



امتحان دبلوم التعليم العام

لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)

الفصل الدراسي الأول - الدور الأول - للعام الدراسي ١٤٤٧/١٤٤٦ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الفيزياء.
- الأسئلة في (١٣) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (○) وفق النموذج الآتي:

س – عاصمة سلطنة عمان هي:

○ القاهرة ○ الدوحة

● مسقط ○ أبوظبي

ملاحظة: يتم تظليل الشكل (●) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ● **غير صحيح** ⊖ ◉ ◒ ⊗ ✓

مُسَوَّدَة، لا يتم تصحيحها

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Question 1: Multiple Choice Questions (14 marks)

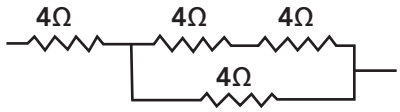
There are 14 multiple-choice items worth one mark each.
Shade in the bubble (⬭) next to the correct answer for each item.

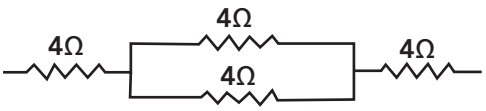
1) What is the **SI** unit of Potential difference?

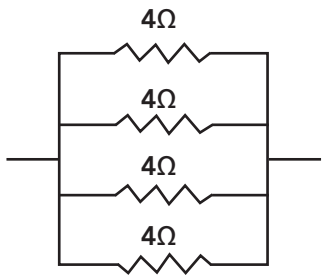
⬭ Ampere. ⬭ Coulomb.

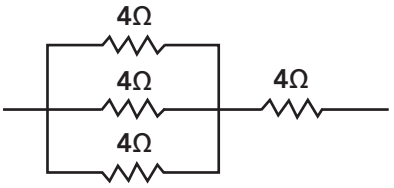
⬭ Joule. ⬭ Volt.

2) Which configuration of the following resistors results in an equivalent resistance of (10Ω)?

⬭ 

⬭ 

⬭ 

⬭ 

3) A (50 W) headlight is connected to a battery of voltage (2.5 V).
What is the value of the resistance (R) of the headlight?

⬭ 0.05 Ω ⬭ 0.125 Ω

⬭ 8.00 Ω ⬭ 125 Ω

4) In an electric circuit, some of the power supply energy is dissipated as thermal energy so the power supply becomes warm. This is due to:

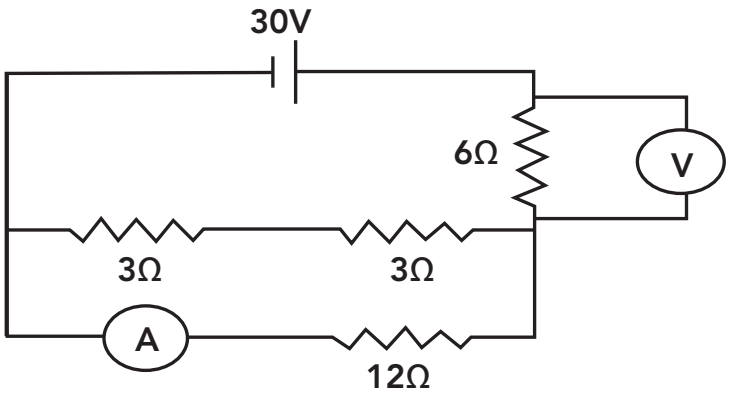
⬭ Potential difference. ⬭ External resistance.

⬭ Electric switch. ⬭ Internal resistance.

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Question 1 continued

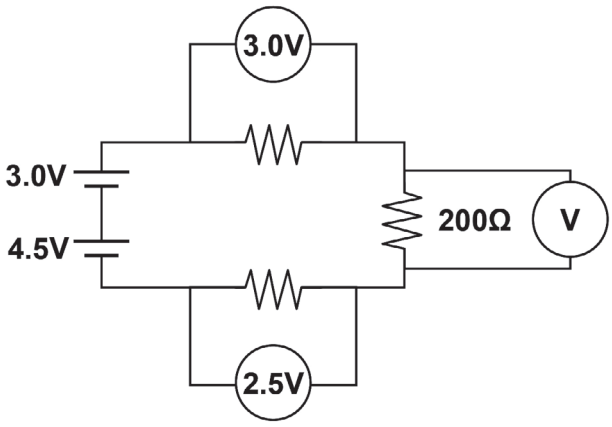
5) The figure below shows an electric circuit.



What are the readings of the ammeter and voltmeter?

	Ammeter's reading (A)	Voltmeter's reading (V)
☐	2.8	18
☐	1.0	18
☐	2.5	30
☐	3.0	30

6) The figure below shows an electric circuit.



What is the potential difference (V) across the (200 Ω) resistor?

☐ 2.0 V ☐ 3.0 V

☐ 4.5 V ☐ 7.5 V

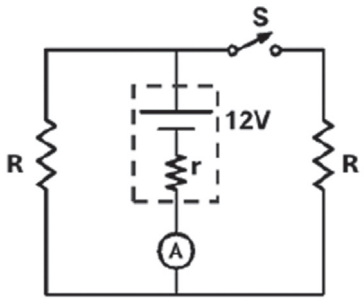
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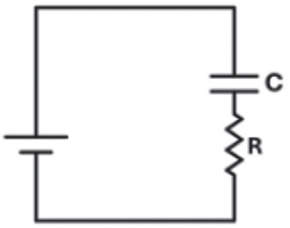
Question 1 continued

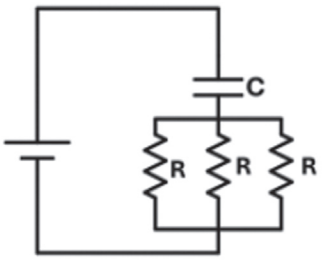
7) In the figure opposite the ammeter reads (3A) when the switch (S) is opened and reads (4.8 A) when the switch (S) is closed.
What is the value of the internal resistance?

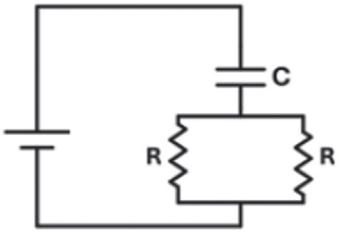


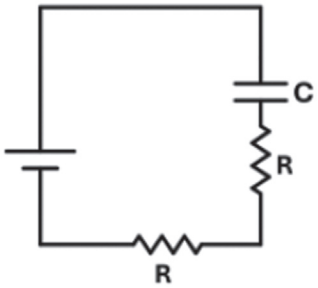
- ☐ 2.0 Ω
- ☐ 1.5 Ω
- ☐ 1.0 Ω
- ☐ 0.5 Ω

8) Which of the following circuits has the highest time constant (τ)?

- ☐ 

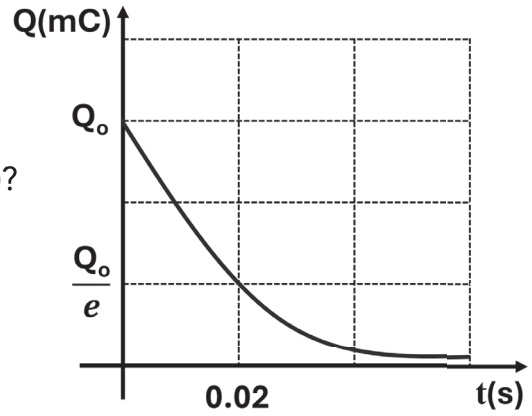
- ☐ 

- ☐ 

- ☐ 

9) The graph opposite shows the charge (Q) against time (t) for a capacitor (C) discharged through a resistor of (500 Ω).

What is the capacitance value of the capacitor (C)?

