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Candidate surname					Other names				
Centre Number					Candidate Number				
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Pearson Edexcel International GCSE (9–1)

Friday 14 June 2024

Afternoon (Time: 1 hour 10 minutes)

Paper reference	4SS0/1P
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Science (Single Award)

Physics

PAPER: 1P

You must have:
Calculator, ruler, protractor, Equation Booklet (enclosed)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Calculators may be used.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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FORMULAE

You may find the following formulae useful.

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

$$P = \frac{W}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}}$$

$$P = \frac{W}{t}$$

Where necessary, assume the acceleration of free fall, $g = 10 \text{ m/s}^2$.

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Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

- 1** The photograph shows an electric lawnmower used to cut grass.



(Source: <https://www.shutterstock.com/image-photo/norwich-norfolk-uk-september-4-2021-2036487353>)

The lawnmower is powered by a battery and has an electric motor and two switches.

A sharp blade is attached to the motor. The blade cuts the grass when the motor spins.

Diagram 1 shows how the electrical components are connected in a circuit.

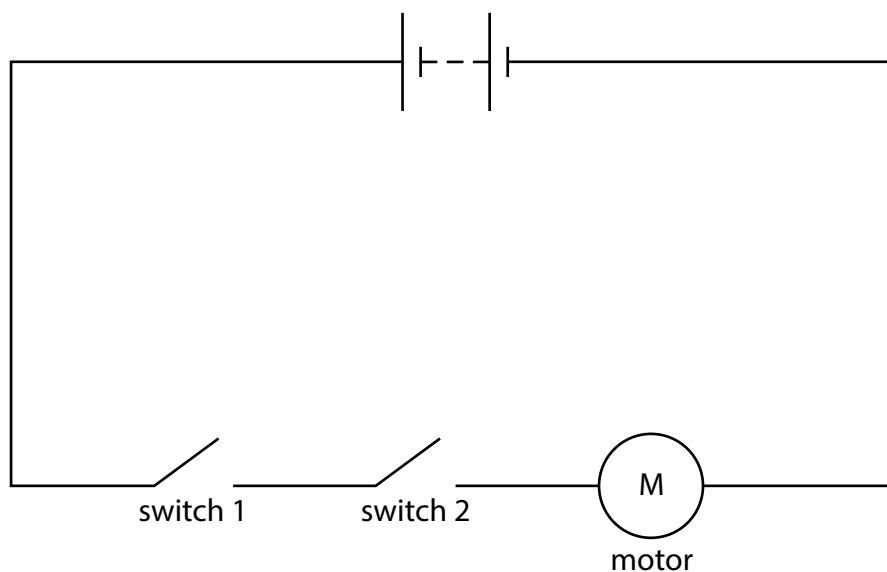


Diagram 1

(a) The lawnmower has two switches in its circuit.

(i) Explain why the motor will not turn when only one switch is closed.

(2)

(ii) Suggest why the lawnmower has two switches instead of only one switch.

(1)

(b) The lawnmower's motor has a voltage of 18V across it.

When the motor is turning, there is a current of 8.6 A in the motor.

(i) State the formula linking voltage, current and resistance.

(1)

(ii) Calculate the resistance of the motor.

Give the unit.

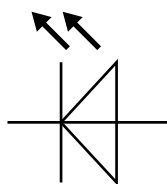
(4)

resistance =

unit

- (c) The manufacturer of the lawnmower wants to include a light emitting diode (LED) in the circuit that will emit light when the motor is turning.

The circuit symbol for an LED is



Draw the LED on diagram 2 so that it will emit light when the motor is turning.

(2)

