







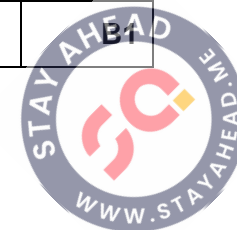


Question	Answer	Marks
2(b)(iii)	1 $(\Delta)E = mg(\Delta)h$ $= 85 \times 9.81 \times 3200$	C1
	$= 2.7 \times 10^6 \text{ J}$	A1
	2 <u>In terms of energy:</u> work done = $2.7 \times 10^6 \text{ J}$ force = $2.7 \times 10^6 / (47 \times 2.8 \times 60)$	C1
	$= 340 \text{ N}$	A1
	<u>In terms of forces:</u> component of weight along path = force due to air resistance force = $85 \times 9.81 \times \sin 24^\circ$	(C1)
	$= 340 \text{ N}$	(A1)
2(b)(iv)	$(\Delta)p = \rho g(\Delta)h$ $(92 - 63) \times 10^3 = \rho \times 9.81 \times 3200$	C1
	$\rho = 0.92 \text{ kg m}^{-3}$	A1

Question	Answer	Marks
3(a)	$(m \times 3.0)$ or $(2.5 \times 9.6 \times \cos 60^\circ)$	C1
	$(m \times 3.0) - (2.5 \times 9.6 \times \cos 60^\circ) = 0$ so $m = 4.0 \text{ (kg)}$	A1

Question	Answer	Marks
3(b)	$2.5 \times 9.6 \times \sin 60^\circ = (4.0 + 2.5) \times V$	<b>C1</b>
	$V = 3.2 \text{ m s}^{-1}$	<b>A1</b>
	or use of momentum vector triangle: $(4.0 \times 3.0)^2 + [(4.0 + 2.5) \times V]^2 = (2.5 \times 9.6)^2$	<b>(C1)</b>
	$V = 3.2 \text{ m s}^{-1}$	<b>(A1)</b>
3(c)	$E = \frac{1}{2}mv^2$ difference in $E_k = \frac{1}{2} \times 2.5 \times (9.6)^2 - \frac{1}{2} \times 4.0 \times (3.0)^2$	<b>C1</b>
	$= 97 \text{ J}$	<b>A1</b>

Question	Answer	Marks
4(a)	force per unit positive charge	<b>B1</b>
4(b)(i)	1 $E = V/d$ or $E = \Delta V/\Delta d$ $d = 4.0 \times 10^3 / 5.0 \times 10^4$	<b>C1</b>
	$= 8.0 \times 10^{-2} \text{ m}$	<b>A1</b>
	2 plates are (in) horizontal (plane) (above and below the rod)	<b>B1</b>
	top (plate) negative and bottom (plate) positive	<b>B1</b>
4(b)(ii)	magnitude $= 5.0 \times 10^4 \times 3 \times 1.6 \times 10^{-19}$ $= 2.4 \times 10^{-14} \text{ N}$	<b>A1</b>
	direction is (vertically) downwards / down	<b>B1</b>



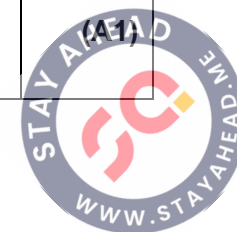
Question	Answer	Marks
4(b)(iii)	$6.2 \times 10^{-16} = 2.4 \times 10^{-14} \times 72 \times 10^{-3} \times \cos \theta$	<b>C1</b>
	$\theta = 69^\circ$	<b>A1</b>

Question	Answer	Marks
5(a)(i)	(two) waves meet/overlap (at a point)	<b>B1</b>
	(resultant) displacement is sum of the displacement of each wave	<b>B1</b>
5(a)(ii)	constant phase difference (between the waves)	<b>B1</b>
5(b)	$I \propto A^2$ $3I / I = (A + 1.5)^2 / 1.5^2$	<b>C1</b>
	$A = 1.1 \text{ cm}$	<b>A1</b>
5(c)(i)	$\lambda = ax / D$	<b>C1</b>
	e.g. $a = 680 \times 10^{-9} \times 2.0 / 4.0 \times 10^{-3}$	<b>C1</b>
	$a = 3.4 \times 10^{-4} \text{ m}$	<b>A1</b>
5(c)(ii)	straight line from positive value on x-axis and always below 'old' line	<b>B1</b>
	straight line with a smaller positive gradient than 'old' line	<b>B1</b>

Question	Answer	Marks
6(a)	e.m.f.: energy transferred from chemical to electrical (per unit charge)	<b>B1</b>
	p.d.: energy transferred from electrical to thermal (per unit charge)	<b>B1</b>

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Question	Answer	Marks
6(b)(i)	1 $I = 4.8 / 32$ $= 0.15 \text{ A}$	<b>A1</b>
	2 $P = EI$ or $P = VI$ or $P = I^2R$ or $P = V^2 / R$ $= 6.0 \times 0.15$ or $0.15^2 \times 40$ or $6.0^2 / 40$	<b>C1</b>
	$= 0.90 \text{ W}$	<b>A1</b>
	3 number = $It / e$ $= [0.15 \times 25] / 1.6 \times 10^{-19}$	<b>C1</b>
	$= 2.3 \times 10^{19}$	<b>A1</b>
	or $Q = 0.15 \times 25 (= 3.75)$ number = $3.75 / 1.6 \times 10^{-19}$	<b>(C1)</b>
	$= 2.3 \times 10^{19}$	<b>(A1)</b>
	4 $4.8 / 6.0 = 32 / (R_{XY} + 32)$ or $1.2 / 6.0 = R_{XY} / (R_{XY} + 32)$ or $4.8 / 1.2 = 32 / R_{XY}$	<b>C1</b>
	$R_{XY} = 8.0 \Omega$	<b>A1</b>
	Alternative methods:	
	$R_{XY} = (6.0 - 4.8) / 0.15$ or	<b>(C1)</b>
	$= 8.0 \Omega$	<b>(A1)</b>
	or $6.0 = 0.15 (32 + R_{XY})$	<b>(C1)</b>
$R_{XY} = 40 - 32$ $= 8.0 \Omega$	<b>(A1)</b>	





Question	Answer	Marks
6(b)(i)	5 $1/8.0 = 1/R_x + 1/24$	<b>C1</b>
	$R_x = 12 \Omega$	<b>A1</b>
	Alternative method:	
	$I_Z = 4.8/32 = 0.15$ and $I_Y = 1.2/24 = 0.05$ $I_x = 0.15 - 0.05 (= 0.10)$	<b>(C1)</b>
	$R_x = 1.2/0.10 = 12 \Omega$	<b>(A1)</b>
6(b)(ii)	<u>total</u> resistance decreases	<b>M1</b>
	(so voltmeter) reading increases	<b>A1</b>

Question	Answer	Marks
7(a)(i)	alpha, neutron and proton	<b>B1</b>
7(a)(ii)	neutron	<b>B1</b>
7(a)(iii)	beta plus or $\beta^+$	<b>B1</b>
7(b)	$\bar{d}$ has charge $(+)\frac{1}{3} e$	<b>C1</b>
	(so) other quark has charge $= e - \frac{1}{3} e$ $= (+)\frac{2}{3} e$	<b>M1</b>
	other quark is an up / u	<b>A1</b>

