سلطنة عمان
وزارة التربية والتعليم

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

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

الفصل الدراسي الأول - الدور الثاني

للعام الدراسي ١٤٤٦ - ١٤٤٧ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الفيزياء.
- الأسئلة في (١٢) 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 Items (14 marks)

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

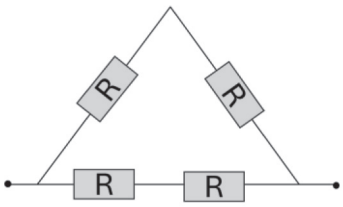
1) "The energy transferred per unit charge" is the definition of:

- ○ Power.
- ○ Current.
- ○ Drift velocity.
- ○ Potential difference.

2) What is **SI** unit of electric charge?

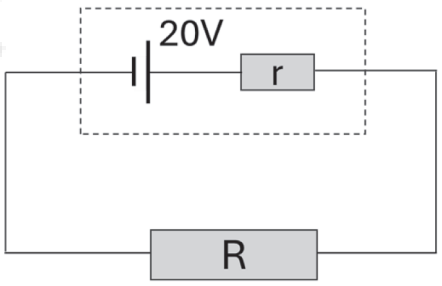
- ○ Jule.
- ○ Volt.
- ○ Ohm.
- ○ Coulomb.

3) What is the combined (total) resistance of the circuit opposite?



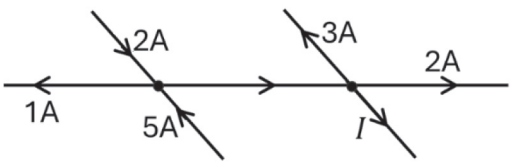
- ○ 0.5 R
- ○ R
- ○ 2 R
- ○ 2.5 R

4) The figure opposite shows an electric circuit. If the internal resistance (r) equals $\frac{R}{4}$, what is (V_r)?



- ○ 2 V
- ○ 4 V
- ○ 5 V
- ○ 16 V

5) What is the magnitude of the current (I) in the diagram shown below?



- ○ 1 A
- ○ 3 A
- ○ 5 A
- ○ 6 A

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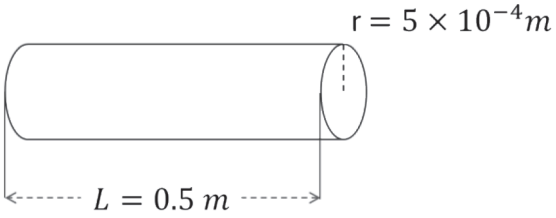
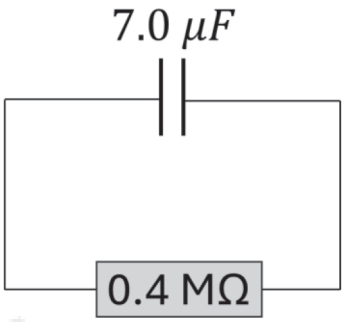
Question 1 continued

6) What is the resistance of the copper wire ($\rho_{copper} = 1.72 \times 10^{-8}\ \Omega.m$) shown opposite?



- ☐ $5.5 \times 10^{-9}\ \Omega$
- ☐ $5.5 \times 10^{-7}\ \Omega$
- ☐ $2.8 \times 10^{-3}\ \Omega$
- ☐ $1.1 \times 10^{-2}\ \Omega$

7) The figure opposite shows a fully charged capacitor with an initial charge of (8.4×10^{-5}C). What is the charge on the capacitor after (3.5 s)?

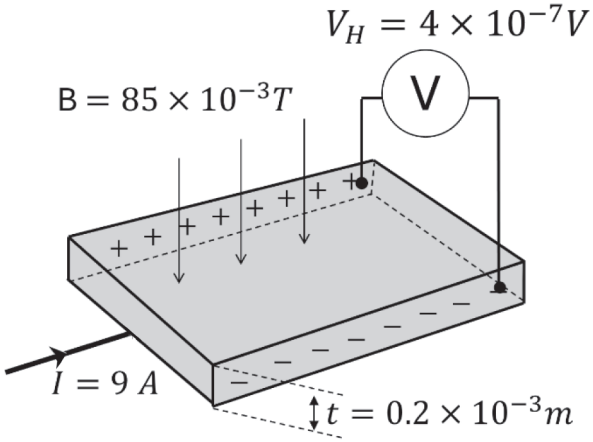


- ☐ 2.5×10^{-6} C
- ☐ 3.2×10^{-6} C
- ☐ 2.4×10^{-5} C
- ☐ 8.4×10^{-5} C

8) The region around a magnet where its force can be felt, is called the:

- ☐ Magnetic pole.
- ☐ Magnetic field.
- ☐ Magnetic material.
- ☐ Magnetic flux density.

