

PHYSICS



EXAM QUESTION PACK

TOPIC 1: KEY CONCEPTS OF PHYSICS (PAPER 1)

SCORE

/35

PERCENTAGE

%

STEMUP

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Q1.

A steel ball has a volume of 3.6 cm^3 and a mass of 28 g.

(i) Calculate the density of steel in kg/m^3 .

(3)

density = ... kg/m^3

(ii) The steel ball is at a room temperature of 20°C .

It is then put in a pan of boiling water maintained at 100°C .

Calculate how much thermal energy the ball gains as its temperature increases from 20°C to 100°C .

Specific heat capacity of steel = $510 \text{ J/kg } ^\circ\text{C}$

Use an equation selected from the list of equations at the end of this paper.

(2)

thermal energy gained = ... J

(iii) The steel ball is put into a furnace where it melts.

Compare the motion of particles in the steel when they are in the solid state with their motion when in the molten (liquid) state.

(3)

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(Total for question = 8 marks)

Q2.

In a science fiction story, lightning is used as an energy source for accelerating a car.

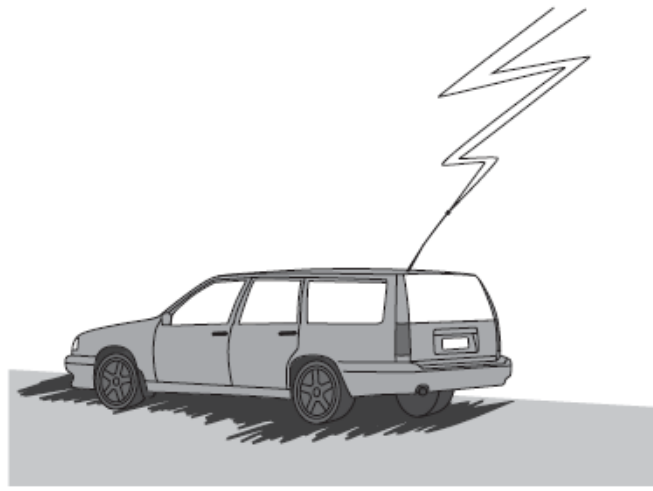


Figure 6

In the story, the car has a kinetic energy of 960 kJ at a speed of 40 m/s.

(i) Calculate the mass of the car.

(4)

mass = ... kg

(ii) Only 5% of the energy of the lightning bolt is transferred to the kinetic energy of the car.

Calculate the total energy of the lightning bolt in MJ.

(2)

energy = ... MJ

(Total for question = 6 marks)

Q3.

Figure 15 is a speed limit sign from a European motorway. The speeds shown are in km/h (kilometres per hour).

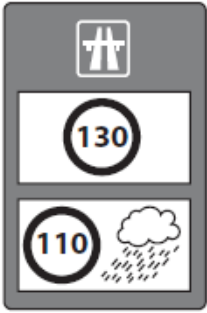


Figure 15

(i) The sign tells drivers to drive at a slower speed in wet weather.

Explain why it is safer for drivers to drive at a slower speed in wet weather.

(2)

.....

.....

.....

.....

(ii) Show that a speed of 31 m/s is less than a speed of 130 km/h.

(2)

(iii)

The driver's reaction time is the time between the driver seeing an emergency and starting to brake.

A car is travelling at a speed of 31 m/s.

The car travels 46 m between the driver seeing an emergency and starting to brake.

Calculate the driver's reaction time.

Give your answer to 2 significant figures.

(3)

driver's reaction time s

(Total for question = 7 marks)

Q4.

Figure 5 is a speed limit sign from a European motorway.

The speeds shown are in km/h (kilometres per hour).

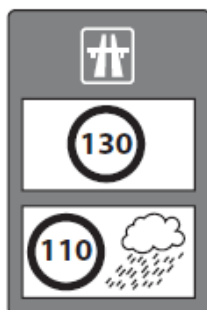


Figure 5

(i) The sign tells drivers to drive at a slower speed in wet weather.

