OXFORD

INTERNATIONAL AQA EXAMINATIONS

Please write clearly in block capitals.

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Surname _____

Forename(s) _____

Candidate signature _____

INTERNATIONAL GCSE

COMBINED SCIENCE

C

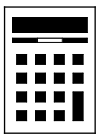
Paper 3 Physics Core

Thursday 6 June 2019 07:00 GMT Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a pencil and a ruler
- a protractor
- a scientific 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.
- All working must be shown.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- 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 100.
- You are expected to use a scientific calculator where appropriate.
- The Physics Equations Sheet is provided as a loose insert.

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

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

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0 1 . 1 Force is a vector quantity.

Which statement is correct for a vector quantity?
Tick (✓) **one** box.

[1 mark]

A vector quantity has magnitude only. ☐

A vector quantity has direction only. ☐

A vector quantity has magnitude and direction. ☐

0 1 . 2 Which of the following is a vector quantity?
Tick (✓) **one** box.

[1 mark]

Acceleration ☐

Distance ☐

Speed ☐

Time ☐

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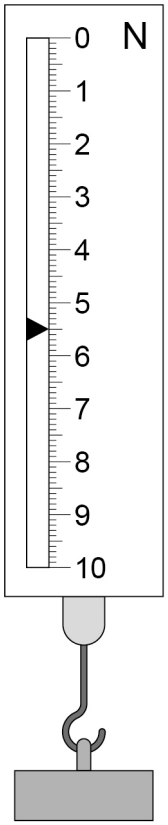
0 1 . 3 **Figure 1** shows a newton meter, which is used to measure the weight of an object.

Figure 1



Give the weight of the object in **Figure 1**.

[1 mark]

Weight = _____ N

0 1 . 4 The same object weighs less on the Moon.

Why is the weight of the object less on the Moon?
Tick (✓) **one** box.

[1 mark]

Gravitational field strength is less on the Moon. ☐

The mass of the object is less on the Moon. ☐

There is no air on the Moon. ☐

There is no gravity on the Moon. ☐

Question 1 continues on the next page

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Our solar system is made up of different objects.

0 1 . 5 Give **two** differences between a planet and a moon.

[2 marks]

1 _____

_____

2 _____

_____

0 1 . 6 Give **two** other objects in our solar system.
Tick (✓) **two** boxes.

[2 marks]

- Comet ☐
- Neutron star ☐
- Red supergiant ☐
- Star ☐
- White dwarf ☐

0 1 . 7 Our solar system is part of a galaxy.

Give the name of our galaxy.

[1 mark]

_____

_____

9

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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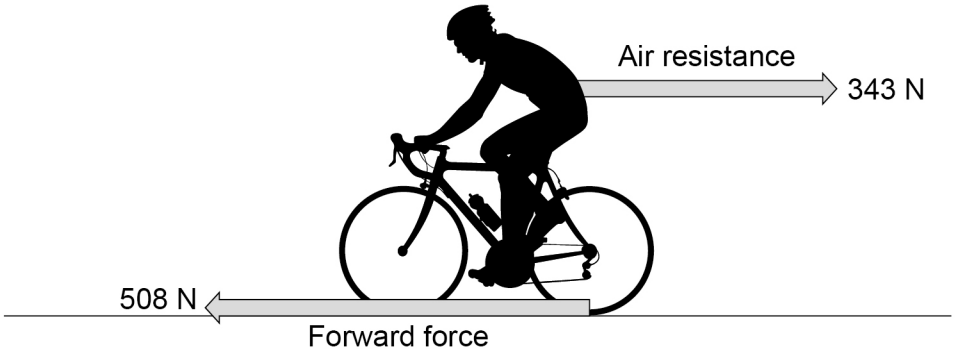
0 2 **Figure 2** shows the horizontal forces acting on a bicycle and cyclist when cycling along a dry road.

Figure 2



0 2 . 1 Calculate the resultant force on the bicycle and cyclist.

[2 marks]

Resultant force = _____ N

0 2 . 2 The bicycle accelerates from rest to a velocity of 6.0 m/s in a time of 4.0 s.

Calculate the acceleration of the bicycle.
Use the Physics Equations Sheet.

[2 marks]

Acceleration = _____ m/s^2

Do not write outside the box

0 2 . 3 The mass of the bicycle and cyclist is 110 kg.
The bicycle is moving at a speed of 6.0 m/s.