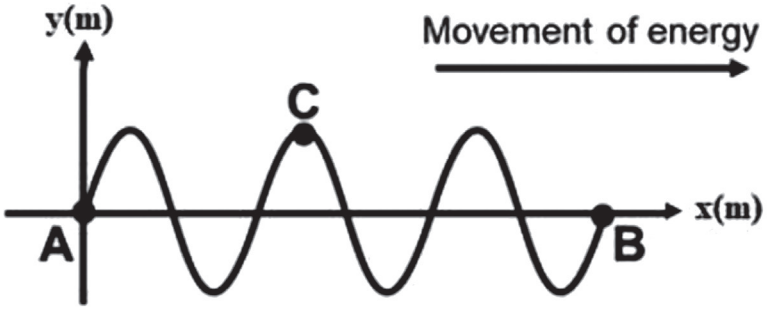


- ☐ 4.0 μF
- ☐ 10 μF
- ☐ 40 μF
- ☐ 100 μF

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Question 1 continued

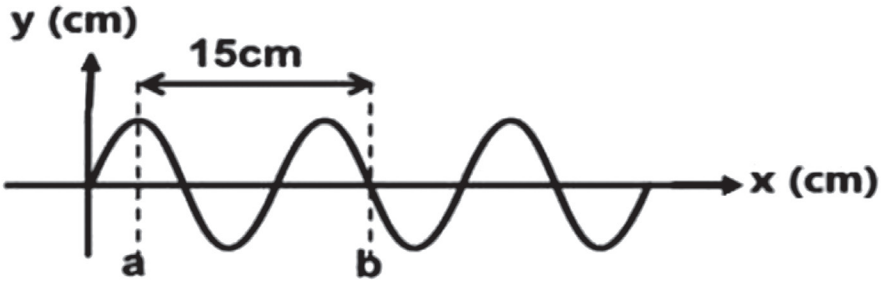
10) The figure below shows a traveling wave.



Which of the following represents the direction of motion of particle (C) when the wave travels from point (A) to point (B)?



11) What is the wavelength of the wave shown below?



- ▢ 5.0 cm
- ▢ 10 cm
- ▢ 12 cm
- ▢ 15 cm

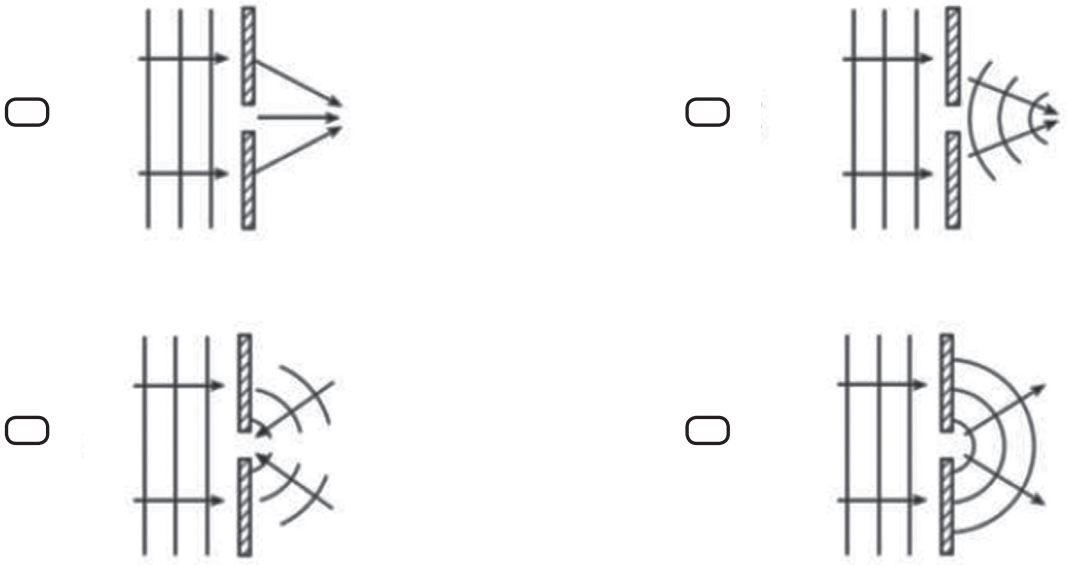
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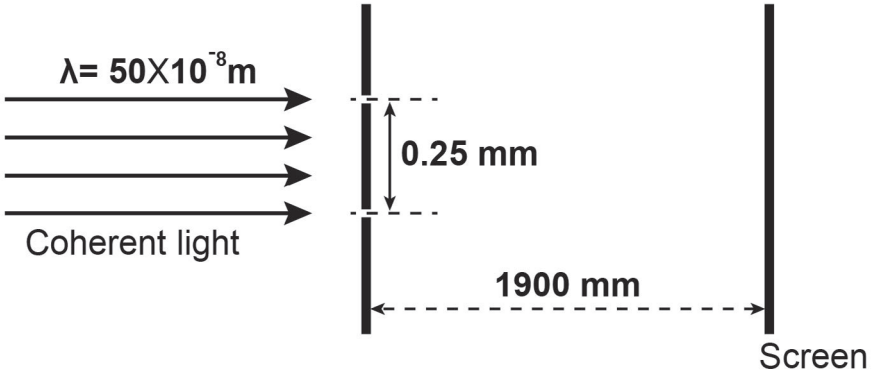
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Question 1 continued

12) Which of the following wave patterns represents the diffraction of water waves through a narrow gap?



13) The figure below shows Young's double-slit experiment using coherent light.



What is the spacing (x) of any two adjacent bright fringes on the screen?

- ▢ 2.6×10^{-2} m
- ▢ 3.8×10^{-3} m
- ▢ 2.4×10^{-10} m
- ▢ 6.5×10^{-11} m

14) Light normally falls on a diffraction grating of (500 lines/mm). If the first order, maximum is observed at an angle of (22°), what is the wavelength of the light?

- ▢ 1.33×10^{-6} m
- ▢ 1.33×10^{-3} m
- ▢ 7.49×10^{-4} m
- ▢ 7.49×10^{-7} m

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Question 2: Extended Questions (56 marks)

Write your answer for each of the following questions in the space provided.

Be sure to show all your work, including the correct units where applicable.

15) a. Define electric current. (1 mark)

b. Calculate the current when a charge of (360 C) passes a point in a circuit during (1.5 min). (2 marks)

c. Complete the following table. (3 marks)

Quantity	Definition	SI unit
e.m.f	_____	V
_____	The ratio of the potential difference (V) across the conductor to the current (I) passing through it.	_____

16) a. A conductive wire has a length (ℓ), radius (r) and resistance (R_1).
If the radius of the same wire is doubled and its length is halved, prove that the new resistance (R_2) will be: $\mathbf{R_2 = \frac{R_1}{8}}$ (3 marks)

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Question 2 continued

b. A copper wire of (1 m) length, a cross-sectional area of (5×10^{-7} m^2) and an electron density of (8×10^{28} m^{-3}) carries a current of (1 A).

(i) Calculate the average drift velocity of the electrons. (2 marks)

(ii) Calculate the charge that passes through the section of wire in (5 s). (2 marks)

(iii) What will happen to the average drift velocity of the electrons if the cross-sectional area of the wire is increased?

☐ Increases ☐ Decreases.

(Choose the correct answer)

Explain your answer (1 mark)

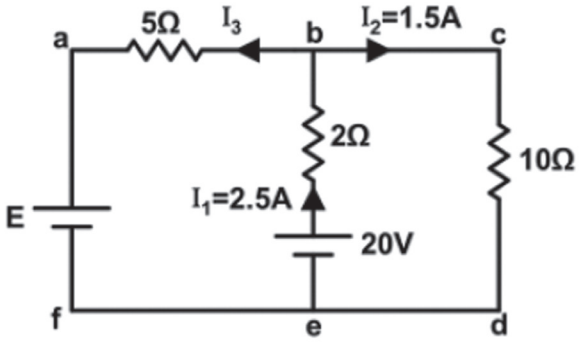
17) a. Complete the table below. (2 marks)

	The conserved quantity
Kirchhoff's first law	
Kirchhoff's second law	

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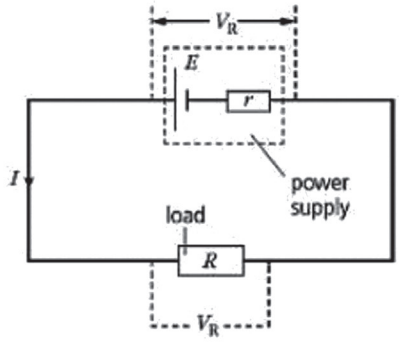
Question 2 continued

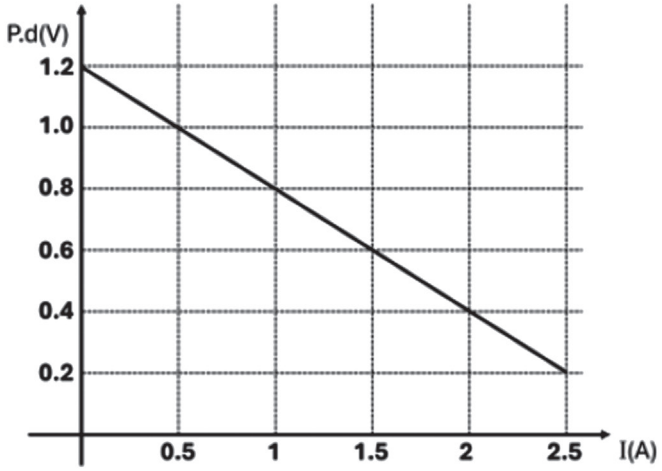
b. The figure below shows an electric circuit.



