Second Semester

Physics

(الفيزياء)

(Answers)

مركز القياس والتقويم التربوي
The Center for Educational Assessment and Measurement (CEAM)

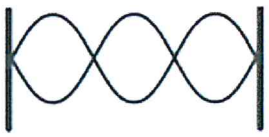
سلطنة عمان
وزارة التربية والتعليم

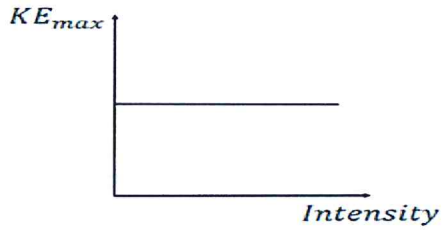
نموذج إجابة امتحان دبلوم التعليم العام
للعام الدراسي: ١٤٤٤هـ - ٢٠٢٢/٢٠٢٣م
الدور: الأول - الفصل الدراسي: الثاني
المادة: فيزياء ثنائي اللغة

Bilingual Private Schools

Physics, 2nd Semester, 1st Session, 2022/2023

Marking Guide

Item	Answer	Answer	Mark	C.L	OB	P.N
1	b	Frequency.	1	K	1.1.b	O120 H113
2	c	0.4 m	1	A	1.1c, b	O120 H112
3	d	Diffraction.	1	K	2.2a	O123 H149
4	b		1	K	2.4c	O130 H 141
5	b	Interference.	1	A	2.1b	O127 H136
6	b	$2\sin^{-1}\left(\frac{2\lambda}{d}\right)$	1	A	2.3b	O142 H151
7	c	$2f$	1	R	2.4d	O130 H142
8	d	D	1	A	2.5a	O132 H145

Item	Answer	Answer	Mark	C.L	OB	P.N
9	a	20.1 eV	1	A	3.2f	O298 H355
10	c		1	A	3.2e	O297 H352
11	a	$\lambda_e/4$	1	R	3.3b	O296,302 H357
12	c	Fusion.	1	K	4.2f	O321 H369
13	b	X	1	A	4.2d, e	O319 H368
14	d	$^{228}_{89}Ac$	1	R	4.1i	O153 H199-203

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
15	a.i	B- Time period. D- Amplitude	1 1	K	1.1b	O120 H113
	a.ii	$f = \frac{1}{T} = \frac{1}{4}$ $= 0.25$ Hz **Note: if stud. writes final result, only one mark is given.**	1	A	1.1c	O120 H113
	b.i	$f_\circ = \frac{f_s v}{v - v_s}$ $f_\circ = \frac{82\times10^3 \times 340}{340-4.40}$ $f_\circ = 83075.1\ Hz$ **OR** $83.075 \times 10^3 Hz$	1 1 1	A	1.2c	O134 H120
	b.ii	$f_s = \frac{v}{\lambda}$ $83075.1 = \frac{340}{\lambda}$ $\lambda = 4.1\times 10^{-3} m$	1 1	R	1.1c, d	O121 H114

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

<table>
<tr><th>Item</th><th>Part</th><th>Answer</th><th>Mark</th><th>C.L</th><th>OB</th><th>P.N</th></tr>
<tr><td rowspan="4">16</td><td>a</td><td><table><tr><th>Constructive (reinforcement)</th><th>Destructive (cancellation)</th></tr><tr><td>mλ, where m = 0,1,2 etc.
Or
whole number of wavelengths (1λ, 2λ, 3λ etc.)</td><td>$\left(m+\frac{1}{2}\right)\lambda$, where m = 0,1,2 etc.
Or
odd number of half-wavelengths (λ/2, 3λ/2, 5λ/2, etc.)</td></tr></table></td><td>1

1</td><td>K</td><td>2.1c, d</td><td>O138 ,139 H134 ,135</td></tr>
<tr><td>b</td><td>1. The two wave sources must have the same single frequency.
2. They must also have a constant phase difference.
<u>Note: if stud. writes two coherent sources, two marks are given</u></td><td>1

1</td><td>K</td><td>2.1f</td><td>O138 H137</td></tr>
<tr><td>c.i</td><td>$x=\frac{D\lambda}{a}$
$x=\frac{1\times 4.5\times 10^{-7}}{0.125\times 10^{-3}}$
$=3.6\times 10^{-3}m$</td><td>1

1</td><td>A</td><td>2.1h</td><td>O138 H138</td></tr>
<tr><td>c.ii</td><td>Will increase</td><td>1</td><td>A</td><td>2.1f, h</td><td>O138 H138</td></tr>
</table>

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
17		$d = \frac{1}{N} = \frac{1}{1 \times 10^6} = 1 \times 10^{-6} m$	1	A	2.3b	O142 H152 ,153
		$d \sin\theta = n\lambda$				
		$\sin\theta = \frac{n\lambda}{d} = \frac{1 \times (7 \times 10^{-7})}{1 \times 10^{-6}}$	1			
		$= 0.7$	1			
		$\theta = sin^{-1}0.7 = 44.43^{\circ}$	1			

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
18	a	Node. Antinode.	1 1	K	2.4b	O128 H141
	b.i	When two or more waves meet at a point, the resultant displacement at that point is equal to the sum of the displacements of the individual waves at that point.	1	K	2.1a	O126 H135
	b.ii	$f_n = \frac{nv}{2L}$ $f_3 = \frac{3 \times 50}{2 \times 1.25}$ $= 60\ Hz$	1 1	A	2.4d	O130 H142

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
19	a	**Pipe (A):** Third harmonic **or** 3rd harmonic or 2nd overtone **Pipe (B):** Second harmonic **or** 2nd harmonic or 1st overtone.	1 1	A	2.5b	O132 H146
	b	$f_A = \frac{(2n_A - 1)v}{4L}$ $100 = \frac{(2 \times 3 - 1) \times 340}{4L}$ $L = 4.25\ m$ $f_B = \frac{(2n_B - 1)v}{4 \times L_B}$ $= \frac{(2 \times 2 - 1) \times 340}{4 \times \frac{2}{3} \times 4.25}$ $= 90Hz$ **OR** $\frac{f_A}{f_B} = \frac{(2n_A - 1)L_B}{(2n_B - 1)L_A}$ (2 marks) **Note: 1 mark for correct relation with (n) and 1 mark for correct relation with (L)** $\frac{100}{f_B} = \frac{5\left(\frac{2}{3}L\right)}{3(L)}$ (1mark) $f_B = 90Hz$ (1 mark)	1 1 1 1 1	R	2.5b	O132 H146

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C. L	OB	P.N
20	a	$\Delta E = E_2 - E_4$ $= -3.40 - (-0.85)$ $= -2.55\ eV$ (No mark detected for the negative sign)	1 1	A	3.4c	O300 H360
	b	**Line (C)** $E = \frac{hc}{\lambda}$ $\lambda = \frac{hc}{E}$ $\lambda = \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{2.55 \times 1.6 \times 10^{-19}}$ $= 4.875 \times 10^{-7}\ m$	1 1	R	3.4c	O300 H360

