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PHYSICS **9702/23**

Paper 2 AS Level Structured Questions **October/November 2019**

MARK SCHEME

Maximum Mark: 60

Published

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Question	Answer	Marks
2(a)	(work done =) force × distance <u>moved</u> in direction of force	**B1**
2(b)(i)	**1.** acceleration = gradient **or** $a = (v - u) / t$ **or** $a = \Delta v / t$	**C1**
	e.g. $a = 2.4 / 3.0$ $= 0.80\ \text{m s}^{-2}$	**A1**
	2. tension in cable = $(13.0 + 2.0) \times 10^3$	**C1**
	work done $= 15 \times 10^3 \times (3.0 \times 2.4)$ $= 1.1 \times 10^5\ \text{J}$	**A1**
2(b)(ii)	power = Fv	**C1**
	$v = 2.0\ (\text{m s}^{-1})$	**C1**
	input power $= (1.6 \times 10^4 \times 2.0) / 0.67$ $= 4.8 \times 10^4\ \text{W}$	**A1**
2(b)(iii)	work is done against friction so (increase in) GPE is less (than work done by motor) **or** energy is lost or transferred or converted to heat/thermal energy due to friction or resistance force **or** work is done lifting the cable so GPE is less	**A1**

Question	Answer	Marks
3(a)(i)	mass	**B1**
3(a)(ii)	charge	**B1**
3(b)(i)	$E = V/d$ **or** $E = F/q$	**C1**
	$F = (1.2 \times 10^3 \times 4.2 \times 10^{-9}) / 3.6 \times 10^{-2}$	**C1**
	$= 1.4 \times 10^{-4}$ N	**A1**
3(b)(ii)	$W = mg$	**C1**
	$= 5.9 \times 10^{-6} \times 9.81$ resultant force = $1.4 \times 10^{-4} - (5.9 \times 10^{-6} \times 9.81)$	**C1**
	$a = F/m$	**C1**
	$a = [1.4 \times 10^{-4} - (5.9 \times 10^{-6} \times 9.81)] / [5.9 \times 10^{-6}] = 14\ \text{m s}^{-2}$	**A1**
3(b)(iii)	**1.** $s = ut + ½at^2$ $1.8 \times 10^{-2} = ½ \times 14 \times t^2$	**C1**
	$t = 0.051$ s	**A1**
	2. $p = 0.75 \times 0.051$ $= 0.038$ m	**A1**

Question	Answer	Marks
4(a)(i)	$p = mv$	**C1**
	$= 0.2(00) \times 6.(00) \times \sin 60(.0)°$ **or** $0.2(00) \times 6.(00) \times \cos 30(.0)°$ $= 1.04\ \text{kg m s}^{-1}$	**A1**
4(a)(ii)	$0.300 \times v_x \times \sin 60.0° = 1.04$ $v_x = 4.00\ \text{m s}^{-1}$	**A1**
4(a)(iii)	$0.30 \times 4.0 \times \cos 60°$ **or** $0.20 \times 6.0 \times \cos 60°$ **or** $(0.30 + 0.20)v$ **or** $0.50v$	**C1**
	$0.30 \times 4.0 \times \cos 60° + 0.20 \times 6.0 \times \cos 60° = (0.30 + 0.20)v$ **or** $0.50v$ so $v = 2.4\ \text{m s}^{-1}$	**A1**
4(b)(i)	$E = ½mv^2$	**C1**
	$½ \times 0.50 \times 2.4^2 = ½ \times 72 \times x^2$	**C1**
	$x = 0.20\ \text{m}$	**A1**
4(b)(ii)	**1.** straight line from the origin sloping upwards	**B1**
	2. line drawn from a positive value of E_k at $x = 0$ to a positive value of x at $E_k = 0$	**M1**
	line has an increasing downwards slope	**A1**

Question	Answer	Marks
5(a)(i)	(coherence means) constant phase difference (between waves)	**B1**
5(a)(ii)	(interference is) the sum/addition/combination of the displacements of overlapping/meeting waves	**B1**
5(b)(i)	$n\lambda = d \sin\theta$	**C1**
	λ = sin 51° / (2 × 6.7 × 10^5) = 5.8 × 10^{-7} m	**A1**
5(b)(ii)	smaller angle (corresponding to second order maxima and so) shorter distance (between second order maxima spots)	**B1**

Question	Answer	Marks
6(a)(i)	$R = V / I$	**C1**
	resistance = (12 / 0.20) / 2 **or** 6 / 0.20 = 30 Ω	**A1**
6(a)(ii)	I = 0.50 – 0.20 (= 0.30 A)	**C1**
	R + 28 = 12 / 0.30 (= 40 Ω) R = 12 Ω	**A1**

Question	Answer	Marks
6(b)	p.d. across lamp = 0.20×30 (= 6.0 V)	**C1**
	p.d. across $R = 0.30 \times 12$ (= 3.6 V)	**C1**
	$V_{XY} = 6.0 - 3.6$ $= 2.4\,\text{V}$	**A1**
	or	
	p.d. across lamp = 0.20×30 (= 6.0 V)	**(C1)**
	p.d. across $28\,\Omega$ resistor = 0.30×28 (= 8.4 V)	**(C1)**
	$V_{XY} = 8.4 - 6.0$ $= 2.4\,\text{V}$	**(A1)**
6(c)	$P = VI$ **or** $P = EI$ **or** $P = I^2R$ **or** $P = V^2/R$	**C1**
	ratio = $(6.0 \times 0.20) \times 2 / (12 \times 0.50)$ **or** $0.20 / 0.50$ $= 0.40$	**A1**
6(d)	no change to V across lamps, so power in lamps unchanged **or** current in battery/total current increases (and e.m.f. the same) so power produced by battery increases	**B1**
	both the above statements and so the ratio decreases	**B1**

Question	Answer	Marks
7(a)	number of protons = 95	**A1**
	number of neutrons = 146	**A1**
7(b)	Np/neptunium (nucleus) has <u>kinetic</u> energy **or** gamma/γ-radiation produced	**B1**
7(c)(i)	$I = NQ / t$	**C1**
	$I = (6.9 \times 10^{11} \times 2 \times 1.60 \times 10^{-19}) / 30$ $= 7.4 \times 10^{-9}$ A	**A1**
7(c)(ii)	$P = (6.9 \times 10^{11} \times 5.5 \times 10^{6} \times 1.60 \times 10^{-19}) / 30$	**C1**
	$= 0.020$ W	**A1**