Calculate the value of (E)?. (5 marks)

18) The figures below shows a graph of the potential difference (P.d) versus the current (I) obtained from the circuit below.





a. Find the (e.m.f) of the cell. (1 mark)

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Question 2 continued

b. Calculate the current when the power supply gives the maximum power delivered to the external load (R)? (2 marks)

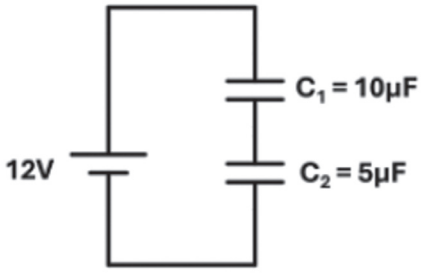
19) **a.** Write three factors that effect the voltage (V) while discharging a capacitor through a resistor (R). (3 marks)

(1)

(2)

(3)

b. From the figure below, calculate the total capacitance. (2 marks)



20) Two capacitors, (C_1 = 6 μF) and (C_2 = 4 μF), are connected in parallel and fully charged with a (20 V) battery.

a. Calculate the total energy stored in the system. (3 marks)

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Question 2 continued

b. In which arrangement of capacitors does the system store more energy?

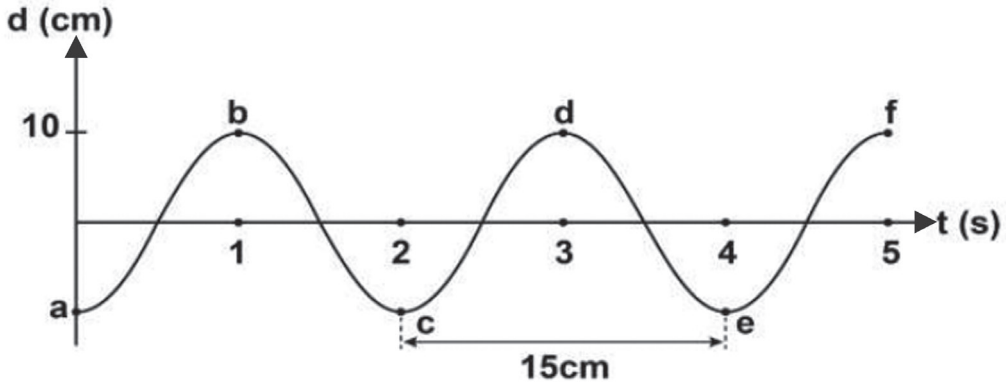
▭ Parallel. ▭ Series.

(Choose the correct answer) (1 mark)

Explain your answer (1 mark)

21) a. Define frequency. (1 mark)

b. The figure below shows (displacement – time) graph for a traveling wave.



(i) Find the following :

- Amplitude (A) _____ (1 mark)
- Wavelength (λ) _____ (1 mark)

(ii) Calculate the speed of the wave (ν) in ($m.s^{-1}$). (2 marks)

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Question 2 continued

22) A train blows its whistle when it passes by a stationary observer who measures a frequency of (219 Hz) when approaching, and (184 Hz) when moving away. Note: speed of sound in the air is (340 m/s).

a. Calculate the speed of the train (v_s). (2 marks)

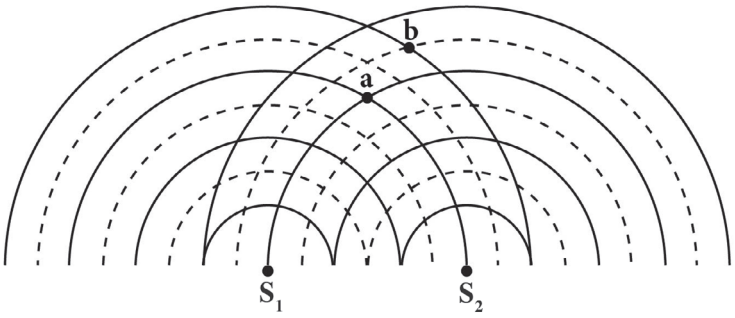
b. Calculate the whistle frequency (f_s). (2 marks)

23) **a.** Define diffraction. (1 mark)

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Question 2 continued

b. The figure below shows an interference of two waves from two coherent sources (S_1 and S_2).



What type of interference are at points (a) and (b)? (2 marks)

point	Constructive / Destructive
(a)	
(b)	

c. In Young's double-slit experiment, (630 nm) laser light is used. The distance between any two adjacent successive fringes is (x = 1.5 mm) and the distance between the double slits is (a = 1.0 mm).

(i) Calculate the distance between the double slits and the screen (D). (2 marks)

(ii) While replacing a laser by another source of light, the distance between any two adjacent successive fringes becomes (x = 2 mm).
What is the wavelength of the new source? (2 marks)

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Question 2 continued

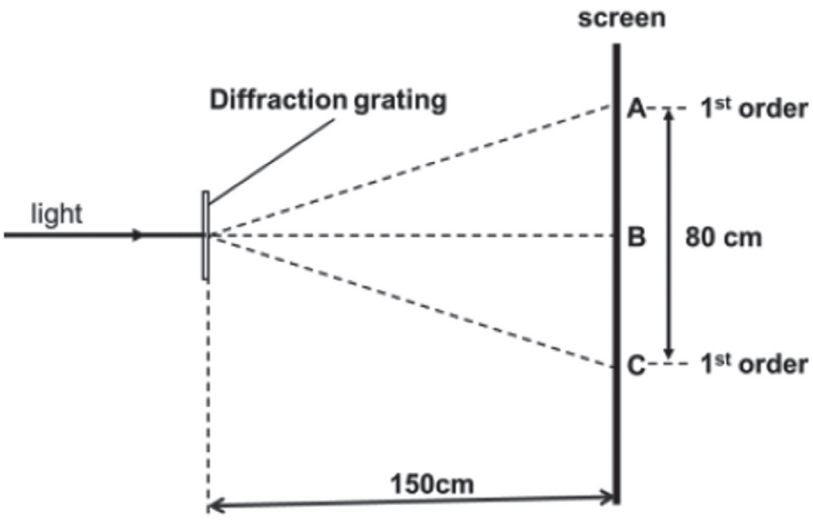
24) a. Define diffraction grating. (1 mark)

b. Light of (590 nm) wavelength, normally falls on a diffraction grating of (10000 lines/30 mm).

(i) Calculate the spacing of the slits. (1 mark)

(ii) Calculate the angle of the second order diffraction (2 marks)

c. The figure below shows a light of wavelength (λ) which falls on a diffraction grating with a spacing of ($d = 2.3 \times 10^{-6}$ m).



Find the wavelength of the light. (2 marks)

[End of Examination]

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Formulas and constants

Electricity				
$Q = It$	$Q = Ne$	$V = \frac{W}{Q}$	$V = IR$	$R = \frac{\rho L}{A}$
$P = IV$	$P = I^2R$	$P = \frac{V^2}{R}$	$P = \frac{W}{t}$	$I = Anvq$
$\sum I_{in} = \sum I_{out}$		$\sum \Delta V_{closed\ loop} = 0$		$emf = IR + Ir$
Capacitance				
$C = \frac{Q}{V}$	$W = \frac{1}{2} QV$	$W = \frac{1}{2} CV^2$	$W = \frac{1}{2} \frac{Q^2}{C}$	$x = x_o e^{-kt}$
waves				
$\nu = f \times \lambda$	Intensity = Power/area		$f_o = \frac{f_s v}{(v \mp v_s)}$	
Phase difference = $(\frac{t}{T}) \times 360^o$		Phase difference = $(\frac{s}{\lambda}) \times 360^o$		
Superposition of waves				
$\lambda = \frac{ax}{D}$		$d \sin\theta = n\lambda$		
Constants				
Speed of sound in air =340 m s^{-1}		$e = 1.6 \times 10^{-19}\ C$		

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GENERAL EDUCATION DIPLOMA EXAMINATION

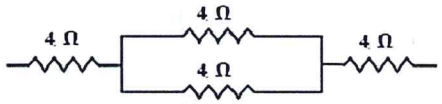
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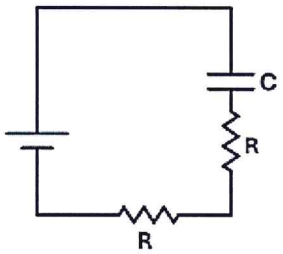
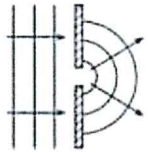
Physics 1st Semester, 1st Session 2024-2025