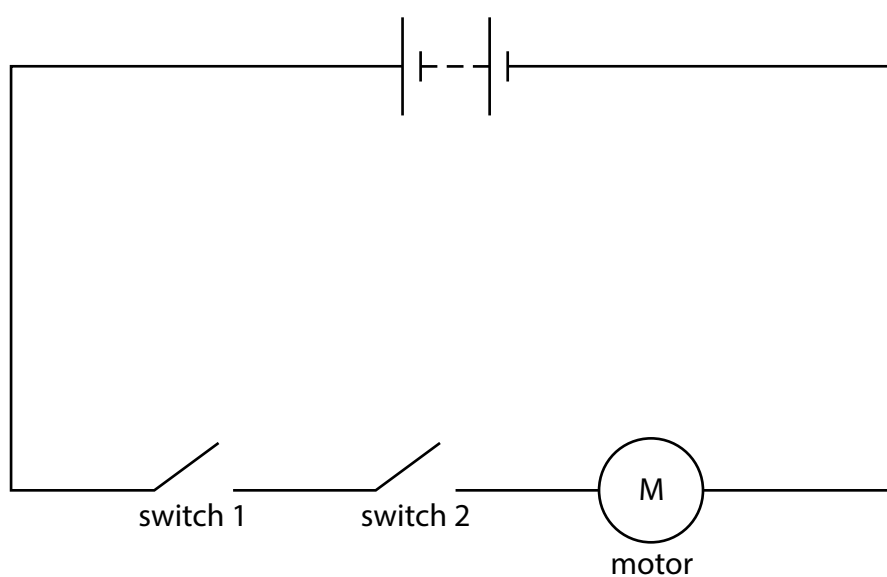


Diagram 2

(Total for Question 1 = 10 marks)

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2 In 1976, a spacecraft called Viking 2 began orbiting the planet Mars.

(a) The orbit of Viking 2 was the same as the orbit of a moon.

(i) Draw a labelled diagram to show how Viking 2 orbited Mars.

(2)

(ii) Add a labelled arrow to the diagram to show the force that causes the spacecraft to orbit Mars.

(2)

(b) A landing vehicle was launched from Viking 2 when the spacecraft was in orbit.

On the surface of Mars, the landing vehicle had a weight of 2.1 kN.

(i) State the formula linking weight, mass and gravitational field strength, g . (1)

(ii) The gravitational field strength on the surface of Mars is 3.7 N/kg.

Calculate the mass of the landing vehicle. (3)

mass = kg

(iii) Suggest why the gravitational field strength on the surface of Mars is less than the gravitational field strength on the surface of Earth. (1)

(Total for Question 2 = 9 marks)

- 3 A student investigates how the mass of sugar dissolved in water affects the refraction of light.

This is the student's method.

- Step 1 fill a semicircular dish with 100 cm^3 of pure water
- Step 2 direct a ray of red light at the flat side of the dish at an angle of incidence of 45°
- Step 3 measure the angle of refraction of the light at the flat surface of the dish
- Step 4 make a solution of 25 g of sugar dissolved in 100 cm^3 of water
- Step 5 refill the dish with the sugar solution and repeat steps 2 and 3

The student repeats this method with solutions made from different masses of sugar dissolved in 100 cm^3 of water.

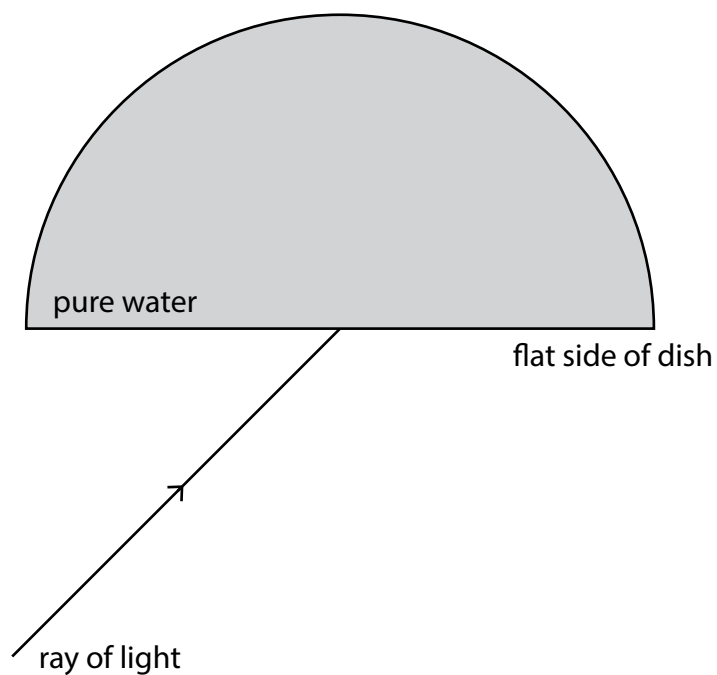
- (a) The table gives some of the variables in the student's investigation.

Place ticks (✓) in the table to show whether each variable is an independent, dependent or control variable.