Calculate the kinetic energy of the bicycle and cyclist.
Use the Physics Equations Sheet.

[2 marks]

Kinetic energy = _____ J

0 2 . 4 Explain why the bicycle slows down when the cyclist stops pedalling.
Use ideas about forces in your answer.

[2 marks]

0 2 . 5 The cyclist travels home in the rain.

Explain why the stopping distance of the bicycle on a wet road is different to the stopping distance on a dry road.

[2 marks]

Question 2 continues on the next page

Turn over ►

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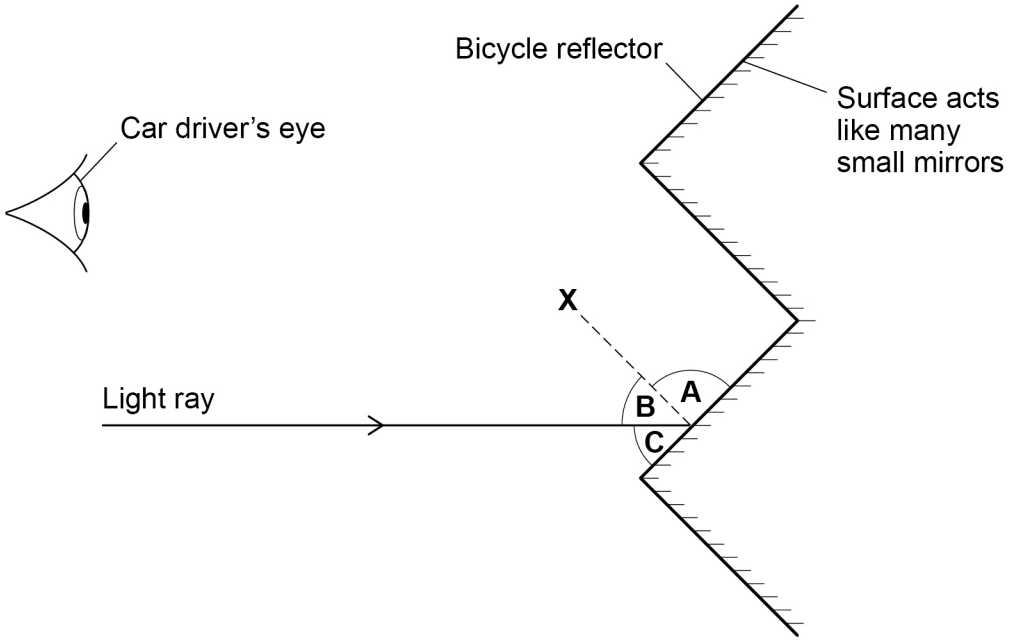
The bicycle has a reflector on the back to reflect light from car headlights at night.

Figure 3 is an incomplete ray diagram showing how reflected light from car headlights can be seen by the driver of the car.

Figure 3



0 2 . 6 Name the dashed line labelled **X**.

[1 mark]

0 2 . 7 Which angle on **Figure 3** is the angle of incidence?
Tick (✓) **one** box.

[1 mark]

A ☐

B ☐

C ☐

Do not write outside the box

0 2 . 8 Measure the angle of incidence.

[1 mark]

Angle of incidence = _____ °

0 2 . 9 Complete **Figure 3** to show how reflected light from car headlights can be seen by the driver of the car.

[3 marks]

16

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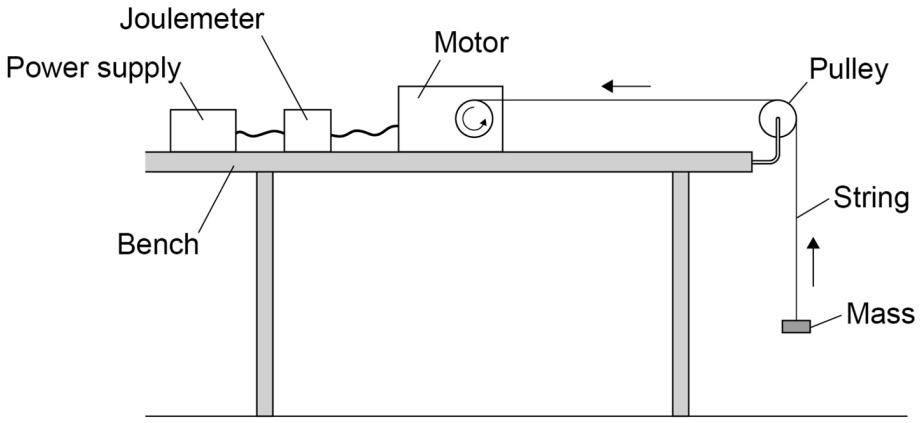
0 3 A student investigated how the mass lifted by a motor affected the efficiency of the motor.

