

CIE A-Level Physics 9702 Paper 2 Practice

Paper (AS) - ANSWERS

Total: 60 marks · 1 hour 15 minutes · 6 questions · 23 parts

Part	Answer	Marking points	marks
1(a)	A scalar has magnitude only; a vector has both magnitude and direction. e.g. speed (scalar), velocity (vector).	1 mark: scalar magnitude only, vector magnitude and direction 1 mark: correct example pair such as speed/velocity	2
1(b)	$a = (26.0 - 8.0)/6.0 = 3.0 \text{ m/s}^2$; $s = (8.0 + 26.0)/2 \times 6.0 = 102 \text{ m}$	1 mark: $a = 3.0 \text{ m/s}^2$ 1 mark: uses mean velocity 17.0 m/s 1 mark: $s = 102 \text{ m}$	3
1(c)	$t = \sqrt{2 \times 45/9.81} = 3.03 \text{ s}$; $v = 9.81 \times 3.03 = 29.7 \text{ m/s}$	1 mark: $t = \sqrt{2s/g}$ 1 mark: $t = 3.03 \text{ s}$ 1 mark: $v = 29.7 \text{ m/s}$	3
1(d)	Displacement = $0.5 \times 4.0 \times 12 + 6.0 \times 12 = 24 + 72 = 96 \text{ m}$ (area under the graph)	1 mark: area split into two sections 1 mark: 96 m	2
2(a)	The resultant force on a body equals its rate of change of momentum; when mass is constant this gives $F = ma$.	1 mark: resultant force equals rate of change of momentum 1 mark: mass constant so $F = ma$	2
2(b)	$a = F/m = 3600/1200 = 3.0 \text{ m/s}^2$	1 mark: $3.6 \text{ kN} = 3600 \text{ N}$ 1 mark: $a = 3.0 \text{ m/s}^2$	2
2(c)	Momentum: $2.0 \times 3.0 = 3.0 \times v$ so $v = 2.0 \text{ m/s}$; KE before = $0.5 \times 2.0 \times 3.0^2 = 9.0 \text{ J}$; KE after = $0.5 \times 3.0 \times 2.0^2 = 6.0 \text{ J}$; loss = 3.0 J	1 mark: $6.0 = 3.0v$ 1 mark: $v = 2.0 \text{ m/s}$ 1 mark: KE 9.0 J before, 6.0 J after 1 mark: loss 3.0 J	4
2(d)	The collision is inelastic: some kinetic energy is transferred to internal energy (heat) and sound, though momentum is still conserved.	1 mark: inelastic collision 1 mark: KE converted to	2