(4)

Variable	Independent	Dependent	Control
volume of water			
angle of incidence			
angle of refraction			
mass of sugar			
colour of light			

- (b) The diagram shows the student's experiment when the semicircular dish contains pure water.



- (i) Draw the normal line where the ray of light hits the flat side of the dish. (1)
- (ii) The ray of light has an angle of refraction of 32.0° for pure water.
Draw the refracted ray of light. (2)

(c) The table shows the student's results.

Mass of sugar in g	Angle of refraction in °
0	32.0
25	31.2
50	30.4
75	29.7
100	28.9
125	28.3
150	26.5
175	27.0

(i) Plot a graph of the results on the grid.

(1)

(ii) One of the results is anomalous.

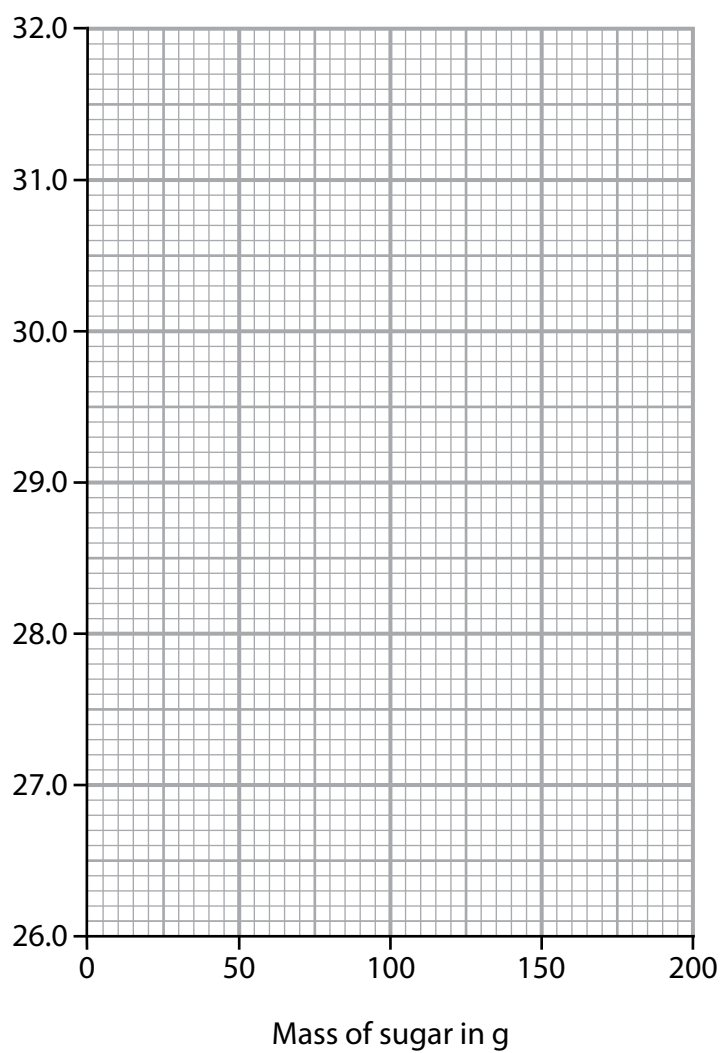
Draw a circle around the anomalous result.

(1)

(iii) Draw the curve of best fit.

(1)

Angle of refraction
in $^{\circ}$



- (iv) Describe the relationship between the mass of sugar and the angle of refraction.

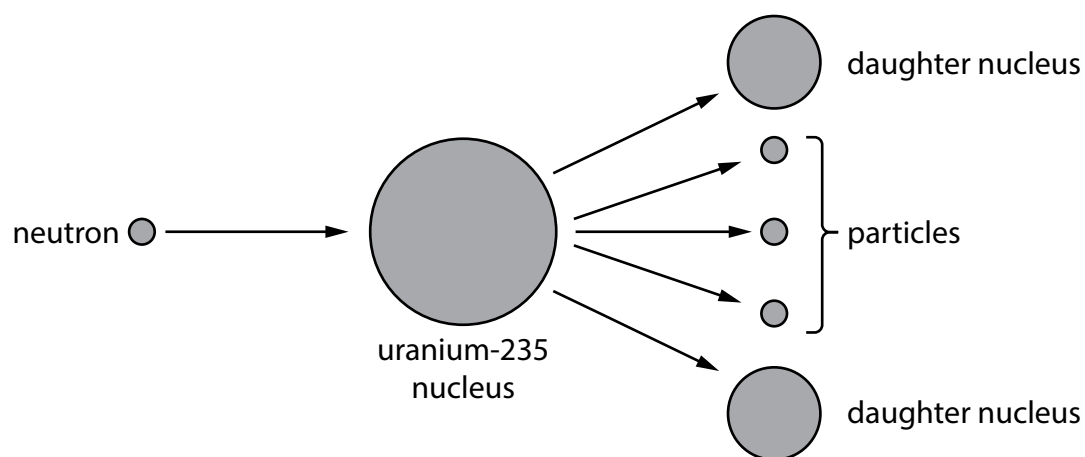
(2)