Marking Guide

Note: the marking guide in (14) pages — Full marks: (70)

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(14 marks)

Item	Answer	Mark	C.L	Ob	page
1	Volt	1	K	(1.2)a	4
2		1	A	(1.3) g	13
3	0.125 Ω	1	A	(1.2)m	6
4	Internal resistance	1	K	(1.4)a	33
5	1.0 | 18	1	R	(1.3)g	12-13
6	2.0 V	1	A	(1.3)b	25
7	1.0 Ω	1	R	(1.4) b	34

Item	Answer	Mark	C.L	Ob	page
8		1	A	(2.1)h	54
9	40 μF	1	R	(2.1)h	54
10		1	K	(3.1)a	57
11	12 cm	1	A	(3.1)c	58
12		1	K	(4.2)b	80
13	$3.8 \times 10^{-3}\ m$	1	A	(4.1)h & i	77-79
14	$7.49 \times 10^{-7}\ m$	1	A	(4.3)b	81-82

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	O.B	Page	ADDITIONAL INFORMATION
15	a	The amount of charge passing a point in the circuit at a certain time.	1	K	(1.1)a	4	Accept The flow of charge carriers.
	b	$t = 1.5 \times 60 = 90$ s **$I = Q/t$** $= 360$ C / 90 s $= 4$ A	1 1	A	(1.1)b	7	
	c	Quantity | Definition | SI unit [ ] | Energy transferred from other forms to electrical in driving charge around a complete circuit. | [ ] Resistance | [ ] | Ohm	1 1+1	K	(1.2)c (1.2)e	10 14	Accept R for quantity and Ω for unit

16	a	$A_2 = \pi(2r)^2 \quad A_2 = 4\pi r^2 \quad A_2 = 4A_1$ $L_2 = \frac{1}{2}L_1$ $R_2 = \rho\frac{L_2}{A_2} = \rho\frac{\frac{1}{2}L_1}{4A_1} = \frac{1}{8}\rho\frac{L_1}{A_1}$ $R_2 = \frac{1}{8}R_1$	1 1 1	R	(1.2)l	17	Accept $\rho_1 = \rho_2$ (1) $\frac{R_2 r_2^2}{L_2} = \frac{R_1 r_1^2}{L_1}$ (1) $R_2 = \frac{R_1 r_1^2 \frac{L_1}{2}}{4 r_1^2 L_1}$ (1) $= \frac{R_1}{8}$

Item	Part	Answer	Mark	C.L	O.B	Page	ADDITIONAL INFORMATION
16	b(i)	$v = \frac{I}{Anq} = \frac{1}{5 \times 10^{-7} \times 8 \times 10^{28} \times 1.6 \times 10^{-19}}$ $v = 1.5625 \times 10^{-4}\ m/s$	1 1	A	(1.1)b	8	Accept $1.6\times 10^{-4} m/s$ (one mark)
	b(ii)	$Q = I.t = 1 \times 5$ $Q = 5C$	1 1	A	(1.1)e	8,9	
	b(iii)	Decreases Because the drift velocity is inversely proportional to the cross-sectional area of the wire.	1	A	(1.1)d	8,9	Accept any other answers with the same meaning.
17	a	<table><tr><td></td><td>The conserved quantity</td></tr><tr><td></td><td>Charge or current</td></tr><tr><td></td><td>Energy or voltage</td></tr></table>	1 1	K	(1.3)a &b	**20+** 23	
	b	$I_3 = I_1 - I_2$ $I_3 = 2.5-1.5$ $I_3 = 1A$	1 1	A	(1.3)h	28-32	Accept **From loop (acdfa)** **$E = (-5\ I_3) + (10\ I_2)$** **(1 mark)**

		From loop (bafeb) 20-E = (2.5×2) + (5×1) E = 20 – 10 E =10 V	 1 1 1				**E = (-5 ×1) + (10 ×1.5) (1 mark)** **E = -5 + 15** **E = 10 V (1 mark)**

tem	Part	Answer	Mark	C.L	O.B	Page	ADDITIONAL INFORMATION
18	a	1.2V	1	K	(1.4)a	36	
	b	The maximum power is when the load resistance (R) is equal to the internal resistance. The gradian= -r Any two points from the graph $r = \frac{-(0.8-1.2)}{(1-0)}$ $r = 0.4\Omega$ The current is E=Ir+Ir = 2Ir $I = \frac{E}{2r} = \frac{1.2}{2\times0.4}$ $I = 1.5\ A$	1 1	R	(1.4)b	36	

Item	Part	Answer	Mark	C.L	B.O	Page	ADDITIONAL INFORMATION
19	a	1- Capacitance of the capacity 2- Resistance of the resistor 3- Initial voltage of the power supply (before discharging) 4- Time constant (Any three of the above)	3	K	(2.1)i	53	
	b	The total charge at (C_1)is the same as the charge in the total capacitor (C_T) $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2}$ $\frac{1}{C_T} = \frac{1}{5\mu} + \frac{1}{10\mu} = \frac{3}{10\mu}$ $C_T = \frac{10\mu}{3}$ F	1 1	A	(2.1)e	45-46	

Item	Part	Answer	Mark	C.L	B.O	Page	ADDITIONAL INFORMATION
20	a	They are in parallel so $C_T = C_1 + C_2$ $C_T = 6\mu + 4\mu = 10\mu F$ The total energy $E_P = \frac{1}{2} \times C_T \times V^2$ $E_P = \frac{1}{2} \times 10 \times 10^{-6} \times (20)^2$ $E_P = 2 \times 10^{-3} J$	1 1 1	A	(2.1)e	47+ 50	
	b	parallel Because the total capacity is greater than in series.	1 1	R	(2.1)e &f	47+ 50	

Item	Part	Answer	Mark	C.L	B.O	Page	ADDITIONAL INFORMATION
21	a	The number of oscillation (cycles) per unit time.	1	K	(3.1)d	60	
	b(i)	Amplitude(A) = 10 cm Wavelength(λ) = 15 cm	1 1	K	(3.1)d	59	No marks for units
	b(ii)	$v = \frac{\lambda}{T}$ $v = \frac{0.15}{2}$ $v = 0.075\ m/s$	1 1	A	(3.1)f	62	One mark if he finds the result in (cm/s)

Item	Part	Answer	Mark	C.L	B.O	Page	ADDITIONAL INFORMATION
22	a	$219 = \frac{f_s \times 340}{340 - v_s}$ *approaching* $184 = \frac{f_s \times 340}{340 + v_s}$ *moving away* $\frac{219}{184} = \frac{340 + v_s}{340 - v_s}$ $62560 + 184v_s = 74460 - 219v_s$ $403v_s = 11900$ $v_s = 29.5\ m/s$	1 1	R	(3.2)b &c	68-69	
	b	$f_0 = \frac{f_s \times v}{v - v_s}$ $219 = \frac{f_s \times 340}{340 - 29.5}$ $f_s = 200$ Hz	 1 1	A	(3.2)c	68-67	

Item	Part	Answer	Mark	C.L	B.O	Page	ADDITIONAL INFORMATION
23	a	Diffraction is defined as the spreading of a wave after passing through a narrow slit or past an edge.	1	K	(4.2)a	80	
	b	Constructive / Destructive a Constructive b Destructive	1 1	K	(4.1)c & d &f	72	
	c(i)	$D = \frac{ax}{\lambda} = \frac{0.001 \times 1.5 \times 10^{-3}}{630 \times 10^{-9}}$ $D = 2.38\ m$	1 1	A	(4.1)i	78-79	

Item	Part	Answer	Mark	C.L	O.B	Page	ADDITIONAL INFORMATION
	c(ii)	$\frac{\lambda_1}{\lambda_2} = \frac{x_1}{x_2}$ $\frac{630}{\lambda_2} = \frac{1.5}{2}$ $\lambda_2 = 840\ nm$	1 1	A	(4.1)i	78-79	Accept $840 \times 10^{-9} m$
24	a	A diffraction grating is a plate on which there is a very large number of parallel, identical, very closely spaced slits.	1	K	(4.3)a	80	
	b(i)	$d = \frac{30}{10000} = 3.0 \times 10^{-3}\ mm$	1	A	(4.3)b	81-82	Accept $3.0 \times 10^{-6}\ m$
	b(ii)	$sin\theta = \frac{n\lambda}{d} = \frac{2 \times 590 \times 10^{-9}}{3.0 \times 10^{-6}}$ $\theta = 23.2^0$	1 1	A	(4.3)b	81-82	

	c	$tan\theta = \frac{40}{150}$ $\theta = 15^0$ $\lambda = \frac{dsin\theta}{n} = \frac{2.3 \times 10^{-6} \times sin15}{1}$ $\lambda = 595 \times 10^{-9}\, m$	1 1	R	(4.3)b	81-82	Accept $600nm$ Or $600 \times 10^{-9}m$