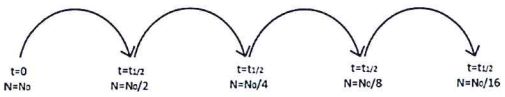
ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
21	a	Interference and diffraction	2	K	3.2b	O302 H356
	b.i	Threshold frequency **Or** f_o **Or** cutoff frequency	1	K	3.2i	O299 H353
	b.ii	Planck's constant **Or** h	1	K	3.2i	O299 H353
	b.iii	Metal (X) Because : $f > f_{0X}$ But $f < f_{0Y}$	1 1 1	A	3.2f	O298 H355

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

<table>
<tr><th>Item</th><th>Part</th><th>Answer</th><th>Mark</th><th>C.L</th><th>OB</th><th>P.N</th></tr>
<tr><td rowspan="2">22</td><td>a</td><td>
<table>
<tr><td>$alpha, (\alpha)$</td><td>Gamma,(γ)</td></tr>
<tr><td>+ or positive</td><td>0, no charge, or neutral</td></tr>
<tr><td>strong</td><td>weak</td></tr>
</table>
<u>Note: each answer worth (1 mark).</u>
</td><td>4</td><td>K</td><td>4.1g</td><td>O150
H199-203</td></tr>
<tr><td>b</td><td>$^{96}_{37}Rb$
$3^{1}_{0}n$</td><td>1
1</td><td>A</td><td>4.1f</td><td>O320
H371</td></tr>
</table>

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Item	Answer	Mark	C.L	OB	P.N
23		At $t = 4t_{1/2}$, $N = N_0/16$ $\Rightarrow N_0 = 16 \times N$ $= 16 \times 0.5 \times 10^{23}$ $= 8 \times 10^{23}$ nuclei (OR)  3 marks (OR) $N = N_0 e^{-\frac{\ln(2)}{t_{\frac{1}{2}}} 4t_{1/2}}$ $N = N_0 e^{-\frac{\ln(2)}{t_{\frac{1}{2}}} 4t_{1/2}}$ 1mark $N = N_0 e^{-4\ln(2)}$ $N = N_0 e^{\ln(2^{-4})}$ $N = N_0 \times (2^{-4}) = \frac{N_0}{16}$ $N_0 = 16 \times N$ $= 16 \times 0.5 \times 10^{23}$ 1*mark* $= 8 \times 10^{23}$ nuclei 1mark	1 1 1	R	4.3d, f	O309-311 H375-378

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Item	Answer	Mark	C.L	OB	P.N
24	a	$\Delta m = Zm_p + (A-Z)m_n - m_{nucleus}$ $= (90 \times 1.673 \times 10^{-27}) + (144 \times 1.675 \times 10^{-27}) - 3.886385 \times 10^{-25}$ $= 3.1315 \times 10^{-27}\ kg$	1 1	A	4.2d	O318 H366
	b	$\Delta m = 3.952926 \times 10^{-25} - (6.646478 \times 10^{-27} + 3.886385 \times 10^{-25})$ $= 7.622 \times 10^{-30}\ kg$	1 1	A	4.2d	O320-321 H365
	c	$E = \Delta mc^2$ $= 7.622 \times 10^{-30} \times (3 \times 10^8)^2$ $= 6.86 \times 10^{-13}\ J$	1 1	A	4.2a	O320-321 H366

End of Marking Guide

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Physics, 2nd Semester, 2nd Session, 2022/2023

Marking Guide

Item	Answer	Answer	Mark	C.L	OB	P.N
1	c	Amplitude	1	K	1.1f	O121 H115
2	d	20 cm	1	A	1.1b	O120 H112
3	c		1	K	2.4c	O130 H 141
4	c	Decrease the distance between the slits.	1	A	2.1h	O138 H 138
5	d	Diffraction.	1	K	2.2a	O123 H149
6	a	7.0°	1	A	2.3b	O142 H151

Item	Answer	Answer	Mark	C.L	OB	P.N
7	c	5 nodes	1	R	2.5b	O130 H142
8	b	$\frac{1}{0.15}f$	1	A	2.4d	O132 H145
9	a	1.6×10^{16} Hz	1	A	3.1c	O297 H350
10	b	1/4	1	R	3.3b	O302 H357
11	a	W	1	A	3.2e	O299 H355
12	a	Fission	1	K	4.2f	O321 H369
13	c	12	1	A	4.1e	O149 H198
14	c	$\lambda_X > \lambda_Z > \lambda_W$	1	R	4.3e	O311 H378

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
15	a	Sound waves. Light waves.	1 1	K	1.2g	O134 H119
	b.i	$f_\circ = \frac{f_s v}{v - v_s}$ $3600 = \frac{340\ fs}{340-240}$ $3600 \times 100 = 340\ f_s$ $360000 = 340\ f_s$ $f_s = 1058.9\ Hz$	1 1 1	A	1.2c	O132 H183-184
	b.ii	$T = \frac{1}{f} = \frac{1}{3600}$ $= 2.8 \times 10^{-4}\ s$	1	A	1.1b	O120 H113
	b.iii	$f_s = \frac{v}{\lambda}$ $1058.9 = \frac{340}{\lambda}$ $\lambda = 0.32\ m$	 1 1	R	1.1c, d	O121 H114

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

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<tr><td>mλ, where m = 0,1,2 etc.
Or
whole number of wavelengths (1λ, 2λ, 3λ etc.)</td><td>$\left(m+\frac{1}{2}\right)\lambda$, where m = 0,1,2 etc.
Or
odd number of half-wavelengths (λ/2, 3λ/2, 5λ/2, etc.)</td></tr>
</table>
<u>Note: one mark for each correct answer</u></td><td>1
1</td><td>K</td><td>2.1c,d</td><td>O138,139 H134,135</td></tr>
<tr><td>b</td><td>1. The two wave sources must have the same single frequency.
2. They must also have a constant phase difference.

<u>Note: if student writes two coherence sources, two marks are given</u></td><td>1
1</td><td>K</td><td>2.1f</td><td>O138 H137</td></tr>
<tr><td>c</td><td>$\lambda = \frac{ax}{D}$
$= \frac{0.15\times10^{-3}\times3\times10^{-3}}{1.2}$
$= 3.75\times10^{-7}m$</td><td>1
1</td><td>A</td><td>2.1h</td><td>O138 H138</td></tr>
</table>

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
17	a	$d = \frac{1}{N}$ $= \frac{1}{1 \times 10^{6}} = 1 \times 10^{-6} m$ $d \sin\theta = n\lambda$ $\sin\theta = \frac{n\lambda}{d} = \frac{1 \times 3 \times 10^{-7}}{1 \times 10^{-6}}$ $= 0.3$ $\theta = sin^{-1}0.3 = 17.46^{\circ}$	1 1 1 1	A	2.3b	O142 H152 ,153
	b	$d \sin\theta = n\lambda$ $n = \frac{d\ sin\theta}{\lambda} = \frac{1 \times 10^{-6} \times sin90^{\circ}}{3 \times 10^{-7}} = 3.33 \approx 3$ **Note: if the student wrote 3.33 one mark must be given**	1	A	2.3b	O143 H153
	c	Continuous spectrum of lights from blue to red. **Or** Rainbow light. (1 mark)	1	K	2.3c	O142 H153

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
18	a	Node: P Antinode: Q	1 1	K	2.4b	O128 H141
	b	$f = \frac{nv}{2L}$ $f = \frac{5 \times 12}{2 \times 2}$ $= 15\ Hz$ OR $2.5\lambda = 2$ $\lambda = \frac{2}{2.5}$ $= \frac{2}{2.5}$ $= 0.8$ m (1 mark) $v = \lambda f$ $f = \frac{v}{\lambda}$ $= \frac{12}{0.8}$ $= 15\ Hz$ (1 mark)	1 1 1	A	2.4d	O130 H142