Figure 4 shows the apparatus used.

Figure 4



This is the method used.

1. Attach the mass to the string.
2. Switch on the power supply so that the motor lifts the mass through a height of 1 m.
3. Record the input energy from the joulemeter.
4. Calculate the useful output energy.
5. Repeat steps 1 to 4 with different masses.

0 3 . 1 What is the independent variable in the investigation?
Tick (✓) **one** box.

[1 mark]

Efficiency of the motor ☐

Length of the string ☐

Mass added to the string ☐

Power of the motor ☐

Question 3 continues on the next page

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Table 1 shows the data from the investigation.

Table 1

Mass lifted in kilograms	Input energy in joules	Useful output energy in joules	Efficiency
0.10	16	1.0	**X**
0.20	25	2.0	0.08
0.30	31	3.0	0.10
0.40	36	4.0	0.11
0.50	41	5.0	0.12
0.60	46	6.0	0.13
0.70	53	7.0	0.13

0 3 . 2 Calculate **X**, the efficiency of the motor when it is lifting a 0.10 kg mass.
Use the Physics Equations Sheet.

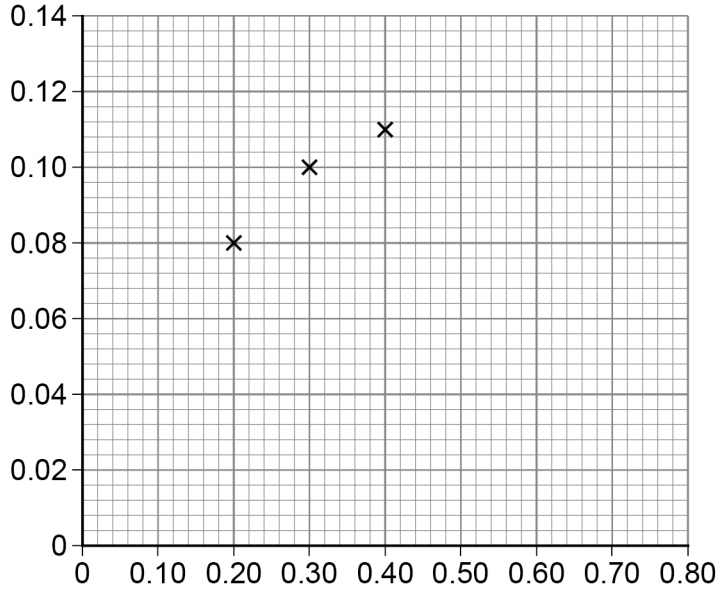
[2 marks]

Efficiency = _____

Do not write outside the box

0 3 . 3 The student plotted a graph of mass lifted against efficiency.
Three of the results are plotted on **Figure 5**.

Figure 5



Complete **Figure 5**.
You should:

- label the x-axis and the y-axis
- plot the missing points
- draw a line of best fit.

[4 marks]

0 3 . 4 Give **two** conclusions that the student should make from the graph in **Figure 5**.

[2 marks]

1 _____

_____

2 _____

_____

Question 3 continues on the next page

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0 3 . 5 The motor wastes energy as it lifts the mass.

What happens to the energy that is wasted?
Tick (✓) **one** box.

[1 mark]

The energy causes pollution. ☐

The energy goes back into the motor. ☐

The energy heats the surroundings. ☐

0 3 . 6 The student then investigated how the mass lifted by the motor affects the time taken for the mass to be lifted through a distance of 1 metre.

Complete the sentence to predict what would be observed in this investigation.
Choose answers from the box.
Each answer can be used once, more than once or not at all.

[2 marks]

greater	less	the same

For a greater mass, the time taken is _____ because the work done on the mass is _____ .

0 3 . 7 The time taken to lift a mass of 0.10 kg through a distance of 1 metre was 0.80 seconds.