End of Marking Guide





امتحان دبلوم التعليم العام

لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)

الفصل الدراسي الأول - الدور الثاني - للعام الدراسي ١٤٤٦ / ١٤٤٧ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الفيزياء.
- الأسئلة في (١٥) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (○) وفق النموذج الآتي:

س – عاصمة سلطنة عمان هي:

○ القاهرة ○ الدوحة

● مسقط ○ أبوظبي

ملاحظة: يتم تظليل الشكل (●) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ● **غير صحيح** ▭ ◉ ◒ ✗ ✓

مُسَوَّدَة، لا يتم تصحيحها

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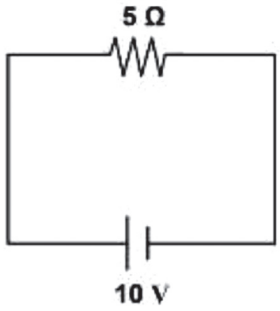
Question 1: Multiple Choice Questions (14 marks)

There are 14 multiple-choice items worth one mark each.
Shade in the bubble (○) next to the **correct** answer for each item.

1) What is the **SI** unit of electric current?

- ○ Ampere.
- ○ Coulomb.
- ○ Joule
- ○ Volt.

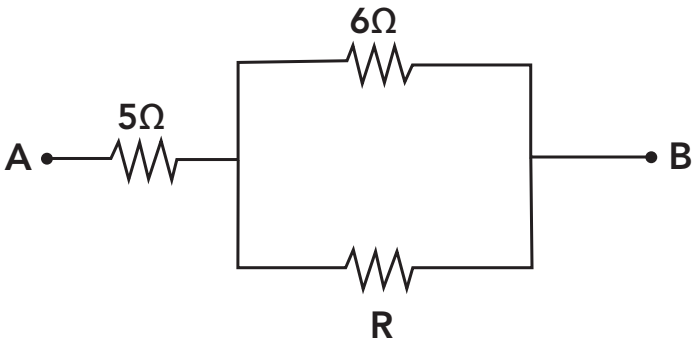
2) How much power is dissipated in the resistor shown in the opposite figure?



- ○ 2.0 W
- ○ 20 W
- ○ 50 W
- ○ 100 W

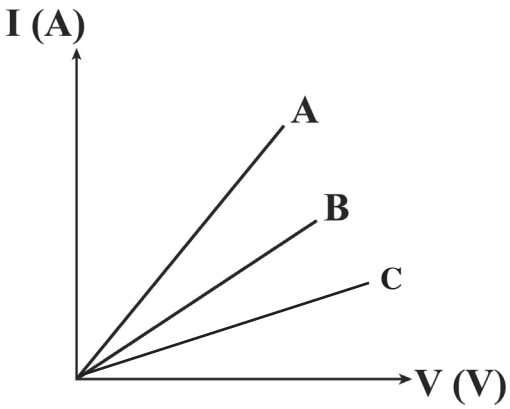
3) The figure below shows part of an electrical circuit. If the equivalent resistance between points A and B is (7 Ω), what is the value of resistor (R)?

- ○ 1 Ω
- ○ 2 Ω
- ○ 3 Ω
- ○ 6 Ω



4. The graph below shows the (current-voltage) variations for three wires (A, B and C). What is the correct values arrangement of the wires resistances?

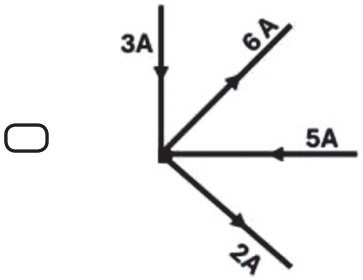
- ○ $R_A > R_B > R_C$
- ○ $R_A < R_B < R_C$
- ○ $R_A > R_C > R_B$
- ○ $R_B > R_C > R_A$

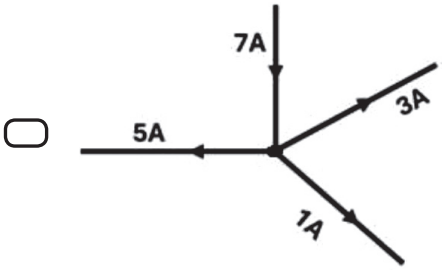


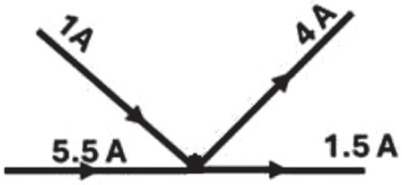
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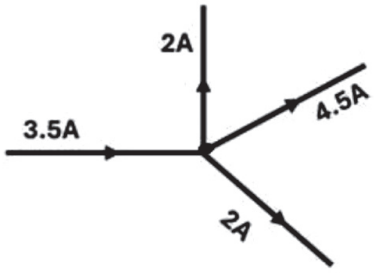
Question 1 continued

5. Which of the following junctions obeys Kirchhoff's First Law?



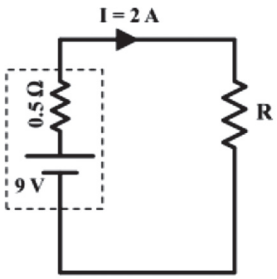






6. The figure opposite shows an electric circuit.

What is the value of resistor (R)?



- 2 Ω
- 4 Ω
- 7 Ω
- 8 Ω

7. An electric blender dissipates (600 W), a toaster dissipates (1100 W), and a microwave dissipates (1000 W). If all three appliances are connected in parallel to a (120 V) circuit, what is the total current flowing through the circuit?

- 22.5 A
- 9.2 A
- 8.3 A
- 5.0 A

8. Two capacitors (C_1 = 4 μF) and (C_2 = 6 μF) are connected in series across a (10 V) battery. What is the total charge on capacitor (C_1)?

- 16 μC
- 24 μC
- 30 μC
- 100 μC

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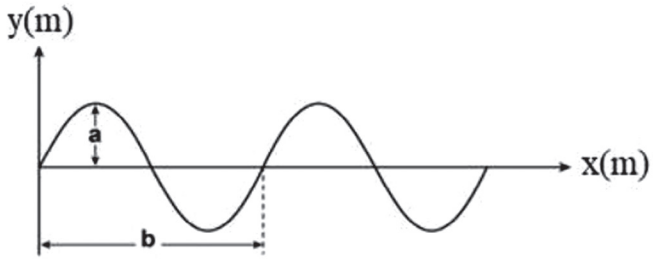
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Question 1 continued

9. A capacitor with capacitance (C) stores charge (Q) at a potential difference (V). If the applied voltage is reduced to half, what will be the new value of the capacitance?

- ☐ $\sqrt{C}$
- ☐ $\frac{1}{2}C$
- ☐ C
- ☐ 2 C

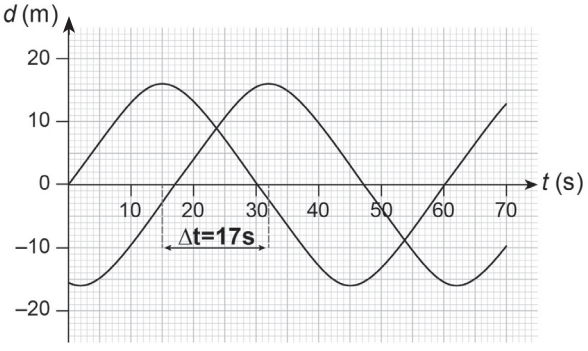
10. The figure below shows a transverse wave.



What do (a, b) represent?

	a	b
☐	Wavelength	Amplitude
☐	Amplitude	Wavelength
☐	Movement of energy	Amplitude
☐	Wavelength	Movement of energy

11. The figure below shows a (displacement – time) graph of two waves.



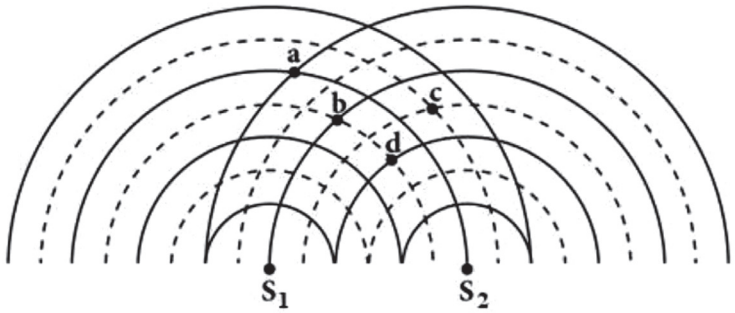
What is the phase difference between them in degrees?