9) The figure opposite shows the setup for the Hall effect experiment.
What is the number density of the charge carrier (n)?



- ☐ 1.2×10^{25} *electrons/m*$^{-3}$
- ☐ 5.1×10^{27} *electrons/m*$^{-3}$
- ☐ 6.0×10^{28} *electrons/m*$^{-3}$
- ☐ 5.4×10^{29} *electrons/m*$^{-3}$

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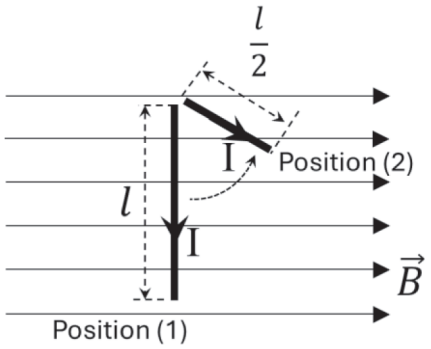
Question 1 continued

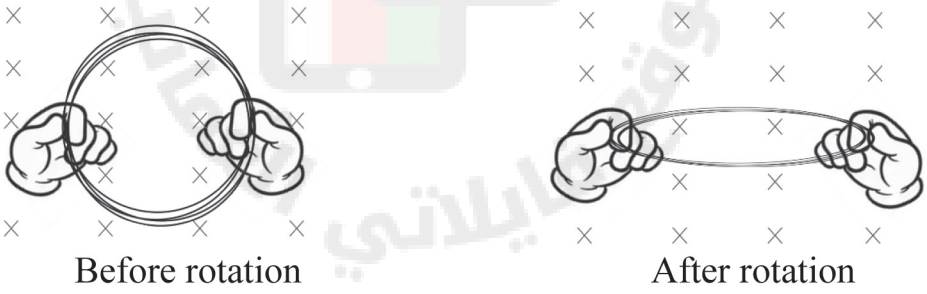
10) The figure below shows a current-carrying wire placed in a uniform magnetic field, experiencing a force of (1.2 N) at position (1).
When its length is reduced to half and it is rotated to position (2), the force becomes (0.3 N).



What is the angle between the **wire at position (2) and the magnetic field (B)?**

- ☐ 15°
- ☐ 18°
- ☐ 25°
- ☐ 30°

11) A coil is placed in a uniform magnetic field. Then the coil is rotated, as shown in figure below.

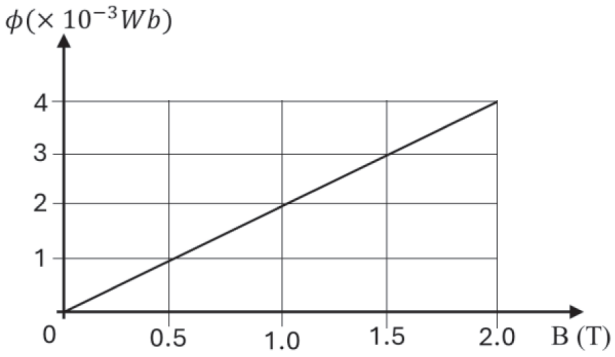


Which row **is correct** during the rotation?

	Magnetic flux through the coil	e.m.f.
☐	Increases.	Induced.
☐	Increases.	Not induced.
☐	Decreases.	Induced.
☐	Decreases.	Not induced.

