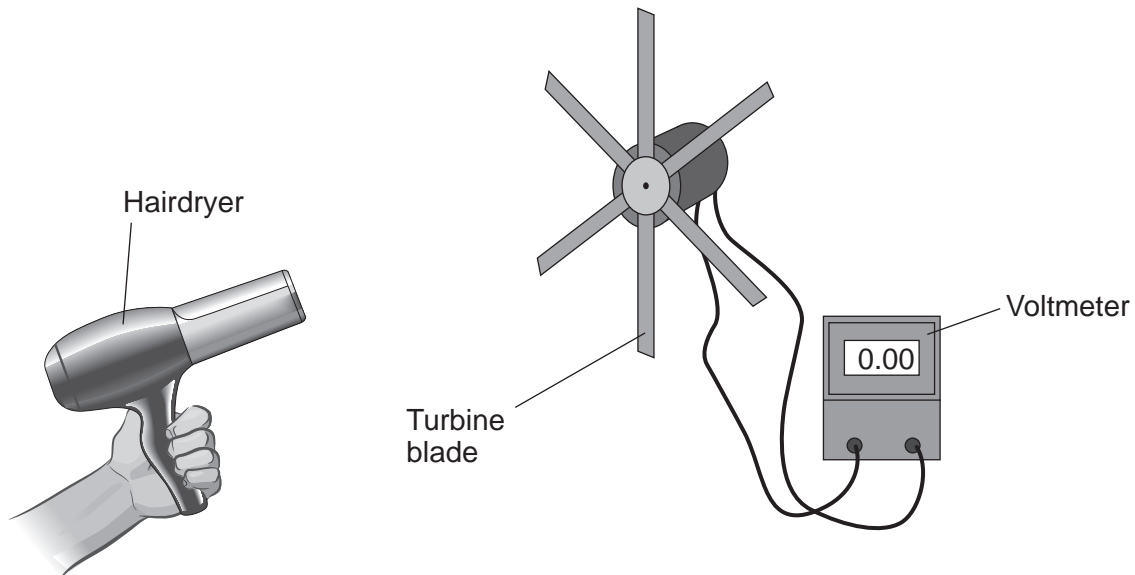
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- 7 A student investigated how the output voltage of a model wind turbine was affected by the number of turbine blades. The equipment he used is shown in **Figure 11**.

**Figure 11**



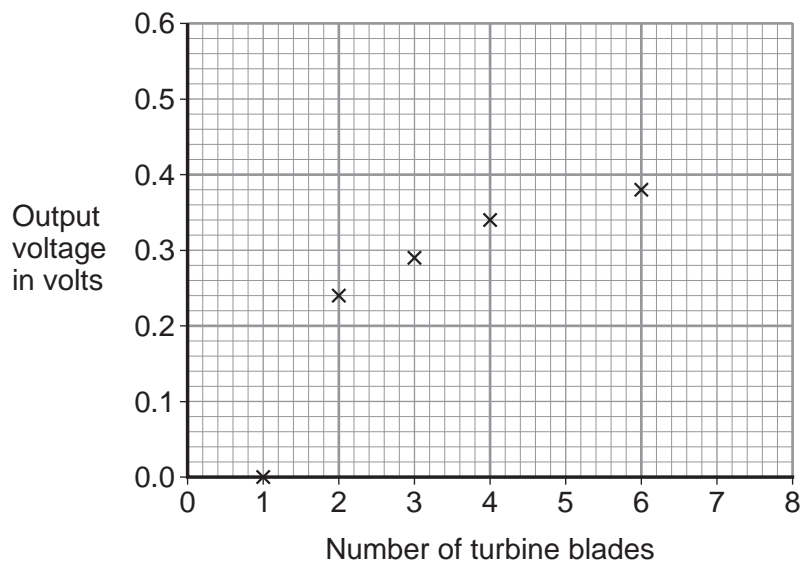
- 7 (a) Suggest **two** factors, other than the number of turbine blades, that will affect the output voltage of the model wind turbine.

[2 marks]

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_

- 7 (b) Some of the student's results are shown in **Figure 12**.

**Figure 12**



7 (b) (i) Plot the remaining results in **Figure 12** using the data in **Table 2**.

