
PHYSICS**9702/23**

Paper 2 AS Level Structured Questions

May/June 2017

MARK SCHEME

Maximum Mark: 60

Published

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This document consists of **7** printed pages.

Question	Answer	Marks
1(a)(i)	$R = 7(.0) \text{ N}$	B1
1(a)(ii)	$R = 13 \text{ N}$	B1
1(b)(i)	forces resolved: $18 \sin 65^\circ$ (vertical) and $55 + 18 \cos 65^\circ$ (horizontal) or scale drawing: correct triangle drawn for forces	B1
	$F = [(18 \sin 65^\circ)^2 + (55 + 18 \cos 65^\circ)^2]^{1/2} = 65 (64.7) \text{ N}$ or scale drawing: scale given, length of resultant given correctly, $\pm 1 \text{ N}$	A1
1(b)(ii)	angle = $\tan^{-1} [18 \sin 65^\circ / (55 + 18 \cos 65^\circ)] = \tan^{-1} (16.3 / 62.6)$ or scale drawing: correct angle measured/direction correct on diagram below the 55 N force	C1
	angle = $15 (14.6)^\circ$ (below the 55 N force) or scale drawing: angle = $15^\circ \pm 1^\circ$	A1
1(c)	(resultant) force = mass \times acceleration	C1
	$80 - 65 = 2.7a$	C1
	$a = 5.6 \text{ m s}^{-2}$ [5.7 if 64.7 N used from (i)]	A1

Question	Answer	Marks
2(a)	(resultant) force is proportional/equal to the rate of change of momentum	B1
2(b)(i)	change in momentum = $m(v_2 - v_1)$ $= 0.84 \times (8.8 - 4.2)$	C1
	$= 3.9 \text{ (3.86) kg m s}^{-1}$	A1
2(b)(ii)	$F = (3.9 / 4.0) = 0.97 \text{ (0.965) N}$	A1
2(c)(i)	change in momentum for A: $0.84 \times (4.7 - 8.8) = -3.4 \text{ (3.44)}$ change in momentum for B: $0.73 \times (4.7 - 0) = 3.4 \text{ (3.43)}$	M1
	change in momentum for B is equal and opposite to A	A1
2(c)(ii)	change in momentum equal (for A and B)	M1
	force is change in momentum / time and time (of collision) is the same hence force on A and B equal and opposite as for Newton's third law	A1
2(c)(iii)	inelastic as relative speed of approach not equal to relative speed of separation	B1

Question	Answer	Marks
3(a)	force per unit (positive) charge	B1
3(b)(i)	$a = (v^2 - u^2) / 2s$ $= [(18 \times 10^6)^2 - (2.5 \times 10^3)^2] / (2 \times 12 \times 10^{-3})$	B1
	$= 1.3 (1.35) \times 10^{16} \text{ m s}^{-2}$	A1
3(b)(ii)	KE = $\frac{1}{2} mv^2$ or $\frac{1}{2} m(v^2 - u^2)$	C1
	change in KE = $0.5 \times 9.11 \times 10^{-31} \times [(18 \times 10^6)^2 - (2.5 \times 10^3)^2]$	B1
	$= 1.5 (1.48) \times 10^{-16} \text{ J}$	A1
3(b)(iii)	$E = F / e = ma / e$ or $eV = \Delta\text{KE}$ so $E = \Delta\text{KE} / (e \times d)$	C1
	$E = (9.11 \times 10^{-31} \times 1.35 \times 10^{16}) / 1.60 \times 10^{-19}$ or $E = (1.48 \times 10^{-16}) / (12 \times 10^{-3} \times 1.60 \times 10^{-19})$	C1
	$= 7.7 (7.69) \times 10^4 \text{ V m}^{-1}$	A1
3(c)	charge on α opposite to electron/charge on α is positive	B1
	ΔKE is negative/KE reduced	B1
	charge of α greater/twice that of electron causes larger/twice ΔKE (in magnitude)	B1

Question	Answer	Marks
4(a)	the straight line does not go through the origin/the force is not proportional to extension (so does not obey Hooke's law)	A1
4(b)	elastic potential energy	B1
4(c)	remove the force/masses and the spring returns to its original length if elastic	B1
4(d)	work done is represented by/linked to area under the line ($\times g$)	C1
	work = $\frac{1}{2} (145 + 70) \times 10^{-3} \times 9.81 \times 120 \times 10^{-3}$	C1
	= 0.13 (0.127) J	A1

Question	Answer	Marks
5(a)(i)	waves at the elements/slits	B1
	waves spread (into the geometric shadow)	B1
5(a)(ii)	1. waves (from each element/slit) overlap/meet/superpose with a phase difference/path difference of zero	B1
	2. phase difference is 360° /path difference of λ	B1
		B1
5(b)(i)	e.g. gradient = $(0.40 - 0.32) / [(500 - 400) \times 10^{-9}]$	C1
	= $8(.0) \times 10^5$	A1
5(b)(ii)	$d \sin \theta = n\lambda$ $d = n / \text{gradient}$	C1
	= $2 / 8.0 \times 10^5 = 2.5 \times 10^{-6} \text{ m}$	A1
5(b)(iii)	straight line drawn with lower gradient (about $\frac{1}{2}$) and all points lower	B1

Question	Answer	Marks
6(a)(i)	straight line <u>through the origin</u>	B1
6(a)(ii)	zero current for one direction (–ve V) up to zero or a few tenths of volt (+ve V)	B1
	straight line positive gradient/increasing gradient (+ve V)	B1
6(b)(i)	1. current = 2.8 A	A1
	2. 4(.0) A for each lamp	C1
	current in circuit = 8(.0) A	A1
6(b)(ii)	use of $R = V/I$ with correct values of V from graph for each arrangement	C1
	1. series resistance (= 2.1 + 2.1) = 4.2 or 4.3 Ω or (12 / 2.8) = 4.3 Ω	A1
	2. parallel resistance 1.5 Ω (each lamp 3.0 Ω) or (12 / 8.0) = 1.5 Ω	A1
6(b)(iii)	power = IV or V^2/R or I^2R	C1
	ratio = $(2.8 \times 6.0) / (4.0 \times 12) = 0.35$	A1

Question	Answer	Marks						
7(a)	electron and quark both underlined/clearly indicated and no others	B1						
7(b)(i)	<div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 20px;"><i>both correct</i></div> <table border="1" style="border-collapse: collapse;"> <tr> <td style="width: 40px;"></td> <td style="width: 40px;">value</td> </tr> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">60</td> </tr> <tr> <td style="text-align: center;">B</td> <td style="text-align: center;">28</td> </tr> </table> </div>		value	A	60	B	28	B1
	value							
A	60							
B	28							
7(b)(ii)	(electron) antineutrino	B1						