- ☐ 43°
- ☐ 60°
- ☐ 77°
- ☐ 102°

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Question 1 continued

12. The figure below shows interference in water waves.



What type is the interference in (**a**, **b**, **c**, **d**) points?

	a	b	c	d
☐	Constructive	Destructive	Constructive	Destructive
☐	Destructive	Constructive	Destructive	Constructive
☐	Destructive	Destructive	Constructive	Constructive
☐	Constructive	Constructive	Destructive	Destructive

13. In Young's double-slit experiment using a light source of a wavelength of (500 nm), the slits are (2 m) away from the screen, and the fringe width is (4.0×10^{-3} m). What is the distance between the slits?

- ☐ 250 m
- ☐ 4×10^{-3} m
- ☐ 2.5×10^{-4} m
- ☐ 2.5×10^{-6} m

14. What is the distance between any two adjacent slits in a grating containing (500 lines per mm)?

- ☐ 2×10^{-3} m
- ☐ 2×10^{-5} m
- ☐ 2×10^{-6} m
- ☐ 2×10^{-9} m

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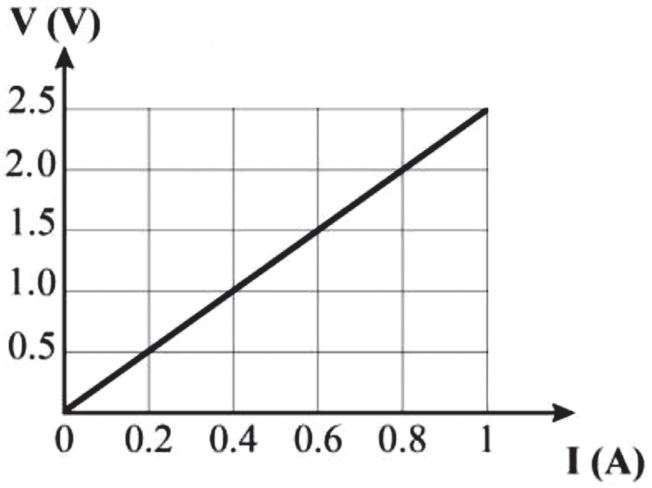
Question 2: Extended Questions (56 marks)

Write your answer for each of the following questions in the space provided.

Be sure to show all your work.

15. **(a)** State Ohm's law. (1 mark)

(b) The graph below shows the potential difference against the current for **Constantan** wire.



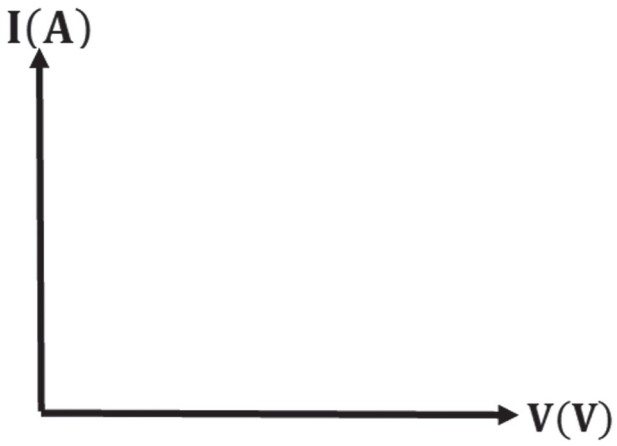
i. Find the resistance (R) of the wire. (2 marks)

ii. Calculate the current (I) at (V = 12 V). (1 mark)

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Question 2 continued

iii. If the wire is replaced by a filament lamp, sketch the new current-voltage (I-V) on the graph below. (1 mark)

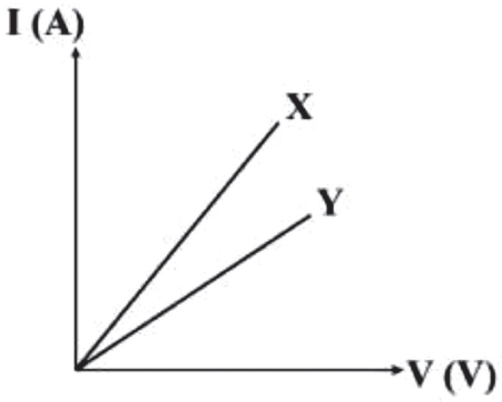


16. (a) i. Write two factors that affect the resistance of a metal wire. (2 marks)

1- _____

2- _____

ii. The graph below shows electric current (I) versus the potential difference (V) for two wires (X & Y) that have the same length and are made of the same material.



Which wire is thicker?

☐ X ☐ Y

(Choose the correct answer) (1 mark)

Explain your answer. _____ (1 mark)

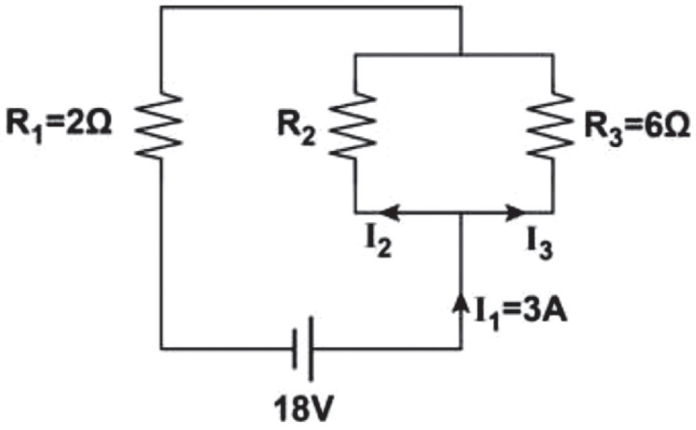
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Question 2 continued

(b) The figure below shows an electric circuit.



i. Calculate the value of (I_3). (2 marks)

ii. Calculate the value of (R_2). (2 marks)

iii. What will happen to the current if R_1, R_2 and R_3 are connected in series? (1 mark)

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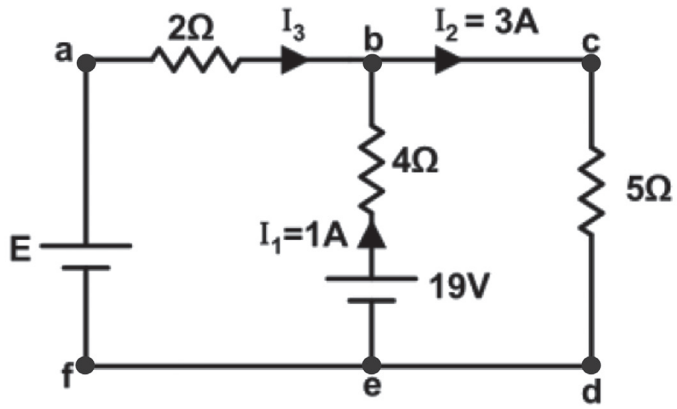
Question 2 continued

17. (a) Complete the table below by writing the name of Kirchhoff's Laws.

(2 marks)

Name of the Law	conserved quantity
_____	Charge
_____	Energy

(b) The figure below shows an electric circuit.



Calculate the value of (E). (5 marks)

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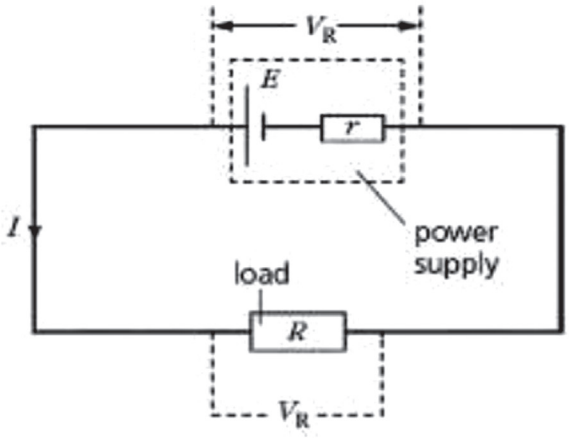
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Question 2 continued

18. (a) What is the effect of the internal resistance in the power supply? (1 mark)

(b) The figure below shows a power supply with an internal resistance of (2 Ω). The load resistance changes from (0 to 5 Ω). The table below lists some values of the load resistance (R) and their matching voltage readings (V_R).