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
19	a	Pipe (X): (Fundamental mode). **Or** (First harmonic). (1 mark) Pipe (Y): (Third mode). **Or** (Third harmonic). (1 mark)	1 1	A	2.5a	O132 H145
	b	$f_x = \frac{(2n-1)v}{4L_x}$ $100 = \frac{(2\times 1-1)\times 340}{4L_x}$ $L_x = 0.85m$ $f_Y = \frac{(2n-1)v}{4L_y}$ $363.2 = \frac{(2\times 3-1)\times 340}{4L_Y}$ $L_Y = 1.17m$ $\Delta L = 1.17 - 0.85 = 0.32\ m$	1 1 1 1	R	2.5b	O132 H146

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
20	a	Interference Diffraction	1 1	K	3.2b	O302 H356
	b.i	$KE_{max} = eV_0$ $= 1.6 \times 10^{-19} \times 1.40$ $= 2.24 \times 10^{-19}$ J	1 1	R	3.2h	O299 H355
	b.ii	$\varphi = E - KE_{max}$ $= 8.29 \times 10^{-19} - 2.24 \times 10^{-19}$ $= 6.05 \times 10^{-19}$J	1 1	A	3.2f	O299 H355
	b.iii	Stay the same **Or** No change (1 mark)	1	A	3.2e	O299 H355

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
21	a	Emission Absorption	1 1	K	3.4b	O301 H358
	b	$\Delta E = E_1 - E_1$ $\Delta E = -13.6 - (-0.85)$ $= -12.75\ eV$ **Note: No mark detection for the negative sign.**	1 1	A	3.4c	O300 H360

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
22	a	*Alpha*, (α) | Beta, $(\beta -)$ + or positive | - or negative strong | weak **Note: One mark for each correct answer.**	4	K	4.1g	O150 H199-203
	b	$^{234}_{90}Th$ **Note: one mark for each correct number**	2	A	4.1i	O153 H199-203

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Item	Answer	Mark	C.L	OB	P.N
23	a	$\lambda_B = \frac{0.693}{t_{1/2(B)}}$ $= \frac{0.693}{40}$ $= 0.017\ min^{-1}$ **OR** $\lambda_B = \frac{0.693}{t_{1/2(B)}}$ $= \frac{0.693}{2400}$ (1 mark) $= 2.8875 \times 10^{-4}\ s^{-1}$ (1 mark)	1 1	A	4.3f	O311 H378
	b	$\lambda_A = \frac{0.693}{t_{1/2(A)}} = \frac{0.693}{20} = 0.035\ min^{-1}$ $\frac{N_A}{N_B} = \frac{N_{0A}e^{-34.65\times10^{-3}\times80}}{N_{0B}e^{-17.325\times10^{-3}\times80}}$ $= 0.25$ **OR** $\frac{N_A}{N_B} = \frac{e^{-\lambda_A t}}{e^{-\lambda_B t}}$ $= \frac{e^{-\frac{0.693}{20}\times80}}{e^{-\frac{0.693}{40}\times80}}$ (1mark) $= \frac{e^{-2.772}}{e^{-1.386}}$ (1 mark) $= 0.25$ (1mark)	1 1 1	R	4.3d,f	O309-311 H377-378

		OR $N_A = N_{0A}e^{-\lambda_A t}$ $N_B = N_{0B}e^{-\lambda_B t}$ $\frac{N_A}{N_B} = \frac{N_{0A}e^{-\lambda_A t}}{N_{0B}e^{-\lambda_B t}}$ (1 mark) $\frac{N_A}{N_B} = e^{(\lambda_B - \lambda_A)t}$ $= e^{(0.693(\frac{1}{40} - \frac{1}{20})\,80}$ (1mark) $= 0.25$ (1 mark) **OR** $t = 4t_{1/2(A)} \implies N_A = N_0/8$ (1mark) $t = 2t_{1/2(B)} \implies N_B = N_0/2$ (1mark) $\therefore \frac{N_A}{N_B} = \frac{N_0/8}{N_0/2}$ $= 0.25$ (1mark)				

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Item	Answer	Mark	C.L	OB	P.N
24	a	$\Delta m = 3.344495 \times 10^{-27}$ $+5.008267 \times 10^{-27}$ $-6.646478 \times 10^{-27}$ $+1.674927 \times 10^{-27}$ $= 3.1357 \times 10^{-29}\ kg$	1 1	A	4.2d	O320-321 H365
	b	$E = \Delta mc^2$ $= 3.1357 \times 10^{-29} \times (3 \times 10^{8})^2$ $= 2.82213 \times 10^{-12}\ J$	1 1	A	4.2a	O320-321 H366

End of Marking Guide

Bilingual Private Schools

Physics, 2nd Semester, 1st Session, 2021/2022

Marking Guide

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(14 marks)

Item	Answer	Answer	Mark	C.L	OB	P.N
1	c	Displacement	1	K	1.1b	C: 180 H: 102
2	d	$A_S = A_R$ | $f_S > f_R$ | $\lambda_S < \lambda_R$	1	A	1.1 b	C: 179 H: 102-103
3	a	Number of nodes: 5 | Number of antinodes: 4	1	K	2.4 b	C: 212 H: 121
4	a	Diffraction	1	A	2.2b	C: 194 H: 126
5	a	$1.5 \times 10^{-3}\ m$	1	A	2.1 h	C: 201 H: 119
6	d	132 m/s	1	A	2.4 e	C: 212 H: 121
7	c	11.1^0	1	R	2.3b	C:204 H: 129

ANSWERS TO MULTIPLE CHOICE QUESTIONS CONTENUED: (14 marks)

Item	Answer	Answer	Mark	C.L	OB	P.N
8	b	Work function	1	K	3.2d	C473 H353
9	c	$1.1 \times 10^{-9} m$	1	A	3.3b	C480 H355
10	c	$4.97 \times 10^{-7}\ m$	1	R	3.2e	C473 H353-354
11	b	Most of the atom is empty.	1	K	4.1a	C223-224 H177-178
12	d	Alpha particle	1	A	4.2c	C491 H171
13	d	1.28×10^{-27}	1	R	4.2 g	C495 H379
14	d	$\frac{N}{16}$	1	A	4.3c &d	C499 H385

ANSWERS TO EXTENDED QUESTIONS: (56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
15	a	Directly proportional.	1	K	1.1f	C: 182 H: 104
	bi	$f_s = \frac{v}{\lambda_s}$ $f_s = \frac{340}{2} = 170\ Hz$	1	A	1.2 c	C: 184-185 H: 108-109
	bii	$f_0 = \frac{f_s v}{v - v_s}$ $f_0 = \frac{170 \times 340}{340 - 34.7}$ $f_0 = 189.3\ Hz$	1 1 1	A	1.2 c	C: 184-185 H: 108-109

