First Semester

Physics

(الفيزياء)

(Questions)



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)

للعام الدراسي ١٤٤٥/١٤٤٦ هـ - ٢٠٢٣ / ٢٠٢٤ م

الدور الأول - الفصل الدراسي الأول

تنبيه:
- المادة: الفيزياء.
- الأسئلة في (١٤) 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 statement "the electric charge flow in one second when the current is one ampere", is the definition for:

○ Ohm. ○ Volt.

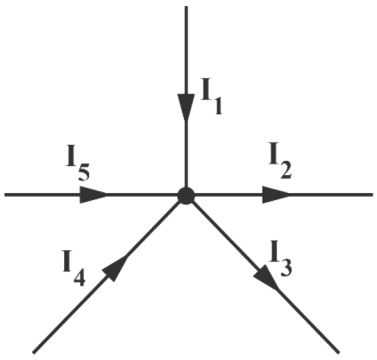
○ Watt. ○ Coulomb.

2) Kirchhoff's first law follows the conservation of:

○ Charge. ○ Energy.

○ Mass. ○ Momentum.

3) In the figure below, which of the following equations is correct about the magnitude of current (I_2)?



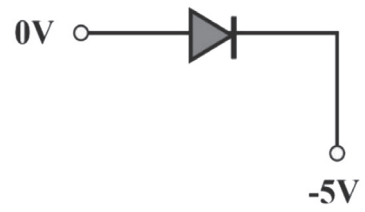
○ $I_2 = I_1 + I_4 - I_5 - I_3$

○ $I_2 = I_1 + I_4 + I_5 - I_3$

○ $I_2 = I_5 + I_1 - I_4 - I_3$

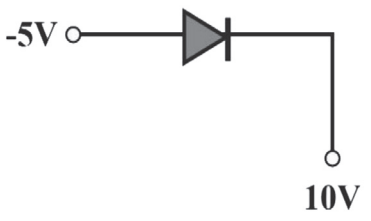
○ $I_2 = I_4 + I_3 + I_5 - I_1$

4) Which of the following diodes is reverse biased?

○ 

○ 

○ 

○ 

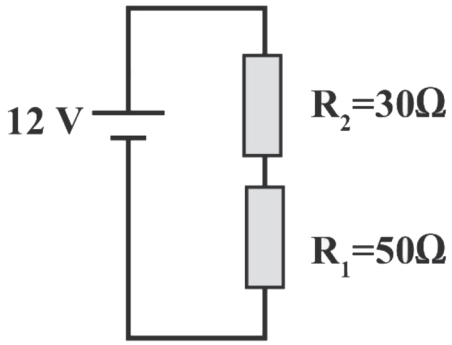
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Question 1 continued

5) A metallic wire has a length (l), a cross-sectional area (A) and a resistance of (4 Ω). What will be the resistance of another wire made of the same material having a length = $\left(\frac{l}{2}\right)$ and a cross-section area (2A) at a constant temperature?

- ☐ 1 Ω
- ☐ 2 Ω
- ☐ 4 Ω
- ☐ 8 Ω

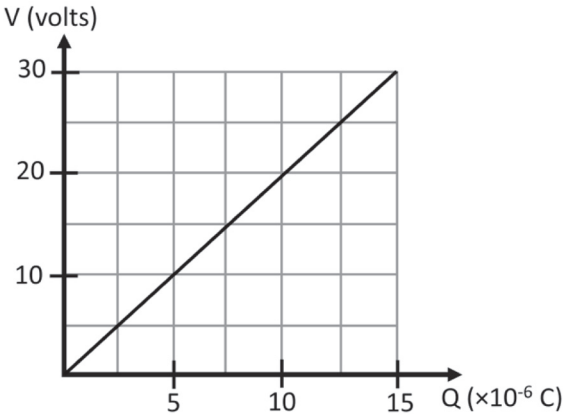
6) The figure below shows an electric circuit. What is the power dissipated in the resistor (R_1)?



- ☐ 0.0225 W
- ☐ 0.150 W
- ☐ 1.125 W
- ☐ 1.80 W

7) The graph below shows the p.d (V) against charge stored (Q) for a capacitor.

What is the energy stored in the capacitor when the potential difference across the capacitor is (20 V)?