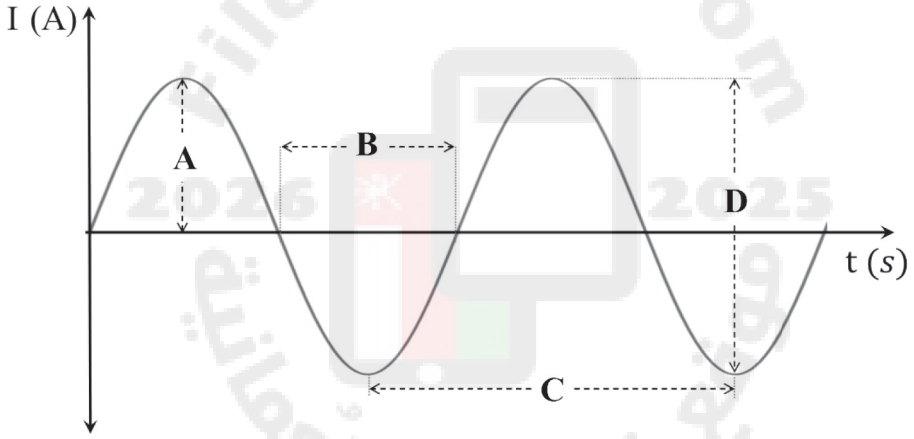
Question 1 continued

12) The graph opposite shows the variation of magnetic flux (ϕ) through a coil versus the magnetic flux density (B) passing perpendicularly through it.
What is the area of the coil?



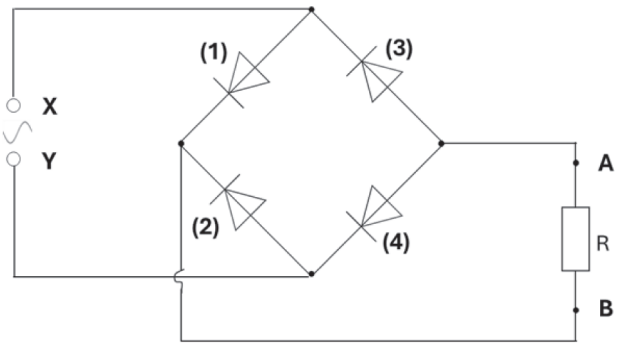
- ☐ 0.002 m^2
- ☐ 0.5 m^2
- ☐ 2.0 m^2
- ☐ 500 m^2

13) In the figure below, which letter represents the period?



- ☐ A
- ☐ B
- ☐ C
- ☐ D

14) Which diodes will conduct when terminal (X) of the input voltage is positive with respect to terminal (Y)?



- ☐ (1) & (3)
- ☐ (2) & (3)
- ☐ (1) & (4)
- ☐ (2) & (4)

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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.** Write the **two ways** of connecting resistors in an electric circuit. (2 marks)

1 _____

2 _____

b. Complete the table below. (4 marks)

Term	Definition	SI Unit
_____	"The rate of flow of charge carriers"	_____
Resistance	_____ _____ _____	_____

16) The table below shows properties for two metallic wires.

	Resistivity	Length	Cross-sectional area
Wire (X)	ρ	L	A
Wire (Y)	$\frac{\rho}{4}$	$2\,L$	A

a. Find the ratio $\left(\frac{R_x}{R_y}\right)$. (3 marks)

_____

_____

_____

_____

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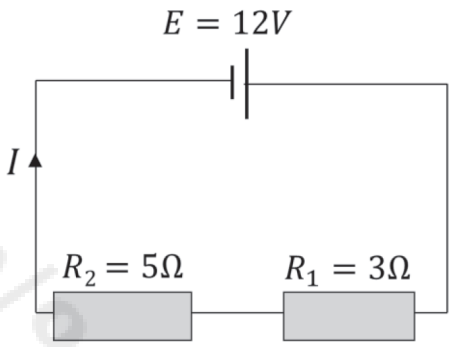
Question 2 continued

b. When both wires are connected in series in an electric circuit, the number of electrons decreases. Explain why. (2 marks)

17) The figure opposite shows an electric circuit.



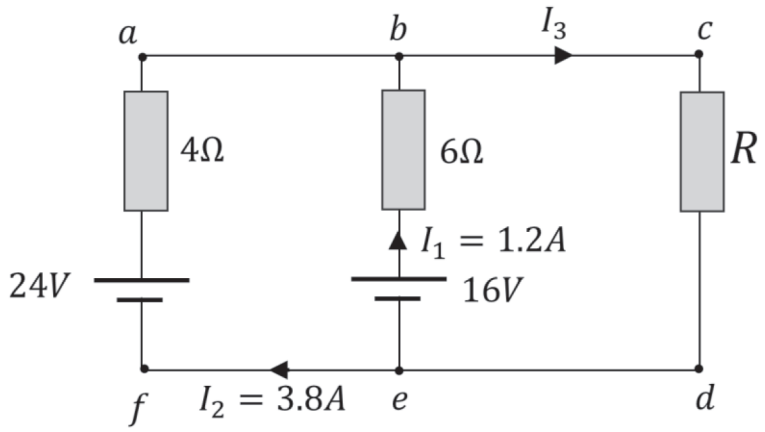
Calculate the following:

a. The current (I). (2 marks)

b. The power dissipated through the resistor (R_2). (2 marks)