[2 marks]

**Table 2**

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

7 (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]

\_\_\_\_\_

7 (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 \_\_\_\_\_

\_\_\_\_\_

7 (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 \_\_\_\_\_

\_\_\_\_\_

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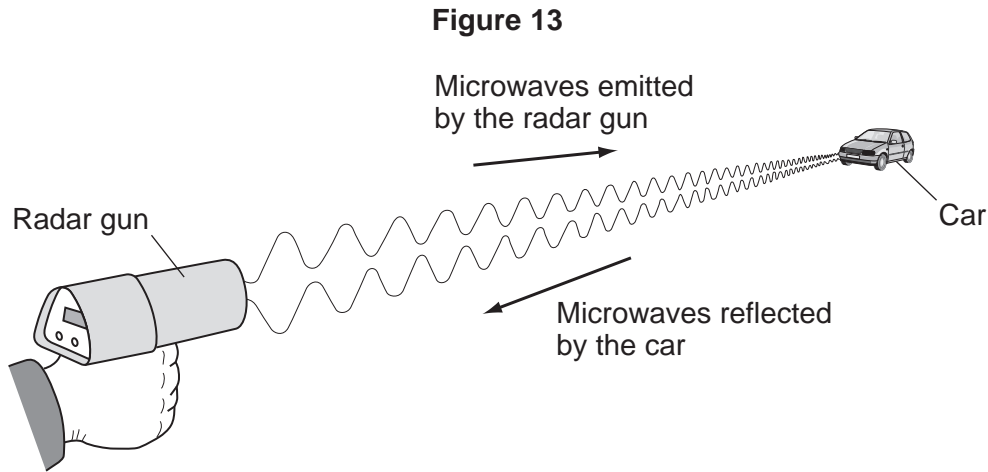
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8 A radar gun can be used to measure the speed of a car.

Microwaves are emitted by the radar gun and reflected by the car, as shown in **Figure 13**.



8 (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]

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8 (b) The data in **Table 3** are measurements taken from three different cars on the same piece of road.

**Table 3**

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





**8 (b) (i)** State which car in **Table 3** is moving towards the radar gun. Give a reason for your answer.

[2 marks]

Car \_\_\_\_\_

Reason \_\_\_\_\_

\_\_\_\_\_

**8 (b) (ii)** State which car in **Table 3** is moving the fastest. Give a reason for your answer.

[2 marks]

Car \_\_\_\_\_

Reason \_\_\_\_\_

\_\_\_\_\_

5

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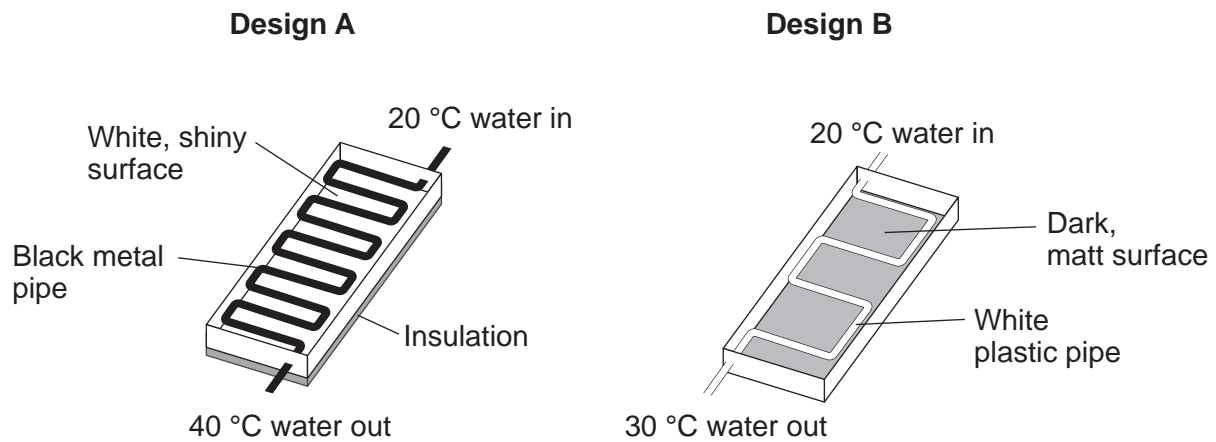
9 In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Solar panels use energy from the Sun to heat water.

Two different designs of solar panel are shown in **Figure 14**.

Both designs have the same water flow rate.

**Figure 14**



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

**[6 marks]**

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**END OF QUESTIONS**



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