ANSWERS TO EXTENDED QUESTIONS CONTINUED

Item	Part	Answer	Mark	C.L	OB	P.N
16	a	The time taken for one complete oscillation of a point in a wave. **OR** The time for a particle in the wave to complete one vibration or one cycle. **(1mark)**	1	K	1.1b	C: 180 H:103
	b	$T = \frac{1}{f}$ $= \frac{1}{500}$ $= 2 \times 10^{-3} s$ $t = \frac{T}{4}$ $= 5 \times 10^{-4} s$ **OR** $v = \lambda f$ $= 2 \times 500 = 1000 \frac{m}{s}$ **(½+½mark)** $t = \frac{d}{v} = \frac{0.5}{1000} = 5 \times 10^{-4}\ s$ **(½+½mark)**	1/2 1/2 1/2 1/2	R	1.1b	C: 180 H: 102

ANSWERS TO EXTENDED QUESTIONS CONTINUED

Item	Part	Answer	Mark	C.L	OB	P.N
17	a	i) Blue ii) Red	1 1	A	2.1	C: 201 H: 119
	b	$\lambda_1 = \frac{ax_1}{D}$ $a = \frac{\lambda_1 D}{x_1}$ $= \frac{480 \times 10^{-9} \times 3.2}{3.84 \times 10^{-3}}$ $= 4 \times 10^{-4}\, m$ **Note: in the case of substituting λ_1 as 670×10^{-9} due to wrong answer in part (a), the final answer will be $(5.58 \times 10^{-4}\, m)$ and the <u>full mark</u> must be given for this part.**	1 1	A	2.1 h	C: 201 H: 119
	c	$x_2 = \frac{D\lambda_2}{a}$ $= \frac{3.2 \times 670 \times 10^{-9}}{4 \times 10^{-4}}$ $= 5.36 \times 10^{-3}\, m$	1 1	A	2.1 h	C: 201 H: 119

ANSWERS TO EXTENDED QUESTIONS CONTINUED

Item	Part	Answer	Mark	C.L	OB	P.N
17	c	**OR** $\frac{x_1}{x_2} = \frac{\lambda_1}{\lambda_2}$ $x_2 = \frac{\lambda_2 x_1}{\lambda_1}$ $= \frac{670 \times 10^{-9} \times 3.84 \times 10^{-3}}{480 \times 10^{-9}}$ **(1mark)** $= 5.36 \times 10^{-3}\ m$ $(\boldsymbol{1mark})$ **Note: in the case of substituting λ_2 as 480×10^{-9} and a $= 5.58 \times 10^{-4}\ m$ due to wrong answers in parts (a) and (b), the final answer will be $(2.75 \times 10^{-3}\ m)$ and the <u>full</u> must be given for this part.**				

ANSWERS TO EXTENDED QUESTIONS CONTINUED

Item	Part	Answer	Mark	C.L	OB	P.N
18	a	$\sin\theta = \frac{n\lambda}{d}$ $d = \frac{n\lambda}{\sin\theta}$ $= \frac{3 \times 590 \times 10^{-9}}{\sin 65^0}$ $= 1.95 \times 10^{-6}\, m$ $sin\theta = \frac{n\lambda}{d}$ $sin\theta = \frac{2 \times 400 \times 10^{-9}}{1.95 \times 10^{-6}}$ $sin\theta = 0.41$ $\theta = 24.2°$ **OR** $\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_1 \times \lambda_1}{n_2 \times \lambda_2}$ **(1mark)** $\sin\theta_2 = \frac{n_2 \times \lambda_2 \times \sin\theta_1}{n_1 \times \lambda_1}$ $= \frac{2 \times 400 \times 10^{-9} \times \sin 65^0}{3 \times 590 \times 10^{-9}}$ **(1mark)** $= 0.4$ **(1mark)** $\theta_2 = \sin^{-1} 0.41$ $= 24.2°$ **(1mark)**	1 1 1 1	R	2.3b	C: 205 H: 128

ANSWERS TO EXTENDED QUESTIONS CONTINUED

Item	Part	Answer	Mark	C.L	OB	P.N
18	b	<table><tr><th></th><th>Phase difference</th><th>Path difference</th></tr><tr><td>Constructive interference</td><td>Equal to even number of π <u>*Or*</u> $(2n\pi)$ n=0,1,…..</td><td>Equal to whole number of wavelength <u>*Or*</u> $(n\lambda)$, n=0,1,…..</td></tr><tr><td>Destructive interference</td><td>Equal to odd number of π <u>*Or*</u> $(2n+1)\pi$ n=0,1,…..</td><td>Equal to odd number of half wavelength <u>Or</u> $((n+\frac{1}{2})\lambda)$, n=0,1,…..</td></tr></table>	1+1 1+1	K	2.1 c	C:197 H:115

ANSWERS TO EXTENDED QUESTIONS CONTINUED

Item	Part	Answer	Mark	C.L	OB	P.N
19	a	B C **Note: If the student writes three points, one mark only will be given.**	1 1	K	2.1 e	C: 198 H: 115
	bi	$A_1 + A_2 = 6 \times 10^{-3}$ $A_2 = 6 \times 10^{-3} - A_1$ $= 6 \times 10^{-3} - 3 \times 10^{-3}$ $= 3 \times 10^{-3}$ m **Note: If the student writes the final answer only without calculation will get (2marks)**	1 1	A	2.1 d	C: 198 H: 115
	bii	distance = $2.5\ \lambda$ $= 2.5 \times 3 \times 10^{-2}$ $= 7.5 \times 10^{-2}\ m$	1 1	A	2.1 d	C: 198 H: 115

ANSWERS TO EXTENDED QUESTIONS CONTINUED

Item	Part	Answer	Mark	C.L	OB	P.N
20	a	<table><tr><td>Movement of an electron</td><td>Transition result (Emission or absorption)</td></tr><tr><td>Downwards transition</td><td>**Emission**</td></tr><tr><td>Upwards transition</td><td>**Absorption**</td></tr></table>	1 1	K	3.4b	C475 H358 -359
	bi	$\Delta E = \frac{hc}{\lambda}$ $= \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{1027 \times 10^{-10}}$ $= 1.94 \times 10^{-18} J$ $= \frac{1.94 \times 10^{-18}}{1.6 \times 10^{-19}}$ $= 12.1 eV$	1 1 1	A	3.4c	C 477 H358- 359
	bii	$\Delta E = E_3 - E$ $12.1 = (-1.5) - E$ $E = -13.6\ eV$ The new energy level is (n=1) **(Note: No mark detected for negative sign.)**	1 1 1	A	3.4a	C476- 477 H 357- 358

ANSWERS TO EXTENDED QUESTIONS CONTINUED

Item	Part	Answer	Mark	C.L	OB	P.N
21	a	Diffraction Interference	1 1	K	3.2b	C468 H355
	b	$2hf_0 = hf_o + \frac{1}{2}mv_1^2$ $hf_0 = \frac{1}{2}mv_1^2 \quad \rightarrow$ (1) $5hf_0 = hf_o + \frac{1}{2}mv_2^2$ $4\,hf_0 = \frac{1}{2}mv_2^2 \quad \rightarrow$ (2) By dividing equations (1) & (2) $\frac{1}{4} = \frac{v_1^2}{v_2^2}$ $v_2^2 = 4v_1^2$ $v_2 = 2v_1$	1/2 1/2 1/2 1/2	R	3.2f	C 473 H 354