(Total for Question 3 = 12 marks)

4 This question is about nuclear fission.

- (a) The diagram shows a uranium-235 nucleus undergoing nuclear fission when it absorbs a neutron.

The uranium-235 nucleus splits into two daughter nuclei and three smaller particles.



- (i) Give the name of the smaller particles released in nuclear fission. (1)
- (ii) State what happens to the amount of energy in the **nuclear** store of the nuclei during nuclear fission. (1)
- (iii) State what happens to the amount of energy in the **kinetic** store of the daughter nuclei during nuclear fission. (1)

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- (b) In a power station, nuclear fission can be used to generate electricity.

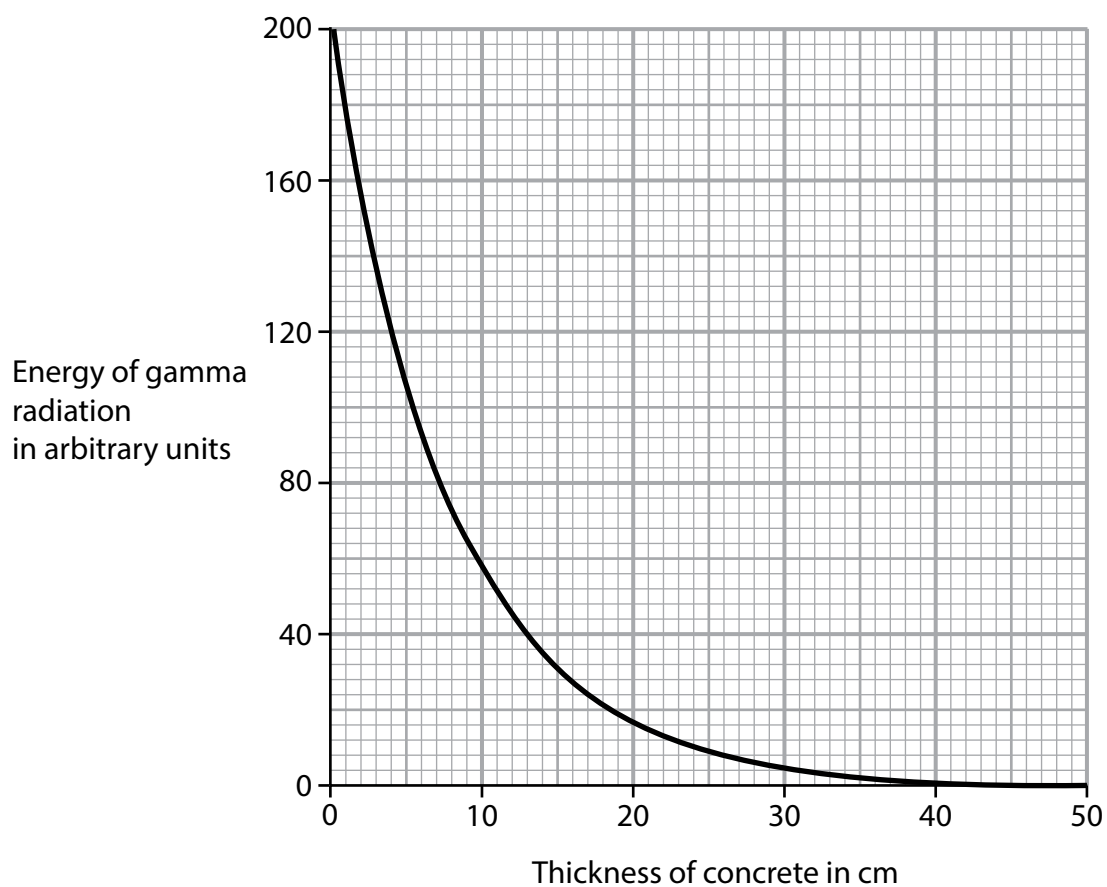
Some of the daughter nuclei produced in fission are highly radioactive and emit gamma radiation.