Question 2 continued

18) The figure below shows an electric circuit.



a. State Kirchoff's second law. (1 mark)

b. Calculate the following:

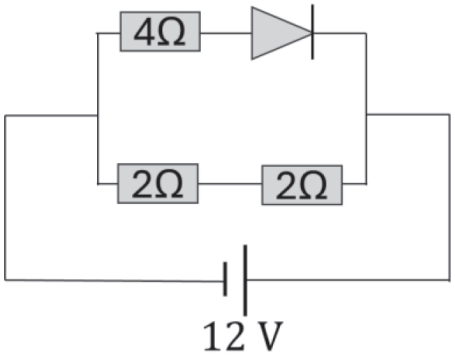
(i) The current (I_3). (1 mark)

(ii) The resistance (R). (3 marks)

Question 2 continued

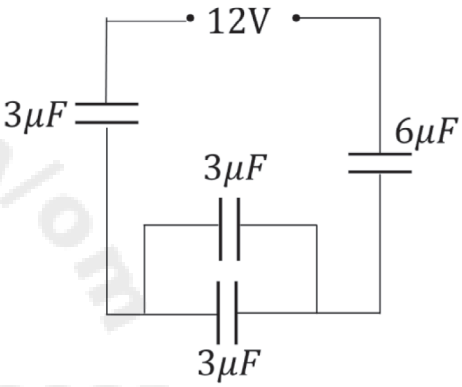
19) The figure opposite shows an electric circuit.

Calculate the total current (I). (2 marks)

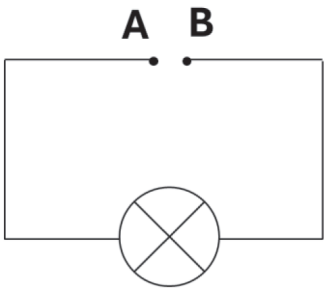


20) The figure opposite shows an electric circuit.

Calculate the combined (total) capacitance. (3 marks)



21) If the fully charged capacitor is connected to the circuit opposite between points A and B.



a. What will happen to the brightness of the light bulb over time?

☐ Decreases. ☐ Stays the same.

(Choose the correct answer)

Explain your answer. (1 mark)

b. Define capacitance. (1 mark)

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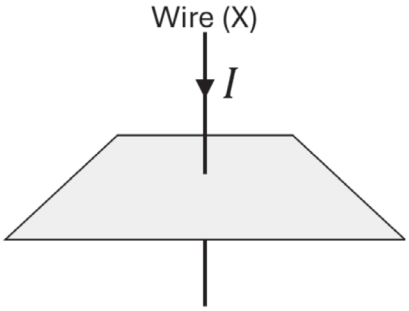
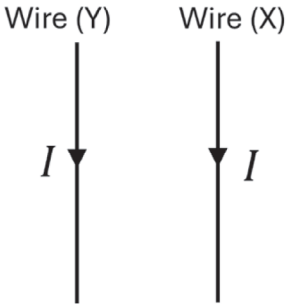
Question 2 continued

22) The figure opposite shows a wire (X) carrying a current (I).



a. On the figure opposite, sketch the magnetic field lines around the wire (X) showing its direction. (2 marks)

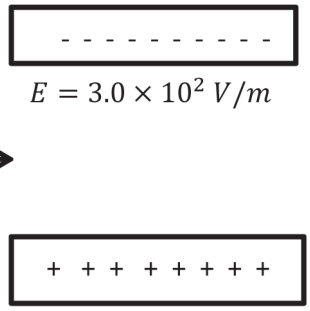
b. If another wire (Y) carrying current (I) is placed close to wire (X) as shown in the figure opposite, What is the direction of the force exerted on wire (Y) by wire (X)? (1 mark)



_____

23) **a.** The figure opposite shows an electron which enters a uniform electric field.