- ☐ 4.5×10^{-4} J
- ☐ 2.25×10^{-4} J
- ☐ 2.0×10^{-4} J
- ☐ 1.0×10^{-4} J

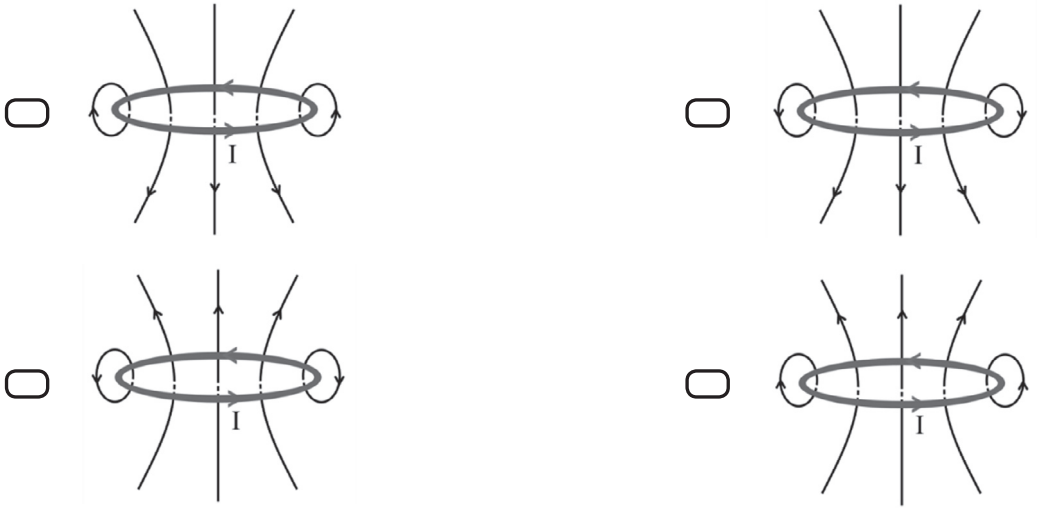
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Question 1 continued

8) Which diagram shows the correct pattern of the magnetic field lines in a circular flat coil?

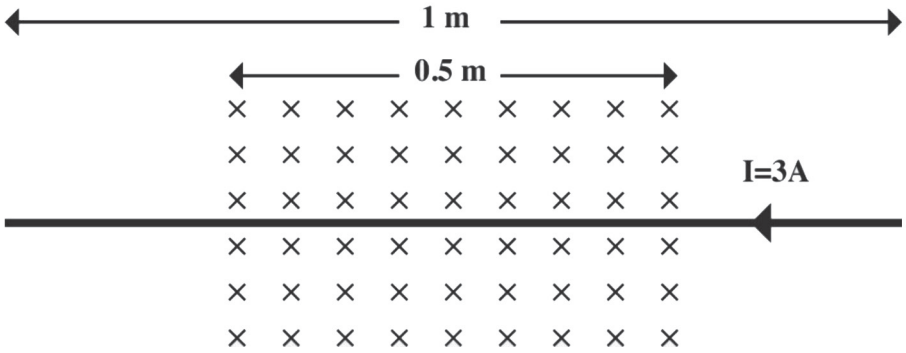


9) A beam of electrons follow a circular path when travelling in a uniform magnetic flux density of (2.1×10^{-5} T) at a right angle to the magnetic field lines.

If the centripetal force acting on each electron is (4.0×10^{-18} N), what is the speed of the electrons?

- ☐ 5.3×10^{12} m/s
- ☐ 1.1×10^{14} m/s
- ☐ 8.4×10^{6} m/s
- ☐ 1.2×10^{6} m/s

10) The figure below shows a current-carrying wire placed in a uniform magnetic field of flux density ($2 \times 10^{-3}\ T$).



What is the magnitude and the direction of the magnetic force acting on the wire?

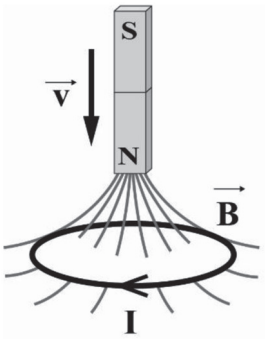
- ☐ $3 \times 10^{-3}\ N$, Upwards.
- ☐ $6 \times 10^{-3}\ N$, Upwards.
- ☐ $3 \times 10^{-3}\ N$, Downwards.
- ☐ $6 \times 10^{-3}\ N$, Downwards.

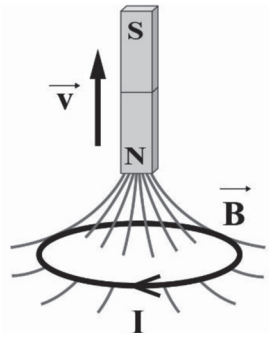
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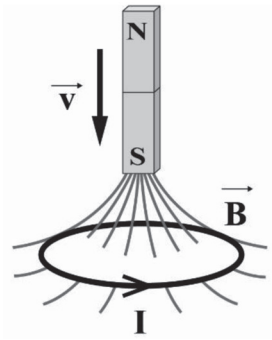
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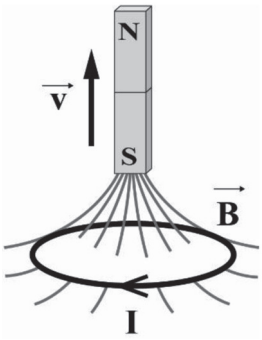
Question 1 continued

11) Which of the following figures shows the correct direction of the induced current in a circular flat coil?