		heat/sound while momentum conserved	
3(a)	$W = 250 \times 9.81 \times 12 = 29,430 \text{ J}$; $P_{\text{out}} = 29,430/20 = 1,471.5 \text{ W} = 1.5 \text{ kW}$; $P_{\text{in}} = 1,471.5/0.70 = 2,102 \text{ W} = 2.1 \text{ kW}$	1 mark: $W = 29,430 \text{ J}$ 1 mark: $P_{\text{out}} = 1.5 \text{ kW}$ 1 mark: divide by 0.70, not multiply 1 mark: $P_{\text{in}} = 2.1 \text{ kW}$	4
3(b)	$k = 12/0.060 = 200 \text{ N/m}$; $E = 0.5 \times 12 \times 0.060 = 0.36 \text{ J}$	1 mark: $k = 200 \text{ N/m}$ 1 mark: $E = 0.5Fx$ 1 mark: $E = 0.36 \text{ J}$	3
3(c)	$A = \pi(0.20 \times 10^{-3})^2 = 1.26 \times 10^{-7} \text{ m}^2$; stress = $8.0/1.26 \times 10^{-7} = 6.4 \times 10^7 \text{ Pa}$; strain = $1.2 \times 10^{-3}/2.50 = 4.8 \times 10^{-4}$; $E = 1.3 \times 10^{11} \text{ Pa}$	1 mark: $A = 1.26 \times 10^{-7} \text{ m}^2$ (use radius) 1 mark: stress $6.4 \times 10^7 \text{ Pa}$, strain 4.8×10^{-4} 1 mark: $E = 1.3 \times 10^{11} \text{ Pa}$	3
4(a)	$\lambda = v/f = 340/512 = 0.664 \text{ m}$	1 mark: $\lambda = v/f$ 1 mark: 0.664 m	2
4(b)	In a transverse wave the oscillation is perpendicular to the direction of travel (e.g. light); in a longitudinal wave it is parallel (e.g. sound).	1 mark: oscillation perpendicular / parallel to travel 1 mark: correct examples	2
4(c)	$x = \lambda D/a = 0.030 \times 2.0/0.12 = 0.50 \text{ m}$	1 mark: $x = \lambda D/a$ 1 mark: substitution 1 mark: 0.50 m	3
4(d)	$f_3 = 3 \times 250 = 750 \text{ Hz}$; the third harmonic has 3 antinodes, $\lambda = 2L/3 = 1.60/3 = 0.533 \text{ m}$	1 mark: $f_3 = 750 \text{ Hz}$ 1 mark: $\lambda = 2L/3$ 1 mark: 0.533 m	3
5(a)	e.m.f. is the energy converted from other forms to electrical energy per unit charge in the source; p.d. is the energy converted from electrical to other forms per unit charge across a component.	1 mark: e.m.f. energy gained per unit charge in the source 1 mark: p.d. energy lost per unit charge across a component	2
5(b)	$\rho = RA/L = 0.90 \times 2.0 \times 10^{-7}/1.5 = 1.2 \times 10^{-7} \text{ ohm m}$	1 mark: $\rho = RA/L$ 1 mark: $1.2 \times 10^{-7} \text{ ohm m}$	2
5(c)	$I = 6.0/(0.50+2.5) = 2.0 \text{ A}$; $V = 6.0 - 2.0 \times 0.50 = 5.0 \text{ V}$; $P_{\text{ext}} = 2.0^2 \times 2.5 = 10 \text{ W}$; $P_{\text{int}} = 2.0^2 \times 0.50 = 2.0 \text{ W}$	1 mark: $I = 2.0 \text{ A}$ (total 3.0 ohm) 1 mark: $V = 5.0 \text{ V}$	4

		1 mark: $P_{\text{ext}} = 10 \text{ W}$ 1 mark: $P_{\text{int}} = 2.0 \text{ W}$	
5(d)	$V_{\text{out}} = 12 \times 2.0 / (4.0 + 2.0) = 4.0 \text{ V}$; as temperature rises the thermistor resistance falls, so its share of the voltage falls and V_{out} decreases.	1 mark: divider $12 \times 2.0 / 6.0$ 1 mark: 4.0 V 1 mark: resistance falls as temperature rises 1 mark: V_{out} decreases	4
6(a)	Proton uud (charge +1); neutron udd (charge 0).	1 mark: uud 1 mark: udd	2
6(b)	$n \rightarrow p + e^- + \text{antineutrino}$; a d quark changes into a u quark.	1 mark: $n \rightarrow p + e^- + \text{antineutrino}$ 1 mark: d $\rightarrow$ u	2
6(c)	Nucleon number $14 = 14 + 0 + 0$; charge $6 = 7 + (-1) + 0$, so both are conserved.	1 mark: nucleon number $14 = 14$ 1 mark: charge $6 = 7 - 1$	2
6(d)	$E = hc/\lambda = 6.63 \times 10^{-34} \times 3.00 \times 10^8 / 520 \times 10^{-9} = 3.83 \times 10^{-19} \text{ J} = 2.39 \text{ eV}$	1 mark: $3.83 \times 10^{-19} \text{ J}$ 1 mark: 2.39 eV	2