Explain why it is safer for drivers to drive at a slower speed in wet weather.

(2)

.....

.....

.....

.....

(ii) Show that a speed of 31 m/s is less than a speed of 130 km/h.

(2)

(iii)

The driver's reaction time is the time between the driver seeing an emergency and starting to brake.

A car is travelling at a speed of 31 m/s.

The car travels 46 m between the driver seeing an emergency and starting to brake.

Calculate the driver's reaction time.

Give your answer to 2 significant figures.

(3)

driver's reaction time s

Q5.

Figure 3 is a speed limit sign from a European motorway.

The speeds shown are in km/h (kilometres per hour).

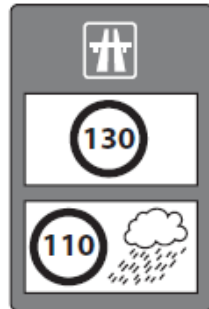


Figure 3

(i) The sign tells drivers to drive at a slower speed in wet weather.

Explain why it is safer for drivers to drive at a slower speed in wet weather.

(2)

.....

.....

.....

.....

(ii) Show that a speed of 31 m/s is less than a speed of 130 km/h.

(2)

(iii)

The driver's reaction time is the time between the driver seeing an emergency and starting to brake.

A car is travelling at a speed of 31 m/s.

The car travels 46 m between the driver seeing an emergency and starting to brake.

Calculate the driver's reaction time.

Give your answer to 2 significant figures.

driver's reaction time s

(Total for question = 7 marks)

Q6.

Complete the sentence by putting a cross (☒) in the box next to your answer.

A student correctly estimated the length of a bee.

The length of a bee is about 2.0

(1)

- ☐ A mm
- ☐ B cm
- ☐ C m
- ☐ D km

Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(i)	Substitution: Density = mass/ volume (1) = 28 x10 ⁻³ / 3.6 x 10 ⁻⁶ (1) Evaluation = 7777 kg / m ³ (1)	(recalled / used) ignore any power of ten (pot) error here do not penalise any sf errors (7.77 etc. would get 2 marks: losing the pot mark in the evaluation)	(3)

	Answer	Additional guidance	Mark
(i)	an explanation linking two from: (wet road means) less / no friction (between tyres and road) (1) (wet weather means) increased stopping distance (1) (slower speed means) shorter braking / stopping distance (1) (dry weather / slower speed) reduces possibility of skidding / sliding / idea of losing control / crashing (1)	accept reverse arguments throughout accept road more slippery / less grip accept idea of reduced visibility accept braking or thinking distance in this context accept takes longer to slow down / stop ignore harder to brake	(2) AO1

	Answer	Additional guidance	Mark
(ii)	convert either distance or time (1) $(31 \text{ m} =) \frac{31}{1000} (\text{km})$ or 0.031 (km) OR $(1 \text{ s} =) \frac{1}{3600} (\text{h}) = \frac{1}{60 \times 60} (\text{h})$ or 0.000 28 (h) evaluation (1) $(31 \text{ m/s} =) 110 (\text{km/h})$	$(130 \text{ km} =) 130 \times 1000 (\text{m})$ or 130 000 (m) OR $(1 \text{ h} =) 60 \times 60 (\text{s})$ or 3600 (s) $(130 \text{ km/h} =) 36(.1) (\text{m/s})$ accept 111.6 or 112 (km/h) for 2 marks if no other marks awarded accept <u>1860 m/min</u> and <u>2167 m/min</u> for 1 mark each award full marks for the correct answer without working	(2) AO2

	Answer	Additional guidance	Mark
(iii)	select and substitute into distance travelled = average speed x time (1) $46 = 31 \times t$ rearrangement and evaluation (1) $(t =) 1.48(3) \text{ (s)}$ evaluation given to 2 sf (1) $(t =) 1.5 \text{ (s)}$	$31 = \frac{46}{t}$ $(t =) \frac{46}{31}$ award two marks for the correct evaluation without working any answer written to 2 sf independent mark 1.5 scores 3 marks 1.4 scores 2 marks 1.50 scores 2 marks 0.67 scores 2 marks 1400 scores 2 marks 0.673(9) scores 1 mark 1426 scores 1 mark	(3) AO2

Q4.