(i) Calculate the magnitude of the electric force acting on the electron. (2 marks)



_____

_____

_____

(ii) What is the direction of the force acting on the electron? (1 mark)

_____

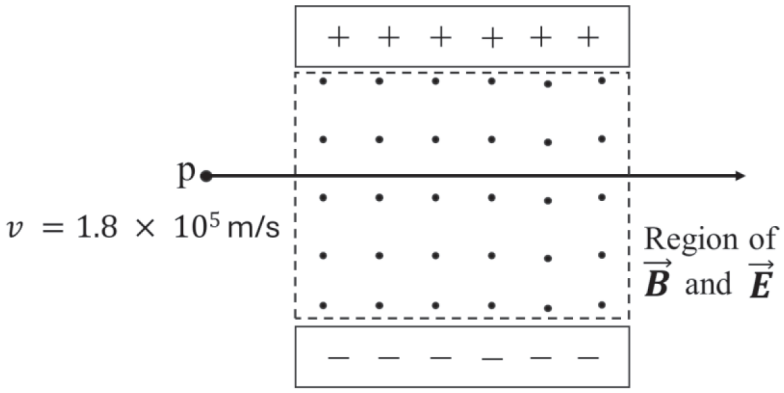
b. Write **two components** of an electron beam tube. (2 marks)

1 _____

2 _____

Question 2 continued

24) A proton enters a region where a uniform magnetic field (B) is perpendicular to an electric field of ($E = 6 \times 10^2\ V/m$) as shown in the figure below.



a. Calculate the magnetic flux density (B). (2 marks)

b. If the initial velocity of the proton is increased, what will happen to its path in the region? Explain Why. (2 marks)

25) Complete the table below. (2 marks)

Term	Definition	Unit
Magnetic flux		

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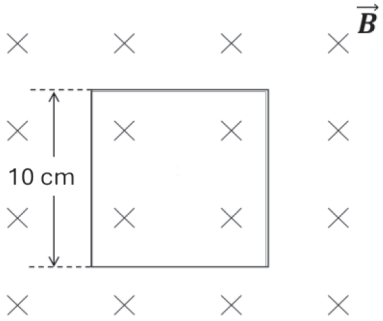
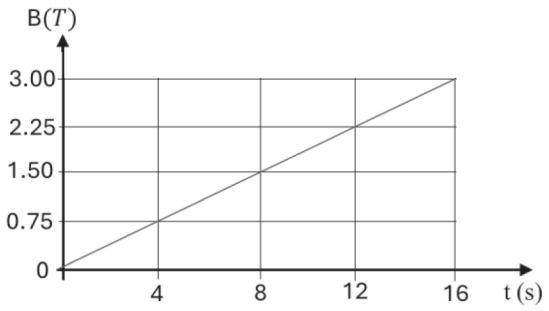
Question 2 continued

26) The figure below shows a square coil of (50 turns) placed stationary in a magnetic field (B) that varies with time (t) as shown in the graph below.

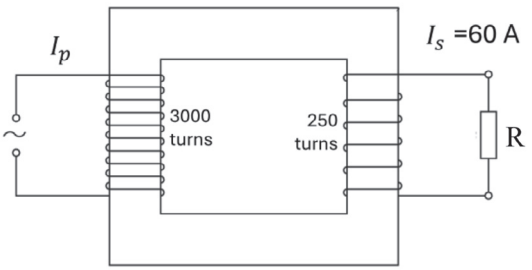




a. Calculate the magnetic flux linkage in the coil at time ($t = 8\ s$). (3 marks)

b. Why does the induced e.m.f. in the coil remain constant between ($t = 0\ s$) and ($t = 16\ s$)? (2 marks)

27) The figure opposite shows a transformer.