- (i) In a power station, nuclear fission takes place inside a nuclear reactor.

Explain why nuclear reactors are surrounded with thick layers of concrete.

(3)

- (ii) The graph shows the energy of gamma radiation that passes through different thicknesses of concrete shielding.



Determine the thickness of concrete needed to reduce the energy of gamma radiation by 90 %.

(3)

thickness = _____ cm

(Total for Question 4 = 9 marks)

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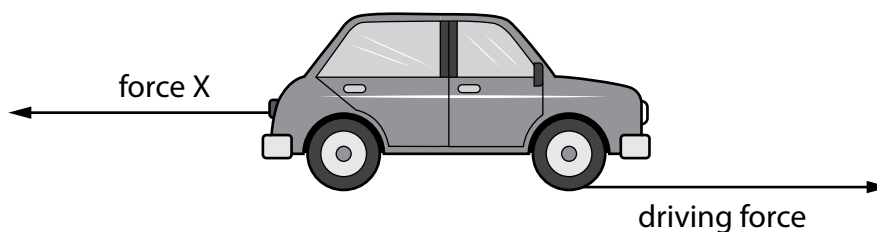
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5 This question is about the stopping distance of a car.

- (a) The diagram shows the forces acting on a car when it is travelling forwards at a constant speed.



The engine of the car applies a constant driving force in the forwards direction.

Force X acts on the car in the opposite direction to its motion.

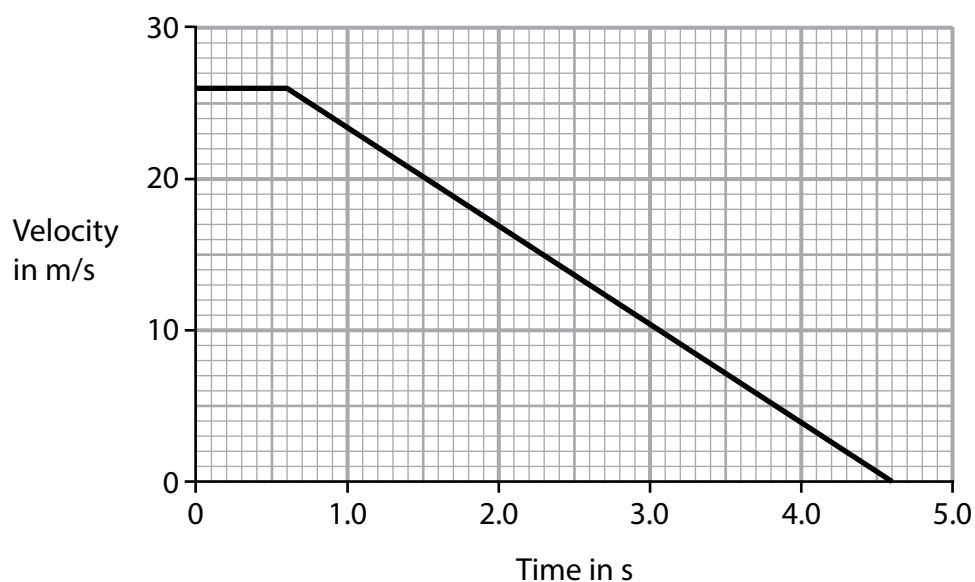
Give the name of the force X.

(1)

- (b) The road the car is travelling on is dry.

The driver of the car sees an obstacle in the road and needs to bring the car to a stop.

The velocity-time graph shows how the velocity of the car changes from when the driver sees the obstacle until the car comes to a stop.



(i) Determine the reaction time of the driver.

(1)

reaction time =

s

(ii) Calculate the total stopping distance of the car.

(4)

stopping distance =

m

(iii) Explain the effect of a wet road on the thinking distance and braking distance.