Determine the input power of the motor.
Use information from **Table 1** and the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Input power = _____ W

14

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0 4 A driver wants to buy a new car.
Table 2 shows some features of petrol cars and electric cars.

Table 2

Feature	Petrol car	Electric car
Cost of driving	\$1.17 per litre of petrol	\$0.20 per kW h of energy
Maximum storage capacity	40 litres	40 kW h
Maximum range in kilometres	720	240
Carbon dioxide emission while being driven in grams per kilometre	99	0

Maximum range is the distance the car can travel before needing to be refuelled or recharged.

0 4 . 1 Give the reason why cars that have zero carbon emissions are being developed.
[1 mark]

0 4 . 2 Determine the cost of driving the electric car 480 km.
Use data from **Table 2**.
[3 marks]

Cost = \$ _____

Do not write outside the box

0 4 . 3 Why might the driver choose to buy a petrol car instead of an electric car? Tick (✓) **two** boxes.

[2 marks]

It is cheaper to fill a petrol car with fuel than to charge an electric car. ☐

It takes less time to fill a petrol car with fuel than to charge an electric car. ☐

The petrol car needs to be filled with fuel less often than the electric car needs to be charged. ☐

There are fewer emissions from a petrol car than from an electric car. ☐

Question 4 continues on the next page

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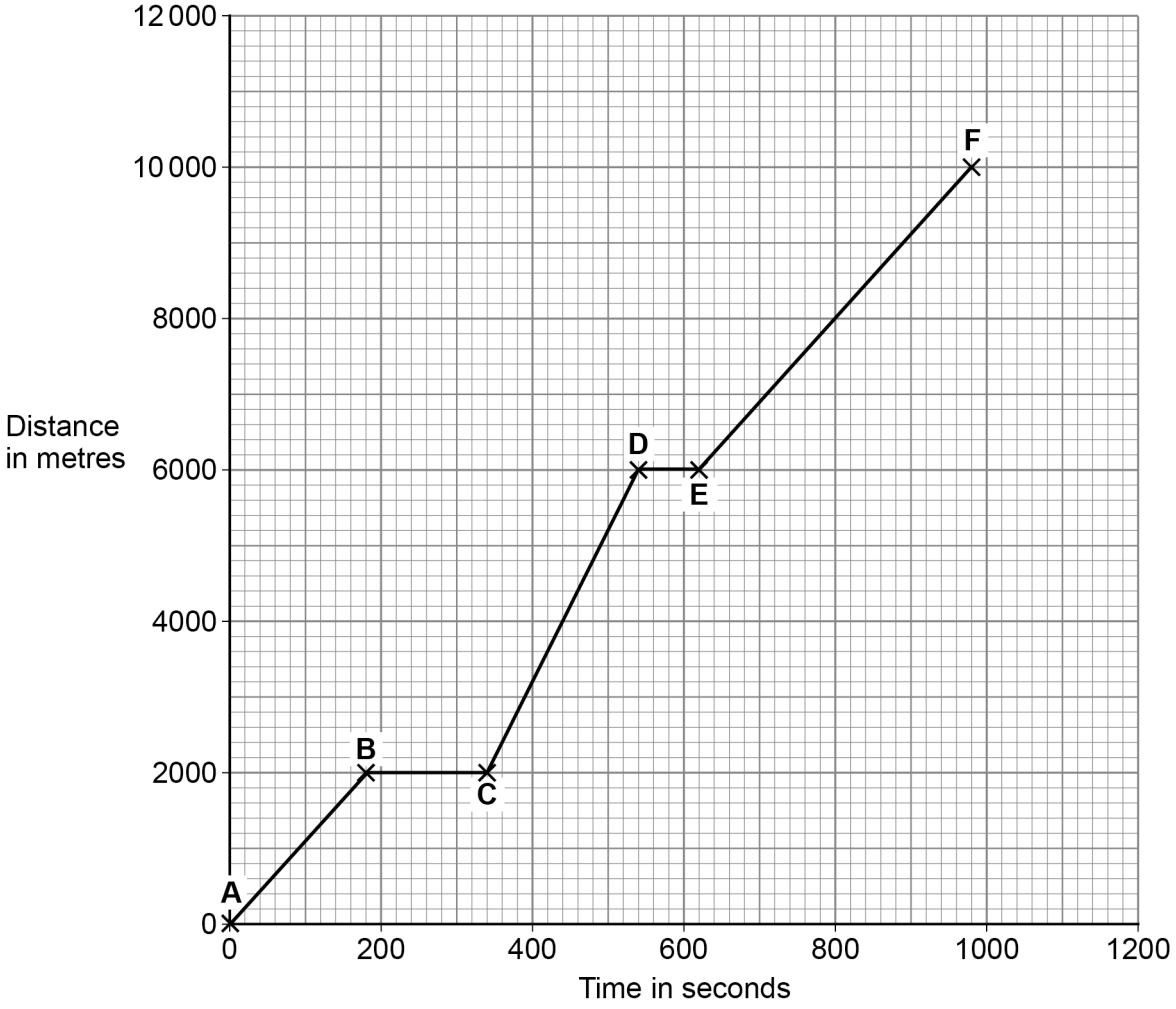
Figure 6 shows part of the driver's journey to work.