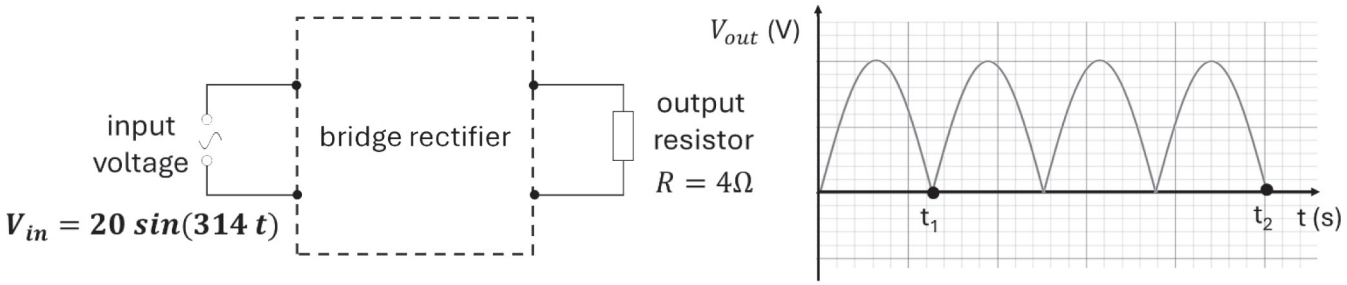


a. What type of transformer is it? (1 mark)

b. Calculate (I_p). (2 marks)

Question 2 continued

28) The figure below shows a bridged rectifier and the graph of the variation of the potential difference (V_{out}) across the output resistor (R) with time (t).



a. What type of rectification is used in the above circuit? (1 mark)

b. Calculate the following:

(i) The maximum power loss across the output resistor (P_{max}). (2 marks)

(ii) The input ($V_{r.m.s}$). (1 mark)

(iii) The time interval between time (t_1) and time (t_2). (2 marks)

c. What component can be added to the circuit to smooth (V_{out})? (1 mark)

[End of Examination]

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FORMULA AND CONSTANTS				
Electricity				
$V = IR$	$R = \frac{\rho L}{A}$	$I = Anvq$	$Q = It$	$Q = Ne$
$I = I_1 + I_2$	$P = VI$	$E = V_1 + V_2$	$emf = IR + Ir$	$E = Ir + IR$
Capacitance				
$C = C_1 + C_2$	$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$	$x = x_0 e^{-t/\tau}$	$\tau = RC$	$C = \frac{Q}{V}$
Magnetic fields and electromagnetism				
$F = BIL\sin\theta$	$v = \frac{E}{B}$	$F_E = qE$	$V_H = \frac{BI}{(ntq)}$	$F = qvBsin\theta$	$KE = \frac{1}{2}mv^2$
Electromagnetic induction				
$\Phi = BAcos\theta$	$\Phi = BAsin\theta$	$E = \frac{-\Delta(N\Phi)}{\Delta t}$	$N\Phi = BAN$	
Alternating current				
$V_{r.m.s} = \frac{V_o}{\sqrt{2}}$	$I_{r.m.s} = \frac{I_o}{\sqrt{2}}$	$\frac{N_s}{N_P} = \frac{V_s}{V_P} = \frac{I_P}{I_s}$	$\omega = \frac{2\pi}{T}$	
$P_{mean} = I_{r.m.s}\, V_{r.m.s}$	$P_{max} = I_o\, V_o$	$P_{max} = 2\, P_{mean}$	$x = x_0 \sin(\omega t)$	
Constants				
$e = 1.6 \times 10^{-19} C$	$m_e = 9.11 \times 10^{-31} kg$	$m_P = 1.67 \times 10^{-27} kg$		

مُسَوَّدَة

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GENERAL EDUCATION DIPLOMA EXAMINATION

Diploma, Bilingual

Physics 1st Semester, 2nd Session 2024-2025

Marking Guide

سلطنة عمان
وزارة التربية والتعليم

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

Note: the marking guide in (12) pages **Full marks: (70)**

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(14 marks)

Item	Answer	Mark	C.L	OB	P.N
1	Potential difference.	1	K	1.2 a	H 164 O 98
2	Coulomb.	1	K	1.1 c	H 161 O 96
3	R	1	A	1.3 g	H 183 O 108
4	4 V	1	R	1.4 b	H 180 O 110
5	1 A	1	A	1.3 a	H182 O 106
6	$1.1 \times 10^{-2}\ \Omega$	1	A	1.2 l	H 170 O 101
7	$2.4 \times 10^{-5}\ C$	1	A	2.1 i	H 310 O 231
8	Magnetic field	1	K	3.1 a	H 305 O 236

9	$6.0 \times 10^{28}\ electrons/m^{-3}$	1	A	3.3 d	H 325 O 245
10	30^0	1	R	3.2 b	H 318,319 O 241
11	Decreases. | Induced.	1	A	4.1g	H 330-332 O 255-256
12	$0.002m^2$	1	R	4.1 b	H330 O255
13	C	1	K	5.3 a	H 344, 336 O 262
14	(1) & (4)	1	A	5.4 e	H 346 O 259