	Answer	Additional guidance	Mark
(i)	an explanation linking two from: (wet road means) less / no friction (between tyres and road) (1) (wet weather means) increased stopping distance (1) (slower speed means) shorter braking / stopping distance (1) (dry weather / slower speed) reduces possibility of skidding / sliding / idea of losing control / crashing (1)	accept reverse arguments throughout accept (road) more slippery / less grip accept idea of reduced visibility accept braking or thinking distance in this context accept takes longer to slow down / stop ignore harder to brake	(2) AO1

	Answer	Additional guidance	Mark
(ii)	convert either distance or time (1) $(31 \text{ m} =) \frac{31}{1000} (\text{km})$ or 0.031 (km) OR $(1 \text{ s} =) \frac{1}{3600} (\text{h}) = \frac{1}{60 \times 60} (\text{h})$ or 0.000 28 (h) evaluation (1) $(31 \text{ m/s} =) 110 (\text{km/h})$	$(130 \text{ km} =) 130 \times 1000 (\text{m})$ or 130 000 (m) OR $(1 \text{ h} =) 60 \times 60 (\text{s})$ or 3600 (s) $(130 \text{ km/h} =) 36(.1) (\text{m/s})$ accept 111.6 or 112 (km/h) for 2 marks if no other marks awarded accept <u>1860 m/min</u> and <u>2167 m/min</u> for 1 mark each award full marks for the correct answer without working	(2) AO2

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Q5.

	Answer	Additional guidance	Mark
(i)	an explanation linking two from: (wet road means) less / no friction (between tyres and road) (1) (wet weather means) increased stopping distance (1) (slower speed means) shorter braking / stopping distance (1) (dry weather / slower speed) reduces possibility of skidding / sliding / idea of losing control / crashing (1)	accept reverse arguments throughout accept (road) more slippery / less grip accept idea of reduced visibility accept braking or thinking distance in this context accept takes longer to slow down / stop ignore harder to brake	(2) AO1

	Answer	Additional guidance	Mark
(ii)	convert either distance or time (1) $(31 \text{ m} =) \frac{31}{1000} (\text{km})$ or 0.031 (km) OR $(1 \text{ s} =) \frac{1}{3600} (\text{h}) = \frac{1}{60 \times 60} (\text{h})$ or 0.000 28 (h) evaluation (1) $(31 \text{ m/s} =) 110 (\text{km/h})$	$(130 \text{ km} =) 130 \times 1000 (\text{m})$ or 130 000 (m) OR $(1 \text{ h} =) 60 \times 60 (\text{s})$ or 3600 (s) $(130 \text{ km/h} =) 36(.1)(\text{m/s})$ accept 111.6 or 112 (km/h) for 2 marks` accept <u>1860 m/min</u> and <u>2167 m/min</u> for 1 mark each award full marks for the correct answer without working	(2) AO2

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(iii)	select and substitute into distance travelled = average speed x time (1) $46 = 31 \times t$ rearrangement and evaluation (1) $(t =) 1.48(3) \text{ (s)}$ evaluation given to 2 sf (1) $(t =) 1.5 \text{ (s)}$	$31 = \frac{46}{t}$ $(t =) \frac{46}{31}$ award two marks for the correct evaluation without working any answer written to 2 sf independent mark 1.5 scores 3 marks 1.4 scores 2 marks 1.50 scores 2 marks 0.67 scores 2 marks 1400 scores 2 marks 0.673(9) scores 1 mark 1426 scores 1 mark	(3) AO2

Q6.

Question Number	Answer	Acceptable answers	Mark
	B cm		(1)