(4)

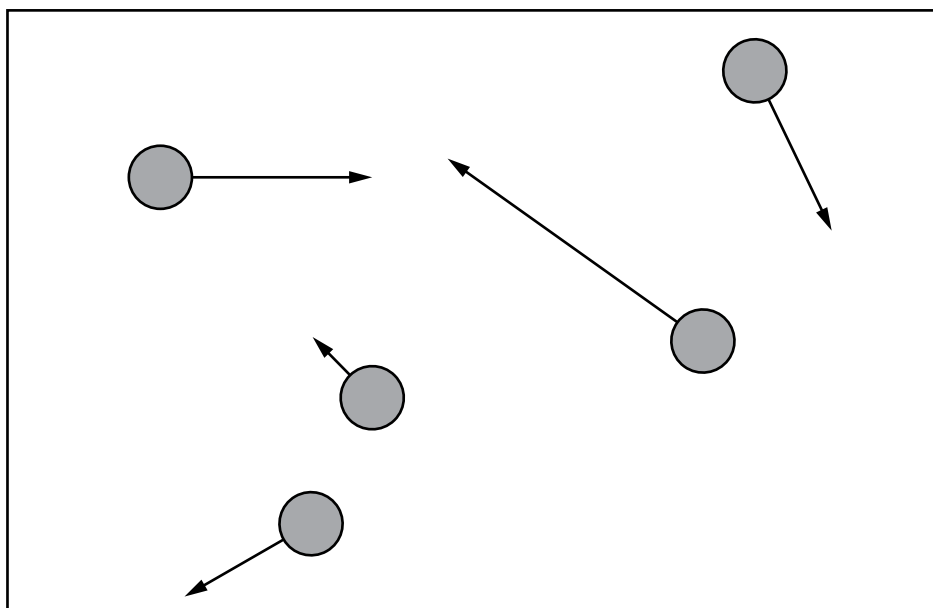
thinking distance

braking distance

(Total for Question 5 = 10 marks)

6 This question is about gases.

(a) The diagram shows some gas particles inside a closed container.



(i) The arrows in the diagram represent the velocities of the gas particles.

Explain what the diagram shows about the motion of the gas particles.

(2)

(ii) Explain how the gas particles exert a pressure on the walls of the container.

(2)

(b) The table gives information about particles in a different sample of gas.

Mass of one gas particle	$7.3 \times 10^{-26} \text{ kg}$
Mean kinetic energy of one gas particle	$9.8 \times 10^{-21} \text{ J}$
Total mean kinetic energy of gas particles	$1.2 \times 10^4 \text{ J}$

(i) Calculate the mean speed of the particles in this gas sample.

[kinetic energy = $\frac{1}{2} \times \text{mass} \times \text{speed}^2$]

(3)

mean speed = m/s

(ii) Calculate the total mass of gas in the sample.

(2)

total mass = kg

(iii) A student quickly compresses the gas. They do 100 J of work on the gas in a time of 0.5 seconds.

Which of these statements is **correct**?

(1)

- A 50 J of energy is transferred to the gas
- B the rate of energy transferred to the gas is 200 W
- C the gas particles move more slowly
- D the volume of the gas increases

(Total for Question 6 = 10 marks)

TOTAL FOR PAPER = 60 MARKS

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reference**

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Science (Single Award)

Physics

PAPER: 1P

Equation Booklet

Do not return this Booklet with the question paper.

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1. Forces and Motion

$$\text{average speed} = \frac{\text{distance moved}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}} \quad a = \frac{(v - u)}{t}$$

$$\text{force} = \text{mass} \times \text{acceleration} \quad F = m \times a$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength} \quad W = m \times g$$

2. Electricity

$$\text{power} = \text{current} \times \text{voltage} \quad P = I \times V$$

$$\text{voltage} = \text{current} \times \text{resistance} \quad V = I \times R$$

3. Waves

$$\text{wave speed} = \text{frequency} \times \text{wavelength} \quad v = f \times \lambda$$

4. Energy resources and energy transfers

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy output}} \times 100\%$$

$$\text{work done} = \text{force} \times \text{distance moved} \quad W = F \times d$$

$$\text{gravitational potential energy} = \text{mass} \times \text{gravitational field strength} \times \text{height}$$

$$GPE = m \times g \times h$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{speed}^2 \quad KE = \frac{1}{2} \times m \times v^2$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \quad P = \frac{W}{t}$$

5. Solids, liquids and gases

$$\text{pressure} = \frac{\text{force}}{\text{area}} \quad p = \frac{F}{A}$$

END OF EQUATION LIST