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB	P.N
15	a	1- Series 2- Parallel	1 1	K	1.3c,e	H 170 O 101
	b	Electric current — Ampere **(OR)** A The ratio of the potential difference V across the conductor to the current I in it. **(OR)** A measure of the difficulty of making the current pass through the component — Ohm **(OR)** Ω **1 mark for each answer**	4	K	1.1a, 1.2a, 1.2e	H 162, 166, 178 O 98, 100

Item	Part	Answer	Mark	C.L	OB	P.N
16	a	$R_x = \frac{\rho L}{A}$, $R_y = \frac{\rho}{4} \times \frac{2L}{A} = \frac{\rho L}{2A}$ $= \frac{1}{2} \times \frac{\rho L}{A}$ $\frac{R_x}{R_y} = \frac{\frac{\rho L}{A}}{\frac{\rho L}{2A}}$ $\frac{R_x}{R_y} = \frac{2}{1}$	1 1 1	A	1.2 l	H 170 O 101

	b	If both wires are connected to each other, then the total length will increase which means the <u>total resistance will increase</u>. <u>So the current passes will decrease.</u> **<u>(OR)</u>** $R\ \alpha\ l,\quad R\ \alpha\ \frac{1}{I}\quad and\quad I\ \alpha$ number of electrons (2)	1 1	R	1.2 l	H 170 O 101

Item	Part	Answer	Mark	C.L	OB	P.N
17	a	$R = R_1 + R_2$ $= 3 + 5 = 8\Omega$ $I = \frac{V}{R} = \frac{12}{8}$ $I = 1.5\ A$	1 1	A	1.2 g	H 166 O 100
	b	$P = I^2R = (1.5)^2 \times 5$ $= 11.25W$ **<u>(OR)</u>** $V_2 = R_2 \times I = 5 \times 1.5 = 7.5V$ $P = IV = 1.5 \times 7.5$ (1) $= 11.25\ W$ (1) **<u>(OR)</u>** $V_2 = R_2 \times I = 5 \times 1.5 = 7.5V$ $P = \frac{V_2^2}{R_2} = \frac{7.5^2}{5}$ (1) $= 11.25W$ (1)	1 1	A	1.2 m	H 167 O 99

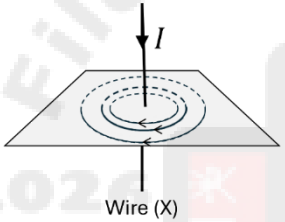
Item	Part	Answer	Mark	C.L	OB	P.N
18	a	The sum of the e.m.f. round any closed loop in a circuit is equal to the sum of the p.d. round the loop. **(OR)** For any complete loop of a circuit, the sum of the e.m.f.s round the loop is equal to the sum of the potential drops round the loop. (1)	1	K	1.3 b	H 183 O 107
	b-i	$I_3 = I_1 + I_2$ $I_3 = 1.2 + 3.8$ $= 5A$	1	A	1.3 h	H 182 O 106
	b-ii	From loop (facdf): $E_2 - I_2R_2 - I_3R_3 = 0$ $24 - (3.8\times4) - 5\,R_3 = 0$ $R_3 = 1.76\ \Omega$ **(OR)** From loop (ebcde): $E_1 - I_1R_1 - I_3R_3 = 0$ (1) $16 - (1.2\times6) - 5R_3 = 0$ (1) $R_3 = 1.76\ \Omega$ (1)	1 1 1	A	1.3 h	H 182 O 106

Item	Part	Answer	Mark	C.L	OB	P.N
19		$R_{series} = 2 + 2 = 4\Omega$ $I = \frac{V}{R} = \frac{12}{4}$ $I = 3A$	1 1	R	1.2 i 1.3 d	O 112 H 168

Item	Part	Answer	Mark	C.L	OB	P.N
20		$C_{parallel} = 3 + 3 = 6\mu F$ $\frac{1}{C_T} = \frac{1}{3} + \frac{1}{6} + \frac{1}{6} = \frac{4}{6}$ $C_T = \frac{6}{4} = 1.5\mu F$	1 1 1	A	2.1 e	H 306 O 224