ANSWERS TO EXTENDED QUESTIONS CONTINUED

Item	Part	Answer	Mark	C.L	OB	P.N
22	a	(α): A $(\beta\text{-})$: C (γ): B	1 1 1	K	4.1g	C231 H170-171
	b	$\Delta m = (m_p + m_n) - m_D$ $\Delta m = ((\mathbf{1.673 + 1.675})$ $- 3.342)) \times 10^{-27}$ $\Delta m = 6 \times 10^{-30}\ kg$ $BE_T = 6 \times 10^{-30} \times (3 \times 10^8)^2$ $= 5.4 \times 10^{-13} J$ $BE_{nucleon} = \frac{5.4 \times 10^{-13}}{2}$ $= 2.7 \times 10^{-13} J$	1 1 1 1	A	4.2 d	C494 H378

ANSWERS TO EXTENDED QUESTIONS CONTINUED

Item	Part	Answer	Mark	C.L	OB	P.N
23	a	$A = A_0 e^{-\lambda t}$ $2700 = 4750\, e^{-\lambda 5}$ $0.5684 = e^{-\lambda 5}$ $\ln(0.5684) = \ln(e^{-\lambda 5})$ $-0.5649 = -\lambda 5$ $\lambda = \frac{0.5649}{5} = 0.1130\ min^{-1}$	1 1	A	4.3d	C501 H385
	b	$\lambda = \frac{0.693}{T_{\frac{1}{2}}}$ $T_{\frac{1}{2}} = \frac{0.693}{0.113}$ $T_{\frac{1}{2}} = 6.13\ min$	1 1	A	4.3f	C501 H385

ANSWERS TO EXTENDED QUESTIONS CONTINUED

Item	Part	Answer	Mark	C.L	OB	P.N
24	a	Fission – Decreases Fusion – Decreases	1 1	K	4.2f	C496 H379-380
	b	Let m be the number of alpha particles and n be the number of beta particles. $m = \frac{238-206}{4} = 8$ $92 - 2m + n = 82$ $n = 82 - 92 + (2 \times 8) = 6$ (8 alpha particles and 6 beta particles). **Note: (1 ½ marks) for the right number of each emitted particle.**	½+½ ½ ½ 1	R	4.1i	C490-491 H171-172

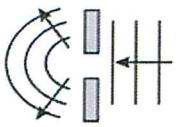
End Of Marking Guid

Bilingual Private Schools

Physics, 2nd Semester, 2nd Session, 2021/2022

Marking Guide

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(14 marks)

Item	Answer	Answer	Mark	C.L	OB	P.N
1	d	Square of amplitude	1	K	1.1f	C 182 H104
2	c	$v_X = v_Z$ | $\lambda_X < \lambda_Z$	1	A	1.2c	C184-185 H108-109
3	c	Same frequency and constant phase difference	1	K	2.1b	C200 H117
4	a	$4 \times 10^{-7} m$	1	A	2.1h	C201 H119
5	b	 b.	1	A	2.2b	C195 H126
6	c	Destructive | 0	1	A	2.1d	C197 H115
7	d	$\frac{3L}{2}$	1	R	2.4d	C216 H121

ANSWERS TO MULTIPLE CHOICE QUESTIONS CONTINUED: (14 marks)

Item	Answer	Answer	Mark	C.L	OB	P.N
8	a	Photoelectric effect	1	K	3.2b	C469 H353
9	c	n= 4 | n= 1	1	A	3.4b, c	C477 H358
10	b	$\frac{1}{2}\lambda$	1	R	3.3b	C480 H355
11	c	Nuclei with the same number of proton but a different number the neutron.	1	K	4.1d	C227 H170
12	a	8	1	A	4.1c	C226 H170
13	c	8 | 4	1	R	4.1i	C491 H170-174
14	c	4500	1	A	4.3d	C501 H385

ANSWERS TO EXTENDED QUESTIONS CONTINUED: (56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
15	a	Distance of a point on the wave from its undisturbed (equilibrium) position. **Or** Distance in a specified direction from its rest position.	1	K	1.1b	C180 H102
	b	$T = 4.0ms = 4.0 \times 10^{-3}s$	1	A	1.1b	C180 H103
	c	$\lambda = \frac{4d}{3} = \frac{4\times0.6}{3} = 0.8m$ $v = \frac{\lambda}{T} = \frac{0.8}{4.0 \times 10^{-3}}$ $= 200m/s$ **Or** $\lambda = \frac{4d}{3} = \frac{4\times0.6}{3} = 0.8m$ **(1mark)** $f = \frac{1}{T} = \frac{1}{4.0\times10^{-3}} = 250Hz$ **(1mark)** $v = \lambda f = 0.8 \times 250 = 200m/s$ **(1mark)** **Or** $t = 3.0 \times 10^{-3}s$ **(1mark)** $v = \frac{d}{t} = \frac{0.6}{3.0\times10^{-3}}$ **(1mark)** $= 200m/s$**(1mark)**	1 1 1	A	1.1b,d	C180, 183 H103-104

ANSWERS TO EXTENDED QUESTIONS CONTINUED:

Item	Part	Answer	Mark	C.L	OB	P.N
16	a	Doppler effect	1	K	1.2a	C188 H108
	b	$f_o = (f_s + 0.05f_s) = 1.05f_s$	1/2	R	1.2c	C181 H108-109
		$f_o = \frac{f_s \times v}{v - v_s}$	1/2			
		$1.05f_s = \frac{f_s \times 340}{340 - v_s}$	1/2			
		$340 - v_s = \frac{340}{1.05} = 323.81$				
		$v_s = 340 - 323.81 = 16.19 m/s$	1/2			

ANSWERS TO EXTENDED QUESTIONS CONTINUED:

Item	Part	Answer	Mark	C.L	OB	P.N
17	a	When two or more waves meet at a point(,the resultant displacement is the algebraic sum of the displacements of the individual waves.	1	K	2.1a	C194 H116
	b	Node : **S** Antinode: **Z**	1 1	K	2.4b	C212 H121
	c	$\lambda = \frac{2L}{n}$ $= \frac{2 \times 0.28}{4}$ $= 0.14m$	1 1	A	2.4d	C216 H121
	d	$v = \lambda f$ $= 0.14 \times 120$ $= 16.8m/s$	1 1	A	2.4d,e	C216 H121

ANSWERS TO EXTENDED QUESTIONS CONTINUED:

Item	Part	Answer	Mark	C.L	OB	P.N
18	a	Large number of equally spaced lines ruled on a glass or plastic slide. **Or** Plate on which there is a very large number of identical parallel, very closely spaced slits.	1	K	2.3a	C203 H129
	b	$d\sin\theta = n\lambda$ $d \times \sin 78.4^o = 3 \times 681 \times 10^{-9}$ $d = \frac{3 \times 681 \times 10^{-9}}{\sin 78.4^o}$ $= 2.0856 \times 10^{-6} m$ $N = \frac{1}{d} = \frac{1}{2.0856 \times 10^{-6}}$ $= 479.48 \times 10^3 lines/m$	1 1 1	A	2.3b	C204 H129
	c	$d\sin\theta = n\lambda$ $2.0856 \times 10^{-6} \times \sin\theta = 4 \times 681 \times 10^{-9}$ $\sin\theta = \frac{4 \times 681 \times 10^{-9}}{2.0856 \times 10^{-6}} = 1.31$ $since\ (\sin\theta > 1)$ its not possiple to get the fourth-order maximum on the screen	1 1 1	A	2.3b	C204 H129

ANSWERS TO EXTENDED QUESTIONS CONTINUED:

Item	Part	Answer	Mark	C.L	OB	P.N
19	A	<table><tr><th>Constructive interference</th><th>Destructive interference</th></tr><tr><td>whole number of wavelength <u>Or</u> $(0,1\lambda, 2\lambda, 3\lambda, etc)$ <u>Or</u> $(n\lambda)$ (1mark)</td><td>odd number of half wavelength. <u>Or</u> $(\frac{\lambda}{2}, \frac{3\lambda}{2}, \frac{5\lambda}{2}, etc)$ <u>Or</u> $(n+\frac{1}{2})\lambda$ (1mark)</td></tr></table>	2	K	2.1d	C197 H116
	b	$\frac{\lambda_1}{\lambda_2} = \frac{x_1}{x_2}$ $\frac{640}{400} = \frac{0.24}{x_2}$ $x_2 = 0.15mm$ $\Delta x = x_1 - x_2$ $= 0.24 - 0.15$ $= 0.09mm$	1 1 1 1/2 1/2	R	1.1b	C201 H119

ANSWERS TO EXTENDED QUESTIONS CONTINUED:

Item	Part	Answer	Mark	C.L	OB	P.N
20	a	i- Increases. ii. No change.	2	K	3.2e	C471 H353
	bi	The release of electrons from the surface of a metal when electromagnetic radiation is incident on its surface.	1	K	3.2a	C471 H353
	bii	The minimum frequency required to release electrons from the surface of a metal.	1	K	3.2a	C 472 H 351
	biii	$\phi = hf_o$ $= 6.63 \times 10^{-34} \times 5 \times 10^{14}$ $= 3.315 \times 10^{-19} J$	1 1	A	3.2c	C 473 H354
	biv	$\lambda_o = \frac{c}{f_o} = \frac{3 \times 10^8}{5 \times 10^{14}}$ $= 6 \times 10^{-7}$m	1 1	R	3.2j	C 477 H352

ANSWERS TO EXTENDED QUESTIONS CONTINUED:

Item	Part	Answer	Mark	C.L	OB	P.N
21	a	$\lambda = \frac{h}{mv}$ $= \frac{6.63 \times 10^{-34}}{9.11 \times 10^{-31} \times 5.93 \times 10^{6}}$ $= 1.23 \times 10^{-10} m$	1 1	A	3.3b	C480 H355
	b	$\Delta E = E - E_4$ $12.09 = E - (-13.6)$ $E = -1.51\ eV$ The new energy level is (n=3) **(Note: No mark is deducted for negative sign.)**	1 1/2 1/2	A	3.4 e	C477 H358

ANSWERS TO EXTENDED QUESTIONS CONTINUED:

Item	Part	Answer	Mark	C.L	OB	P.N
22	a	Most of the atom mass is concentrated in a small space (nucleus) (**Or**), Most of the atom is empty space.	1	K	4.1a	C225 H177
	bi	$\Delta m = (5 \times m_p + 6 \times m_n) - m_B$ $= ((\mathbf{5} \times \mathbf{1.673}) + (6 \times \mathbf{1.675}) \times 10^{-27}) - 1.795 \times 10^{-26}$ $= 4.65 \times 10^{-28}\ kg$	1 1	A	4.2 d,a	C492 H377
	bii	$E = \Delta mc^2$ $= 4.65 \times 10^{-28} \times (3 \times 10^8)^2$ $= 4.185 \times 10^{-11} J$	1 1	A	4.2 d,a	C492 H377

ANSWERS TO EXTENDED QUESTIONS CONTINUED:

<table>
<tr><th>Item</th><th>Part</th><th>Answer</th><th>Mark</th><th>C.L</th><th>OB</th><th>P.N</th></tr>
<tr><td rowspan="6">23</td><td>a</td><td>
<table>
<tr><th></th><th>α- particle</th><th>γ- radiation</th></tr>
<tr><td>Charge</td><td>+2e <u>or</u> positive</td><td>0 <u>or</u> no charge</td></tr>
<tr><td>Nature</td><td>Helium nucleus</td><td>Electromagnetic waves</td></tr>
</table>
<u>1mark for each answer</u>
</td><td>4</td><td>K</td><td>4.1g</td><td>C231
H174</td></tr>
<tr><td rowspan="5">b</td><td>$E_X = 8 \times 90$</td><td>1</td><td rowspan="5">A</td><td rowspan="5">4.2d,e</td><td rowspan="5">C495
H378</td></tr>
<tr><td>$= 720\ MeV$</td><td>1/2</td></tr>
<tr><td>$E_Y = 8.5 \times 60$</td><td>1</td></tr>
<tr><td>$= 510\ MeV$</td><td>1/2</td></tr>
<tr><td>$\therefore E_Y < E_X$</td><td>1</td></tr>
</table>

ANSWERS TO EXTENDED QUESTIONS CONTINUED:

Item	Part	Answer	Mark	C.L	OB	P.N
24		After (2hr): remaining nuclei Sample (M) $= \frac{N}{4}$ remaining nuclei Sample (K) $= \frac{N}{2}$ $\frac{A_M}{A_K} = \frac{\lambda_M N_M}{\lambda_K N_K}$ $= \frac{T_K N_M}{T_M N_K}$ $= \frac{2 \times \left(\frac{N}{4}\right)}{1 \times \left(\frac{N}{2}\right)}$ $= 1$	1/2 1/2 1/2 1/2 1/2 1/2	R	4.3c,e	C499 H385

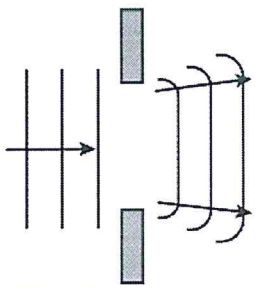
End Of Marking Guide

Bilingual Private Schools

Physics, 1st Session, 2020/2021

Marking Guide

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(12 marks)

Item	Answer	Answer	Mark	C.L	OB	P.N
1	c	Coulomb	1	K	1.1c	C 131 H-146
2	b	Increase | Decrease	1	R	1.3d	C148-149 H161-162
3	b	$1.82 \times 10^{-4} C$	1	A	2.1c	C374 H281-282
4	d	3.0 A	1	A	3.2b	C409 H314
5	c	Motion	1	K	4.1e	C438 H334
6	a	4.5 | 0.22	1	A	5.1b	C458-459 H343-344
7	a	A	1	K	1.1b	C179 H102
8	b		1	A	2.2b	C195 H126

ANSWERS TO MULTIPLE CHOICE QUESTIONS CONTENUED :(12 marks)

Item	Answer	Answer	Mark	C.L	OB	P.N
9	a	$\frac{1}{4}KE$	1	R	3.3,b	C476 H355
10	b	$6.15 \times 10^{14}\ Hz$	1	A	3.4c	C477 H358
11	d	Nuclear fusion	1	K	4.2f	C496 H379
12	b	143	1	A	4.1c	C226 H169

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
13	a	The rate of flow of charge past a point. **OR** Charge per unit time	1	K	1.1a	C131 H145
	b	$I_{max} = \frac{E}{r} = \frac{1.6}{0.1}$ $= 16A$	1 1	R	1.4b	C169 H158
14	a. i	The sum of the currents entering any point in a circuit is equal to the sum of the currents leaving that same point.	1	K	1.3a	C144 H160
	a. ii	The sum of the e.m.f. around any closed loop in a circuit is equal to the sum of the p.d around the loop.	1	K	1.3b	C145 H160

