

APOLLO

Standing waves and resonance

HL

Physics

First assessment 2025

9 questions | mark schemes

Mark-scheme answers

Physics HL | Paper 1A | May 2025 TZ1 | Q22 | 1 marks

22. C

Physics HL | Paper 1A | May 2025 TZ2 | Q19 | 1 marks

19. A

Physics HL | Paper 1A | May 2025 TZ3 | Q25 | 1 marks

25. B

Physics HL | Paper 1A | Nov 2025 TZ1 | Q21 | 1 marks

21. C

Physics HL | Paper 1A | Nov 2025 TZ1 | Q22 | 1 marks

22. A

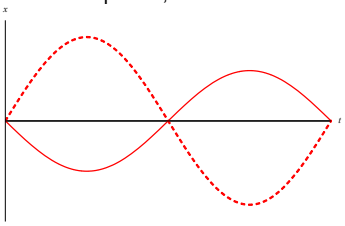
Physics HL | Paper 1A | Nov 2025 TZ3 | Q24 | 1 marks

24. C

9.	a	i	ALTERNATIVE 1 One mole contains 6.02×10^{23} atoms and has mass 63.5 g ✓ Mass of one atom is $\frac{63.5 \times 10^{-3}}{6.02 \times 10^{23}} = 1.055 \times 10^{-25} \approx 1.1 \times 10^{-25}$ kg ✓ ALTERNATIVE 2 The atom has mass 63.5 u ✓ I.e. $63.5 \times 1.661 \times 10^{-27} = 1.055 \times 10^{-25} \approx 1.1 \times 10^{-25}$ kg ✓	Award full marks for a CNA Accept similar calculation for a mass of 0.4 kg ($n = 6.3$)	[2]
9.	a	ii	Volume of copper = $\frac{0.0635}{8940}$ ✓ $V = \frac{0.0635}{(8940 \times 6.02 \times 10^{23})} = 1.2 \times 10^{-29} \text{ m}^3$ ✓	Award full marks for a CNA Accept similar calculation for a mass of 0.4 kg	[2]
9.	a	iii	Side of cube $a = \sqrt[3]{1.180 \times 10^{-29}} = 2.277 \times 10^{-10} \approx 2 \times 10^{-10}$ m ✓	Allow ECF from a ii Award the mark for the CNA	[1]
9.	b		$Q \ll mL = 0.400 \times 206 \times 10^3 = 82.4 \text{ kJ}$ ✓		[1]

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Question			Answers	Notes	Total
9.	c		Internal energy is greater in the liquid phase ✓ in liquid the intermolecular potential energy is greater / the separation is greater / energy has been added ✓ kinetic energy is unchanged / temperature is the same / internal energy is the sum of kinetic and potential energies ✓		[3]
9.	d	i	wave «created by the hammer» is reflected / two «identical» waves in opposite directions ✓ the right and left waves superpose / add up / interfere ✓	Accept reference to constructive and destructive interference in MP2	[2]
9.	d	ii	Antinodes at both ends, a node in the middle ✓	Accept only one wave or wave and envelope, either solid or broken lines.	[1]
9.	d	iii	Opposite line i.e. phase difference of π ✓ Smaller amplitude, ✓ 	Labelling not necessary MP2 only scores if MP1 scores	[2]
9.	e	i	The standing wave is longitudinal/sand moves horizontally / sand is pushed/vibrates OR there are nodes and antinodes ✓ « sand moves» away from antinodes/ to nodes ✓		[2]

Question			Answers	Notes	Total
9.	e	ii	ALTERNATIVE 1 Wavelength in air is $2d$ ($= 3.6 \text{ cm}$) ✓ Frequency of wave in copper is the same as that in the air in the tube ✓ $\frac{v_{\text{Cu}}}{2L} = \frac{v_{\text{air}}}{2d} \text{ ✓}$ $v_{\text{Cu}} = \frac{L}{d} \times v_{\text{air}} = \frac{34}{1.8} \times 330 = 6.2 \times 10^3 \text{ m s}^{-1} \text{ ✓}$ ALTERNATIVE 2 Wavelength in air is $2d$ ($= 3.6 \text{ cm}$) ✓ $f = \frac{330}{3.6 \times 10^{-2}} = 9.167 \times 10^3 \text{ Hz} \text{ ✓}$ $\lambda_{\text{Cu}} = 68 \text{ cm} \text{ ✓}$ $v_{\text{Cu}} = 9167 \times 0.68 = 6.2 \times 10^3 \text{ m s}^{-1} \text{ ✓}$	Award [4] for a CNA Allow ECF from wrong wavelengths	[4]

Question	Answers	Notes	Total
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Mark-scheme answers

Physics HL | Paper 1A | Specimen 2025 | Q20 | 1 marks

20. C

3.	a	standing waves form «in the oven» by superposition / constructive interference✓ energy transfer is greatest at the antinodes «of the standing wave pattern»✓		2
3.	b	$\lambda = 12.2 \text{ cm}$ ✓ $f \ll \frac{c}{\lambda} = \frac{3.0 \times 10^8}{1.22 \times 10^{-1}}$ ✓ $f = 2.46 \text{ GHz}$ ✓ correct answer only including power of ten	Allow $\lambda \pm 2 \text{ mm}$. Condone power of ten error in MP2 only.	3

Question	Answers	Notes	Total
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