Item	Part	Answer	Mark	C.L	OB	P.N
21	a	☑ Decreases. Over time, as the capacitor discharges, the current decreases, causing the bulb's brightness to gradually dim. **The student gets 1 mark only if he chooses and explains correctly.**	1	R	2.1 g	H 302 O 230

	b	The charge stored on one plate per unit of potential difference between the plates. **(OR)** Charge stored per unit p.d. (1)	1	K	2.1 a	H 303 O 222

Item	Part	Answer	Mark	C.L	OB	P.N
22	a	 1 mark for the circle lines and 1 mark for the direction of the arrows.	1 1	K	3.1 b	H 327 O 236
	b	The force on wire Y is to the right-hand side. **(OR)** Along the positive x-axis / Towards wire (X) / if the student draws the correct direction on the figure. (1)	1	A	3.2 d	H 329 O 242

Item	Part	Answer	Mark	C.L	OB	P.N
23	a-i	$F = Eq$ $F = 3 \times 10^2 \times 1.6 \times 10^{-19}$ $F = 4.8 \times 10^{-17} N$	1 1	A	3.3 j	H 323 O 249
	a-ii	Downward **(OR)** towards the positive plate **(OR)** away from the negative plate **(OR)** draw an arrow downward on the figure	1	A	3.3 j	H 323 O 249
	b	- Charged plates - Vacuum tube - Screen - Coils (or Helmholtz coils) / Magnet / Magnetic field - Anode - Filament / Electron gun - Source of high voltage - Glass bulb - Gas of low pressure **Any two of above**	2	K	3.3 g	H 322 O 244

Item	Part	Answer	Mark	C.L	OB	P.N
24	a	$v = \frac{E}{B}$ $B = \frac{E}{v} = \frac{6.0 \times 10^2}{1.8 \times 10^5}$ $= 3.3 \times 10^{-3}\ T$	1 1	A	3.3 k	H 323-324 O 249
	b	The path will be deflected upwards/towards the positive plate. The magnetic force will be greater than the electric force. **(OR)** The magnetic force will increase. (1)	1 1	R	3.3 k	H 323-324 O 249

Item	Part	Answer	Mark	C.L	OB	P.N
25		Magnetic flux is the product of the magnetic flux density and the area normal to the lines of flux. **(OR)** Magnetic flux is the product of the B and A. (1) Weber **(OR)** Wb (1) **1 mark for each column**	2	K	4.1 a	H 330 O 255

Item	Part	Answer	Mark	C.L	OB	P.N
26	a	$A = l^2 = (10cm)^2$ $= 100\ cm^2 = 0.01m^2$ From the graph: $B = 1.5\ T$ $N\varphi = BAN$ $= 1.5 \times 0.01 \times 50 = 0.75\ Wb$ **- If the student combined all the steps into one, he should receive full marks.** **- Failing to convert centimeters into meters will result in a deduction of one mark.**	1 1 1 1	A	4.1 c	H 330 O 255
	b	Since the area of the coil is constant and the line is a straight line with a constant slope, it gives a constant electromotive force value. **(OR)** The rate of change of φ is constant. (1)	1 1	R	4.1 f	H 333 O 256

Item	Part	Answer	Mark	C.L	OB	P.N
27	a	Step-down transformer	1	K	5.2 a	H 344, 336 O 261
	b	$\frac{N_s}{N_p} = \frac{I_p}{I_s}$ $\frac{250}{3000} = \frac{I_p}{60}$ $I_p = 5\ A$	1 1 1	A	5.2 b	H 344, 336 O 260, 261

Item	Part	Answer	Mark	C.L	OB	P.N
28	a	Full-wave rectification	1	K	5.4 e	H 346 O 259
	b-i	$P_{max} = I_o V_o = \frac{V_o^2}{R}$ $= \frac{(20)^2}{4}$ $= 100\ W$	1 1	A	5.3 b	H 344 O 260
	b-ii	$V_{r.m.s.} = \frac{V_0}{\sqrt{2}} = \frac{20}{\sqrt{2}}$ $= 14.1\ V$	1	A	5.1 d	H 344 O 260
	b- iii	$T = \frac{2\pi}{\omega} = \frac{2\pi}{314} = 0.02\ s$ Time between $t_1 and\ t_2$ is 1.5 T Time = $1.5 \times 0.02 = 0.03\ s$	1 1	R	5.1 b	H 341 O 258,260
	c	Capacitor.	1	K	5.4 g	H 346 O 259

End of Marking Guide