Figure 6



0 4 . 4 The car was stationary for some of the journey.

Determine the total time for which the car was stationary.

[3 marks]

Total time = _____ s

Do not write outside the box

0 4 . 5 Which section of the graph in **Figure 6** shows the car travelling at the greatest speed? Tick (✓) **one** box.

A to **B** ☐

B to **C** ☐

C to **D** ☐

D to **E** ☐

E to **F** ☐

Give the reason for your answer.

[2 marks]

0 4 . 6 Calculate the average speed for the journey.

[3 marks]

Average speed = _____ m/s

14

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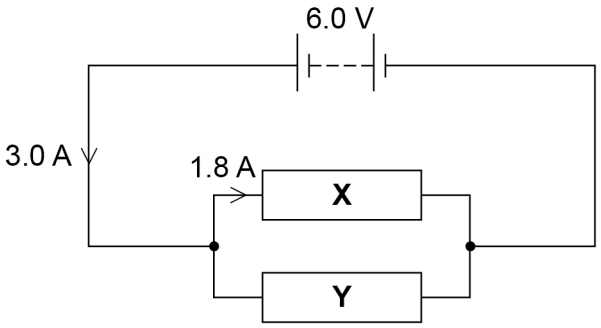
0 5 **Figure 7** shows a circuit with two resistors **X** and **Y** in parallel.

Figure 7



0 5 . 1 Determine the current in resistor **Y**.

[1 mark]

Current = _____ A

0 5 . 2 Give the potential difference across resistor **Y**.

[1 mark]

Potential difference = _____ V

0 5 . 3 Calculate the resistance of resistor **Y**.
Use the Physics Equations Sheet.

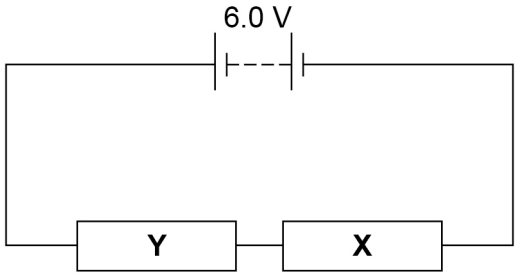
[2 marks]

Resistance = _____ Ω

Do not write outside the box

0 5 . 4 Resistor **X** and resistor **Y** are then connected in series. **Figure 8** shows the series circuit.

Figure 8



Complete **Table 3** to explain what happens when the resistors are connected in series rather than in parallel.

[5 marks]

Table 3

	Change	**Reason**
Resistance of circuit	Increases	
Current in circuit		
Potential difference across **Y**		

9

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0 6 In a nuclear power station, the energy released in the fission of uranium-235 is used in the generation of electricity.

0 6 . 1 What are the drawbacks of generating electricity in a nuclear power station?
Tick (✓) **two** boxes.

[2 marks]

Decommissioning costs are high. ☐

Carbon dioxide is released into the atmosphere. ☐

Radioactive waste is produced and is difficult to dispose of. ☐

Nuclear power stations are a reliable source of energy. ☐

Uranium-235 is a renewable resource. ☐

0 6 . 2 Energy is released during the process of nuclear fission.

What is nuclear fission?

[1 mark]

_____

_____

0 6 . 3 A common product of nuclear fission is caesium-137.
The chemical symbol for caesium-137 is $^{137}_{55}Cs$.

Give the number of protons and the number of neutrons in an atom of caesium-137.