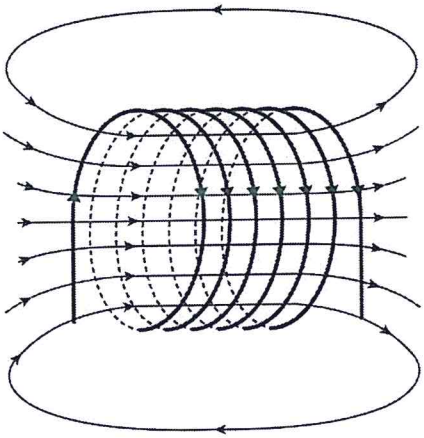
ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
14	b. i	From loop (efabe) $12 - 3I_3 - 6I_2 = 0$ $12 - 3 \times 1 - 6I_2 = 0$ $I_2 = 1.5A$	1 1	A	1.3h	C146 H160
	b. ii	$I_2 = I_3 + I_1$ $I_1 = I_2 - I_3$ $I_1 = 1.5 - 1 = 0.5A$ From loop (cbedc) $E - 6I_2 - 4I_1 = 0$ $E = 6 \times 1.5 + 4 \times 0.5 = 11V$ **OR** $I_1 = I_2 - I_3$ $I_1 = 1.5 - 1 = 0.5A$ **1mark** From loop (cbafedc) $E + 3I_3 - 12 - 4I_1 = 0$ $E = -3 \times 1 + 12 + 4 \times 0.5$ **1mark** $= 11V$ **1mark**	1 1 1	A	1.3h	C146 H160

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
15	a	- Store energy in electrical circuits. - Store charges. - smooth current or voltage.- -When used in conjunction with a coil, it can form a part of circuit that produces electrical oscillations.so, it can be used to turn a circuit to particular radio frequency. - prevent arcing. **Any one from the above is correct**	1	K	2.1j	C373 H289
	b	$C_T = \frac{Q}{V}$ $C_T = \frac{36\mu C}{6V} = 6\mu F$ $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$ $\frac{1}{6} = \frac{1}{60} + \frac{1}{C} + \frac{1}{20}$ $C = 10\mu F$ **OR** $V_{60\mu F} = \frac{Q}{C} = \frac{36\mu C}{60\mu F} = 0.6V$ $V_{20\mu F} = \frac{36\mu C}{20\mu F} = 1.8V$ $V_C = 6 - (0.6 + 1.8) = 3.6V$ **1mark** $C = \frac{Q}{V} = \frac{36\mu C}{3.6V}$ **1mark** $= 10\mu F$ **1mark**	1 1 1	A	2.1g	C377-379 H284
	c	Will decrease.	1	R	2.1c,f	C378 H284

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
16	a	Solenoid	1	K	3.1b	C408 H324
	b	 **1 mark** for correct pattern. **1 mark** for correct direction.	2	A	3.1b	C408 H324
	c	An electromagnet is considered a temporary magnet because if the current flow stops, there will no longer be a magnetic field. **OR** There is temporary electric field with temporary magnetic effect.	1	R	3.1a	C408 H325

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
17	a	The magnitude of the induced e.m.f is proportional to the rate of change of magnetic flux linkage.	1	K	4.1d	C441 H334
	b. i	$\Phi = ABcos\theta$ $= 0.2 \times 4.5cos0 = 0.9Wb$ **OR** $\Phi = ABsin\theta$ $= 0.2 \times 4.5sin90 = 0.9Wb$ **1mark** **Note:** mark is for final answer.	1	A	4.1b	C440 H332
	b. ii	c. Becomes four times greater	1	R	4.1b	C440 H332
	c	$\frac{V_S}{V_P} = \frac{I_P}{I_S}$ $I_P = \frac{I_S V_S}{V_P} = \frac{0.15 \times 12}{240}$ $= 7.5 \times 10^{-3} A$	1	A	5.1b	C459 H343

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
18	a	The number of complete vibrations (cycles) per unit time. **OR** The number of oscillations per unit time of a point in a wave.	1	K	1.1b	C180 H103
	b	$T = 4 \times 0.06 = 0.24\ s$	1	A	1.1b	C182 H103
	c	Because the medium of wave is not changed. **OR** If the frequency is changed, the wavelength also will change so the velocity of the wave remains constant in the rope.	1	R	1.1d	C183 H104

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
19	a	Diffraction grating.	1	K	2.3a	C203 H129
	b	$d\ sin\theta = n\lambda$ $3.33 \times 10^{-6}\ sin20^{o} = 2\lambda$ $\lambda = 5.69 \times 10^{-7} m$	1 1	A	2.3b	C204 H129
20	a	The minimum amount of energy necessary for an electron to escape from the surface of the metal. **OR** The energy required for an electron to escape from the surface of the metal.	1	K	3.2a	C473 H353
	b	$E = hf = 6.63 \times 10^{-34} \times 1 \times 10^{15}$ $= 6.63 \times 10^{-19} J$ $= \frac{6.63 \times 10^{-19}}{1.6 \times 10^{-19}} = 4.14eV$ Energy of photon < work function $E < \emptyset$ $4.14eV < 5.1eV$ **OR** $f_o = \frac{\emptyset}{h} = \frac{5.1 \times 1.6 \times 10^{-19}}{6.63 \times 10^{-34}}$ **1mark** $= 1.23 \times 10^{15} Hz$ **1mark** $f < f_o$ **1mark**	1 1 1	A	3.2d	C473 H354

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
21	a. i	A	1	K	3.4b	C475-377 H358-359
	a. ii	B	1	K	3.4b	C475-377 H358-359
	b	$\Delta E = E_3 - E_1$ $= -0.24 \times 10^{-18} - (-2.18 \times 10^{-18})$ $\Delta E = 1.94 \times 10^{-18} J$	1 1	A	3.4c	C477 H359
	c	$\Delta E = E_2 - E_1$ $= (-0.54 \times 10^{-18}) - (-2.18 \times 10^{-18})$ $= 1.64 \times 10^{-18} J$ $\lambda = \frac{h\,c}{E} = \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{1.64 \times 10^{-18}}$ $= 1.21 \times 10^{-7} m$	1 1	R	3.4c	C477 H358

NSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
22	a	**(γ) radiation**: electromagnetic radiation. **(α) particles**: nucleus of helium. **OR** ^4_2He **(β) particles**: negative or positive electron $(-_e \; or \; +_e)$	1 1 1	K	4.1g	C231-234 H170-174
	b	Δm $= [(94 \times 1.673 \times 10^{-27}) + (145 \times 1.675 \times 10^{-27}) - (3.9682659 \times 10^{-25})]$ $= 3.31 \times 10^{-27} kg$ $E = \Delta mc^2$ $= 3.31 \times 10^{-27} \times (3 \times 10^8)^2$ $= 2.98 \times 10^{-10} J$	1 1 1 1	A	4.2d	C495 H378
	c	The radioactive source is emitting beta radiation. Because beta can pass easily through the thin card but it is stopped by the 1mm thickness lead.	1 1	R	4.1g	C234-235 H171-173