V_R (V)	R (Ω)
4	1
6	2
8	4

When the power delivered to the load is maximum, find the corresponding current. (2 marks)

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Question 2 continued

19. (a) Complete the table below. (3 marks)

Term	Definition	unit
Farad	_____	**F**
_____	The time for the charge to have decreased to 1/e of its initial value	_____

(b) An electric circuit contains (n) identical capacitors. When these capacitors are connected in parallel, the total capacitance is (800 μF), and when they are connected in series, the total capacitance is (200 μF).

i. Find the number of capacitors (n). (2 marks)

ii. What is the value of the capacitance (C)? (1 mark)

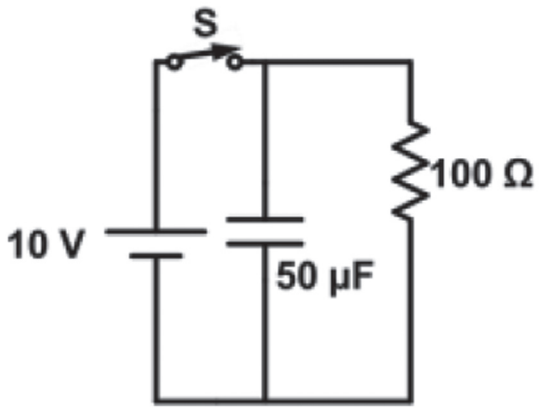
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Question 2 continued

20. In the circuit shown below, the switch is closed and the capacitor is fully charged.



(a) Calculate the time constant. (1 mark)

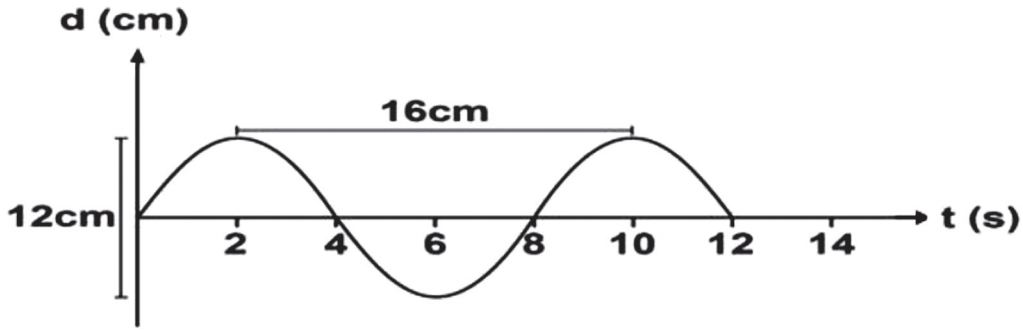
(b) If the switch (S) is open, calculate the voltage across the resistor after (10 ms). (3 marks)

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Question 2 continued

21. (a) Define phase difference. (1 mark)

(b) The figure below shows a transverse wave.



Find the value of the following:

i. Amplitude: _____ (1 mark)

ii. Period: _____ (1 mark)

iii. Speed of the wave. (1 mark)

(c) Two waves (x and y) of amplitudes (A_x = 1.5 cm) and (A_y = 30 cm) respectively. If both waves have the same frequency.

Calculate $\frac{\text{intensity of the wave } (I_x)}{\text{intensity of the wave } (I_y)}$ (2 marks)

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Question 2 continued

22. A train moves with a speed of (27 m s^{-1}) towards a stationary observer, who was able to hear a (400 Hz) frequency of the train's whistle sound.

(a) Calculate the frequency of the train's whistle. (2 marks)

(b) Find the frequency that the observer hears as the train moves away from him.

(2 marks)

23. **(a)** State the principle of the superposition of waves. (1 mark)

(b) Write the type of interference (constructive/destructive) in the table below.

(2 marks)

Trough+ Trough	Crest+ Trough

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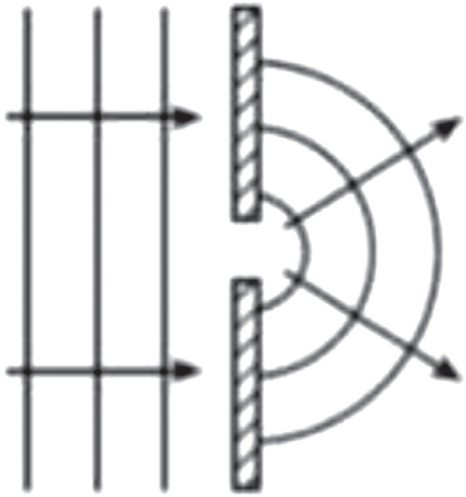
Question 2 continued

(c) In Young's Double-slit experiment, a light with a wavelength of (500 nm) falls on two slits (1 mm) apart. The third bright fringe appears at a distance of (12 mm) from the central fringe.

i. Find the distance between any two adjacent bright fringes (x). (1 mark)

ii. Calculate the distance between the screen and the slits (D). (2 marks)

24) (a) Write the name of the phenomena shown under the figure below. (1 mark)



(b) A light of (589 nm) wavelength normally falls on a diffraction grating. The first order maximum appears at an angle of (15.5°).

i. Calculate the distance between the fringes. (2 marks)

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Question 2 continued

ii. Find the diffraction angle of the third order maximum. (1 mark)

(c) In a diffraction grating experiment two light sources (λ_1 and λ_2) were used where (λ_1 = 430 nm). If the fourth fringe of (λ_1) and the sixth fringe of (λ_2) lie at the same distance from the zero order fringe.

What is the value of (λ_2)? (2 marks)

[End of Examination]

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Formulas and constants

Electricity				
$Q = It$	$Q = Ne$	$V = \frac{W}{Q}$	$V = IR$	$R = \frac{\rho L}{A}$
$P = IV$	$P = I^2R$	$P = \frac{V^2}{R}$	$P = \frac{W}{t}$	$I = Anvq$
$\sum I_{in} = \sum I_{out}$		$\sum \Delta V_{closed\ loop} = 0$		$emf = IR + Ir$
Capacitance				
$C = \frac{Q}{V}$	$W = \frac{1}{2} QV$	$W = \frac{1}{2} CV^2$	$W = \frac{1}{2} \frac{Q^2}{C}$	$x = x_o e^{-kt}$
waves				
$v = f \times \lambda$	Intensity = Power/area		$f_o = \frac{f_s v}{(v \mp v_s)}$	
Phase difference = $(\frac{t}{T}) \times 360$			Phase difference = $(\frac{s}{\lambda}) \times 360^o$	
Superposition of waves				
$\lambda = \frac{ax}{D}$			$d \sin\theta = n\lambda$	
Constants				
Speed of sound in air =340 m s^{-1}			$e = 1.6 \times 10^{-19}\ C$	

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

GENERAL EDUCATION DIPLOMA EXAMINATION

Royal Guard of Oman Technical College,

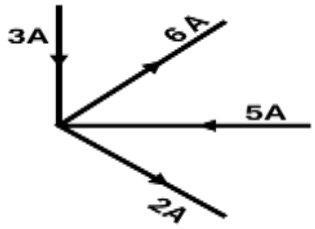
Physics 1st Semester, 2nd Session 2024-2025

سلطنة عمان
وزارة التربية والتعليم

Marking Guide

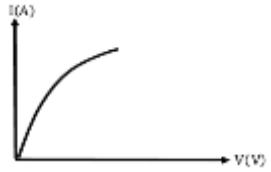
Note: the marking guide in (13) pages **Full marks: (70)**

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(14 marks)

Item	Answer	Mark	C.L	Ob	P.N
1	Ampere	1	K	(1.1) a	4
2	20 W	1	A	(1.2) m	7
3	3 Ω	1	A	(1.3) g	13
4	$R_A < R_B < R_C$	1	R	(1.2) g&h	14
5		1	A	(1.3)a	20

Item	Answer	Mark	C.L	Ob	P.N
6	4 Ω	1	A	(1.4)b	34
7	22.5 A	1	R	(1.2)l	36
8	24 µC	1	A	(2.1)e	46
9	C	1	R	(2.1)a	43
10	Amplitude | Wavelength	1	K	(3.1)d&g	58
11	102^0	1	A	(3.1)d	60-61
12	constructive | destructive | constructive | destructive	1	K	(4.1)c&d&f	72
13	$2.5 \times 10^{-4}\ m$	1	A	(4.1)h&i	79-77
14	2×10^{-6} m	1	A	(4.3)a	81-80