[2 marks]

_____

_____

Number of protons = _____

Number of neutrons = _____

Do not write outside the box

0 6 . 4 In nuclear power stations, nuclear reactors are surrounded by a barrier that absorbs radiation.
The barrier reduces radioactive emissions to safe levels.
Barriers can be several metres of concrete or a few centimetres of lead.

Table 4 gives two properties of concrete and lead.

Table 4

Material	Density in kg / m^3	Maximum temperature that the material can withstand in °C
Concrete	2400	> 1000
Lead	11 340	328

Give **two** reasons why concrete is usually used for the barrier instead of lead.
Use information from **Table 4**.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Question 6 continues on the next page

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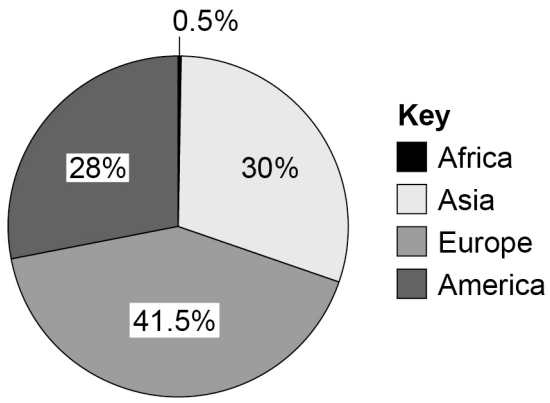
0 6 . 5 There are 450 nuclear power stations generating electricity around the world.

Figure 9 shows the percentage of these nuclear power stations that are in different continents.

Figure 9



Calculate the number of nuclear power stations in Asia.

[2 marks]

Number of power stations = _____

0 6 . 6 New nuclear power stations are being built around the world.

Suggest **two** reasons why more nuclear power stations are being built.

[2 marks]

1 _____

2 _____

11

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0 7 A student investigated the effect of the starting temperature of hot water on the rate at which it cooled.

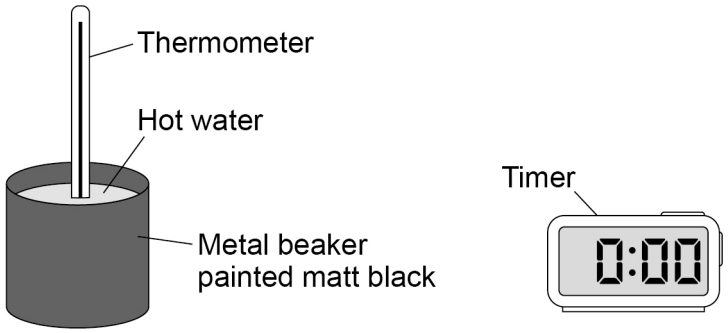
Table 5 shows the student's results.

Table 5

Starting temperature in °C	Temperature after 5 minutes in °C
80	66
70	59
60	52
50	45
40	37

Figure 10 shows the equipment used.

Figure 10



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0 7 . 1 Describe a method the student could use to carry out the investigation safely and obtain the results in **Table 5**.

[6 marks]

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0 7 . 2 What was the resolution of the thermometer used in the investigation?

[1 mark]

Resolution = _____ °C

0 7 . 3 Explain **one** conclusion the student should make from the results in **Table 5**.

[2 marks]

0 7 . 4 The student repeated the investigation using a metal beaker of the same shape and size but painted shiny silver.

Explain why the temperature after 5 minutes was higher than with the matt black beaker for each starting temperature.

[2 marks]

11

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0 8 Light and sound are examples of waves.

0 8 . 1 Give **two** differences and **two** similarities between light waves and sound waves.
[4 marks]

Difference 1 _____

_____

Difference 2 _____

_____

Similarity 1 _____

_____

Similarity 2 _____

_____

0 8 . 2 **Figure 11** shows a loudspeaker connected to a signal generator.

The loudspeaker emits sound waves that are detected by the microphone.
The oscilloscope produces a trace that represents the sound waves.