End Of Marking Guide

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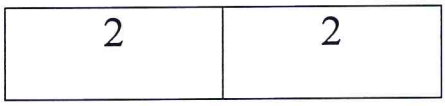
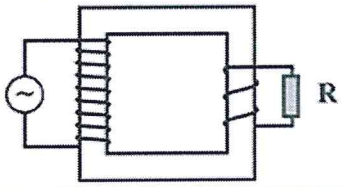
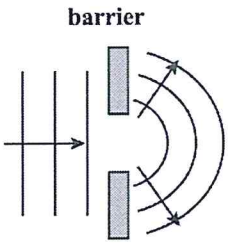
Marking Guide

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(12 marks)

Item	Answer	Answer	Mark	C.L	OB	P.N
1	b	Current.	1	K	1.1a	C 131 H-145
2	d		1	R	1.3g	C148-149 H161
3	d	$1.5\ \mu F$	1	A	2.1c	C374 H281
4	b	Out of the page	1	A	3.2b	C410 H315
5	d	Current	1	K	4.1e	C438 H334
6	c		1	A	5.1a	C458 H343
7	a	Wavelength	1	K	1.1b	C179-180 H103
8	a		1	A	2.2b	C195 H126

ANSWERS TO MULTIPLE CHOICE QUESTIONS CONTENUED : (12 marks)

Item	Answer	Answer	Mark	C.L	OB	P.N
9	b	$\frac{1}{2}\lambda$	1	R	3.3b	C480 H355
10	c	$4.32 \times 10^{-7} m$	1	A	3.4c	C473 H353-354
11	c	Helium nucleus | Electromagnetic radiation	1	K	4.1g	C231 H170-171
12	a	34	1	A	4.1c	C226 H170

ANSWERS TO EXTENDED QUESTIONS : (48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
13	a	The sum of the currents entering a junction in a circuit is always equal to the sum of currents leaving it.	1	K	1.3a	C144 H160
	b	$I_3 = I_1 + I_2$ $= 0.25 + 0.2$ $= 0.45A$	1 1	A	1.3h	C146 H160
	c	From the loop (dcbed) $E - 15 \times 0.2 - 20 \times 0.45 = 0$ $E = 12V$ **OR** From the loop (dcbafed) $E - 15 \times 0.2 + 20 \times 0.25 - 14 = 0$ **2 marks** $E = 12V$ **1 mark** **Note:** (1 mark for finding the voltage across each resistor)	1+1 1	A	1.3h	C146 H160

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
14	a	-current -area of the wire -number density of the wire -number of electrons. - volume of the wire. **(any two from the above is correct)**	2	K	1.1d	C132-133 H147
	b	$n = \frac{I}{evA}$ $= \frac{10.6}{(1.6 \times 10^{-19}) \times (1.179 \times 10^{-4}) \times (6.621 \times 10^{-6})}$ $= 8.5 \times 10^{28} electrons/m^3$ $n = \frac{number\ of\ electrons}{volume}$ $number\ of\ electrons = n \times volume$ $= 8.5 \times 10^{28} \times 3.531 \times 10^{-10}$ $= 3 \times 10^{19} electrons$	1 1	R	1.1e	C132-133 H147

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
15	a	The ratio of charge to potential for a conductor. **OR** The charge stored on plate per unit potential difference between the plates.	1	K	2.1a	C374 H281
	b	$C_{T1} = \frac{2 \times 4}{2+4} = 1.33\mu F$ $C_{T2} = 1.33 + 3 = 4.33\mu F = 4.33 \times 10^{-6} F$ $Q_T = C_T \times V_T$ $Q_T = 4.33 \times 10^{-6} \times 10$ $Q_T = 43.3 \times 10^{-6} C$	1 1 1	A	2.1f	C377-378 H284
	c	Will increase	1	R	2.1f	C378 H284

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
16	a	Magnetic force.	1	K	3.2a	C409 H314
	b	$F = BILsin\theta = 0.8 \times 0.10 \times 20 \times sin45^o$ $= 1.13N$	1 1	A	3.2b	C414 H315
	c	Decreases	1	R	3.2b	C414 H315
17	a. i	Magnetic flux is the product of the magnetic flux density and the area normal to the lines of flux	1	K	4.1a	C440 H332
	a .ii	$E = \frac{\Delta N\Phi}{\Delta t} = \frac{12 \times 10^{-3} - (6 \times 10^{-3})}{0.01}$ $= 0.6V$	1	A	4.1f	C441 H335
	b	- No change in magnetic flux. - No change in magnetic field density. - No change in area. - No change in the angle **(any one from the above is correct)**	1	R	4.1b	C440 H332
	c	$\frac{N_s}{N_P} = \frac{V_S}{V_P} = \frac{10}{5} = 2$	1	A	5.1b	C458-459 H343-344

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
18	a	Amplitude	1	K	1.1b	C180 H103
	b	$T = 60\ s$ $f = \frac{1}{T} = \frac{1}{60} = 0.017\ Hz$	1	A	1.1c	C183 H103
	c	$\frac{3\lambda}{4} = 0.6m$ $\lambda = 0.8\ m$	1	R	1.1b	C183 H104
19	a	Diffraction is the spreading of a wave as it passes through a gap or around an edge.	1	K	2.2a	C194 H126
	b	$d = \frac{1}{3000} = 3.33 \times 10^{-4} cm$ $d \sin\theta = n\lambda$ $\lambda = \frac{d \sin\theta}{n} = \frac{3.33 \times 10^{-4} \times \sin 25}{2}$ $= 7 \times 10^{-5} cm$	1 1	A	2.3b	C205 H129

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
20	a	Photoelectric emission **OR** Photoelectric effect.	1	K	3.2a	C471 H350-351
	b	$\emptyset = hf_o$ $5.11 \times 1.6 \times 10^{-19} = 6.63 \times 10^{-34} \times f_o$ $f_o = 1.23 \times 10^{15} Hz$	1 1	A	3.2f	C 473 H 354
21	a	i) b ii) a	1 1	K	3.4b	C 477 H357
	b	$\Delta E = E_4 - E_3$ $= (-0.85) - (-1.51) = 0.66eV$ $= 0.66 \times 1.6 \times 10^{-19}$ $= 1.056 \times 10^{-19} J$ $\Delta E = \frac{hc}{\lambda}$ $1.056 \times 10^{-19} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{\lambda}$ $\lambda = 1.88 \times 10^{-6} m$	1 1 1	A	3.4c	C 477 H358-359
	c	$\Delta E = E_2 - E_1$ $\Delta E = (-3.4) - (-13.6)$ $= 10.2\ eV$ Absorbed energy is less than ΔE	1 1	R	3.4a	C476-477 H 357-358

ANSWERS TO EXTENDED QUESTIONS :(48 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
22	a	The three main particles of an atom are **protons, electrons, and neutrons**.	3	K	4.1b	C226 H168
	b. i	$\Delta m = 5.015491 \times 10^{-27} - 5.006643 \times 10^{-27}$ $= 8.848 \times 10^{-30}\ kg$	1 1	A	4.2,d	C492 H377
	b. ii	$E = \Delta mc^2$ $= 8.848 \times 10^{-30} \times (3 \times 10^8)^2$ $= 7.9632 \times 10^{-13}\ J$	1 1	A	4.2,d	C492 H377
	c.	Nuclei A is more stable than nuclei B Because the binding energy of the nucleus **B** is less than the binding energy of nucleus **A**.	1 1	R	4.2 e	C495 H389

End Of Marking Guide