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
15	a	Ohm's law states that, for a metallic conductor at a constant temperature, the current in the conductor is proportional to the potential difference across it.	1	K	(1.2) f	15	
	b (i)	$R = \frac{V}{I} = \frac{2.5 - 0}{1 - 0}$ $= 2.5\ \Omega$	1 1	A	(1.2) g	5	Accept any two right points from the graph
	b (ii)	$I = \frac{V}{R} = \frac{12}{2.5} = 4.8\ A$	1	A	(1.2) g	5	Accept the final result Error carried forward should be considered
	b (iii)		1	K	(1.2) h	14	

Item	Part	Answer	Mark	C.L	Ob.	P.N.	ADDITIONAL INFORMATION
16	(a) i	1. Cross-sectional area 2. Length 3. Resistivity of material	1 1	K	(1.2) I	16,17	Accept any correct two of them.
	(a)ii	x Because its slope ($\frac{1}{R}$) is higher The lower the cross-sectional area (A), the higher the resistance (R).	1 1	R	(1.2) l	17	Accept the inverse of its slope (R) is smaller with the same explanation.
	(b) i	$V_1 = 2 \times 3 = 6\ V$ $V' = V - V_1 = 18 - 6 = 12\ V$ $I_3 = \frac{V'}{R_3} = \frac{12}{6} = 2\ A$	1 1	A	(1.3) g	12,13	Accept $18 = 6I_3 + (3 + 2)$ (1 mark) $6I_3 = 12$ $I_3 \equiv \frac{12}{6} = 2A$ (1 mark)
	(b)ii	I_2= 3-2 = 1 A $R_2 = \frac{V'}{I_2} = \frac{12}{1} = 12\ \Omega$	1 1	A	(1.3) g	12,13	$R_{eq} = \frac{V}{I_3} = \frac{18}{3} = 6$ (1 mark) $R_1 + R_{eq_2} = 6$ $R_{eq} = 6 - 2 = 4$

							$\frac{1}{R_{eq_2}} = \frac{1}{R} + \frac{1}{R_3}$ $\frac{1}{4} = \frac{1}{R} + \frac{1}{6}$ $R = 12\Omega$ (1 mark)
	(b) iii	It will decrease	1	R	(1.3) g	12,13	Accept resistance will increase

<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><th>ADDITIONAL INFORMATION</th></tr>
<tr><td rowspan="2">17</td><td>(a)</td><td><table><tr><th>Name of the Law</th><th>conserved quantity</th></tr><tr><td>Kirchhoff's First Law <u>or</u>
Kirchhoff's Current Law</td><td>Charge</td></tr><tr><td>Kirchhoff's Second Law <u>or</u>
Kirchhoff's Voltage Law</td><td>Energy</td></tr></table></td><td>1

1</td><td>K</td><td>(1.3)
a&b</td><td>20
+23</td><td></td></tr>
<tr><td>(b)</td><td>Using KCL
$I_3 = I_1 - I_2$
$I_3 = 3-1$
$I_3 = 2A$
From loop (abefa)
$E - 19 = (2\times I_3) - (4\times I_1)$
$E - 19 = (2\times 2) - (4\times 1)$
$E = 19$ V</td><td>1
1

1
1
1</td><td>A</td><td>(1.3)h</td><td>28-
32</td><td>Accept
From loop (abcdefa)
$E = (2\times I_3) + (5\times I_2)$
(1 mark)
$E = (2\times 2) + (5\times 3)$
(1 mark)
$E = 19$ V (1 mark)</td></tr>
<tr><td>18</td><td>(a)</td><td>It dissipates some of the electric energy of the power supply as thermal energy.</td><td>1</td><td>K</td><td>(1.4)a</td><td>33</td><td>Accept
it will make the P.d of the power supply less than its e.m.f</td></tr>
</table>

	(b)	The current when the power delivered to the load is maximum is when R=r From the table R=2 Ω and V_R= 6 V I= $\frac{V_R}{R} = \frac{6}{2}$ I= 3 A	1 1	R	(1.4)b	36	-Any other values of R & V are not accepted -Writing the final answer gets the full mark

Item	Part	Answer	Mark	C. L	Ob	P.N	ADDITIONAL INFORMATION
	(a)	<table><tr><th>Term</th><th>Definition</th><th>unit</th></tr><tr><td>Farad</td><td>One coulomb per volt Or one farad when potential difference of one volt will charge it with one coulomb of electricity</td><td>F</td></tr><tr><td>Time constant</td><td>The time for the charge to have decreased to 1/e of its initial value</td><td>s</td></tr></table> one mark for each blank	3	K	(2.1)a &h	40+ 54	

19	b(i)	In Parallel $C_T = n\,C = 800\ \mu F$ In Series $C_T = \frac{C}{n} = 200\ \mu F$ Divide them $\frac{800\ \mu F}{200\ \mu F} = n^2$ So, $n^2 = 4$ $n = 2$	1 1	R	(2.1) e	45-46	Writing the final answer gets the full mark Accept **in parallel** **$C_T = C_1 + C_2 + C_3 + \ldots$** **Since they are identical** **800μF = 400 μF +400 μF (one mark)** **So n = 2 (one mark)**
	b(ii)	$C = \frac{C_{T(parallel)}}{n} = 400\ \mu F$	1	A	(2.1) e	46-47	Accept **$C = n\,C_{T(series)} = 400\ \mu F$ (one mark)** **Or** **$C = 400\ \mu F$ (one mark)**

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
20	(a)	Time constant= RC $= 100 \times 50 \times 10^{-6}$ $=5\times 10^{-3}$ s	1	A	(2.1)h	54	Accept (5 ms)
	(b)	$10\ ms = 10 \times 10^{-3} s$ $V = V_o e^{t/RC}$ $V = 10\ e^{10\times10^{-3}/5\times10^{-3}}$ V= 1.35 V	1 1 1	A	(2.1)i	47+50	- only one mark is reduced if the unit of time is not converted

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
21	a	- Phase difference is used to describe the relative positions of the crests or troughs of two different waves of the same frequency.	1	K	(3.1)d	59	
	b (i)	Amplitude: 6cm	1	K	(3.1)d	59	Accept 0.06m for amplitude
	b (ii)	Period: 8 s	1	K	(3.1)d	59	
	b (iii)	$v = \frac{\lambda}{T} = \frac{16}{8} = 2\ cm.s^{-1}$	1	A	(3.1)f	62	Accept $v = 0.02\ m.s^{-1}$
	c	$\frac{I_x}{I_y} = \frac{A_x^2}{A_y^2}$ $\frac{I_x}{I_y} = \frac{1.5^2}{3.0^2}$ $\frac{I_x}{I_y} = \frac{1}{4} = 0.25$	1 1	R	(3.1)h	62	

Item	Part	Answer	Mark	C.L	O.B	P.N	ADDITIONAL INFORMATION
22	a	$f_0 = \frac{f_s v}{v - v_s}$ $f_s = \frac{f_0(v - v_s)}{v}$ $f_s = \frac{400(340 - 27)}{340}$ $f_s = 368Hz$	1 1	A	(3.2) b&c	67-68	
	b	$f_0 = \frac{f_s v}{v + v_s}$ $f_0 = \frac{368 \times 340}{340 + 27}$ $f_0 = 341Hz$	1 1	A	(3.2) b&c	67-68	

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
23	a	When two or more waves meet at a point, the resultant displacement at that point is equal to the sum of the displacement of the individual waves at that point.	1	K	(4.1)a	73	
	b	Trough+ Trough: constructive; Crest+ Trough: destructive	1+1	K	(4.1)c	72	
	c (i)	$x = \frac{12}{3} = 4\ mm = 4 \times 10^{-3} m$	1	A	(4.1)i	77-79	
	c (ii)	$D = \frac{ax}{\lambda} = \frac{1 \times 10^{-3} \times 4 \times 10^{-3}}{500 \times 10^{-9}}$ $D = 8\ m$	1 1	A	(4.1)i	77-79	

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
24	a	Diffraction	1	k	(4.3) a	80	
	b (i)	$d = \frac{n\lambda}{sin\theta} = \frac{1 \times 589 \times 10^{-9}}{sin(15.5)}$ $d = 2.2 \times 10^{-6}\ m$	1 1	A	(4.3) b	81-82	
	b (ii)	$sin\theta = \frac{n\lambda}{d}$ $sin\theta = \frac{3 \times 589 \times 10^{-9}}{2.2 \times 10^{-6}}$ $\theta = 53.4^0$	1	A	(4.3) b	81-82	
	c	$\frac{\lambda_1}{\lambda_2} = \frac{n_2}{n_1}$ $\frac{430}{\lambda_2} = \frac{4}{6}$ $\lambda_2 = 645\ nm$	1 1	R	(4.3) b	81-82	Accept $645 \times 10^{-9}\ m$

End of Marking Guide