Figure 11

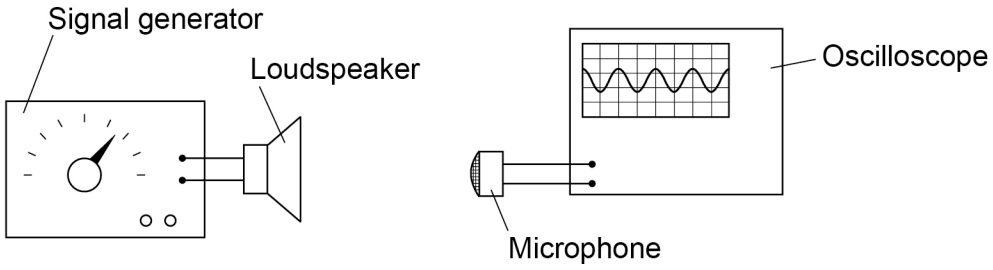

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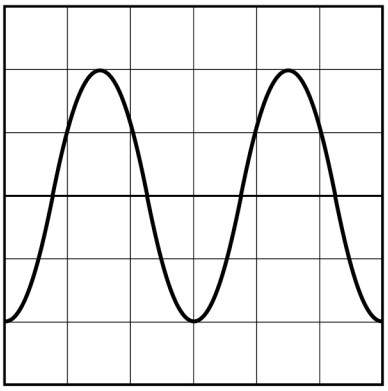
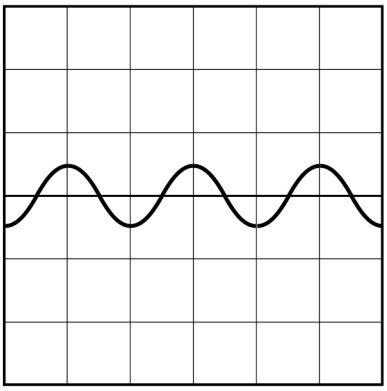
Figure 12 shows oscilloscope traces for two different sound waves, **A** and **B**.
The oscilloscope settings remain constant.

Figure 12

Trace for sound **A**



Trace for sound **B**



Explain why the two different sound waves, **A** and **B**, sound different.

[4 marks]

0 8 . 3 Sound wave **A** has a frequency of 12 kHz and a wavelength of 2.8 cm.

Calculate the speed of sound wave **A**.
Use the Physics Equations Sheet.

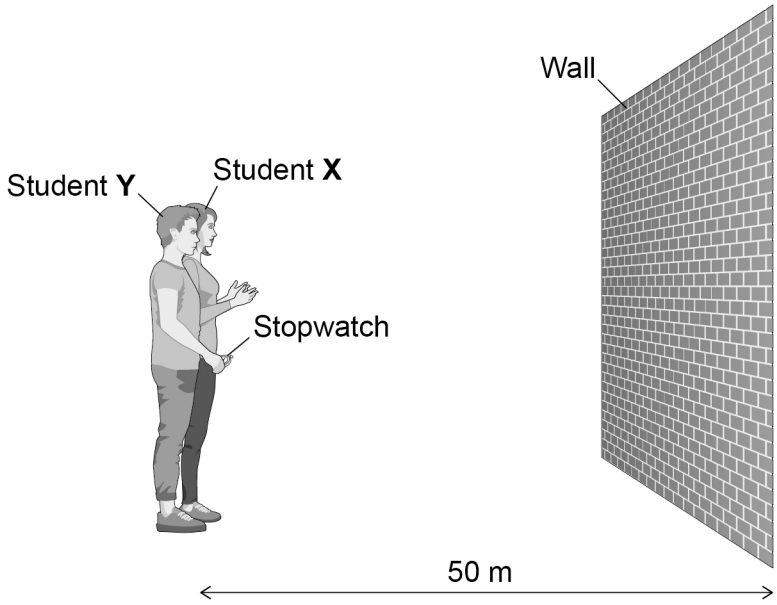
[4 marks]

Speed = _____ m/s

Question 8 continues on the next page

Figure 13 shows two students measuring the speed of sound in air.

Figure 13



This is the method used.

- The students stood 50 m away from a wall.
- Student **X** produced a sound and at the same time student **Y** started a stopwatch.
- Student **Y** stopped the stopwatch when they heard the echo from the wall.

Measurements were taken three times. **Table 6** shows the results.

Table 6

Measurement number	1	2	3
Time for echo to be heard in seconds	0.45	0.35	0.40

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0 8 . 4 Explain why it was a good idea to take the measurements three times.

[2 marks]

0 8 . 5 The results in **Table 6** do **not** give an accurate value for the speed of sound in air.

Suggest **one** improvement to the method that would increase the accuracy of the results.
Give a reason for your answer.

[2 marks]

16

END OF QUESTIONS

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