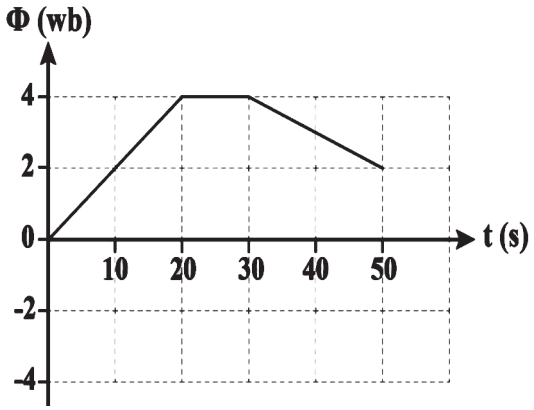








12) The graph opposite shows the variations of the magnetic flux (ø) versus time (t) of a rectangular loop with resistance (R = 5 Ω).



If the direction of the induced current in the loop is clockwise during the interval (t = 0 ⟶ 20s), what is the magnitude and direction of the induced current during the interval (t = 30 ⟶ 50s)?

	I (A).	Direction of the induced current.
☐	0.02	Clockwise.
☐	0.02	Counterclockwise.
☐	0.04	Clockwise.
☐	0.04	Counterclockwise.

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Question 1 continued

13) Which of the following elements will decrease the fluctuations (ripples) in the output voltage of a four-diode bridge circuit?

- ☐ A diode.
- ☐ A resistor.
- ☐ A transformer.
- ☐ A capacitor.

14) In an a.c. circuit, the peak potential difference across a resister is (20 V) and the peak current is (3 A).

What is the mean power dissipated in the resistor?

- ☐ 30 W
- ☐ 42 W
- ☐ 60 W
- ☐ 85 W

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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) Complete the table below: (6 marks)

Quantity	Definition	SI unit
_____	The ratio of the potential difference across the conductor to the current in it.	_____
_____	_____	Ampere (A)
Potential difference.	_____	_____

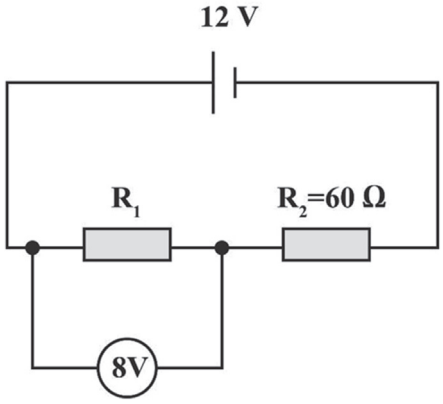
16) **a.** State Ohm's law. (1 mark)

_____

_____

_____

b. The figure below shows an electric circuit.



Calculate the following:

(i) The current through the circuit. (3 marks)

_____

_____

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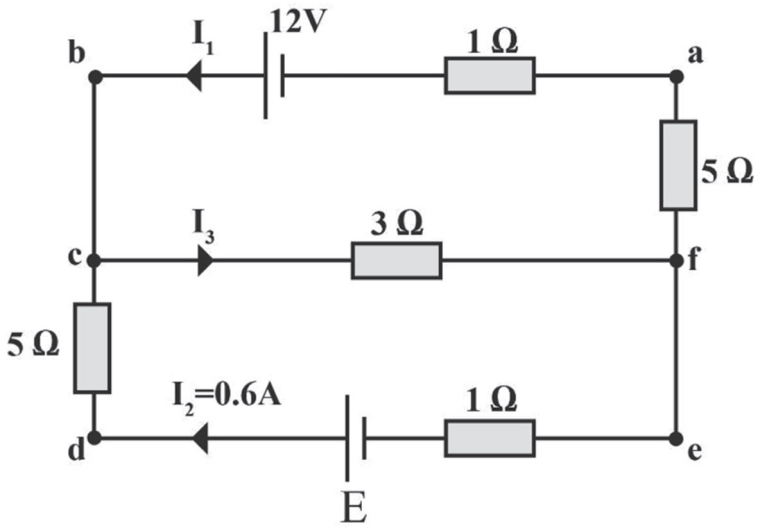
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Question 2 continued

(ii) The charge passing through the battery in (2 minutes). (2 marks)

17) The figure below shows an electric circuit.



Calculate the following:

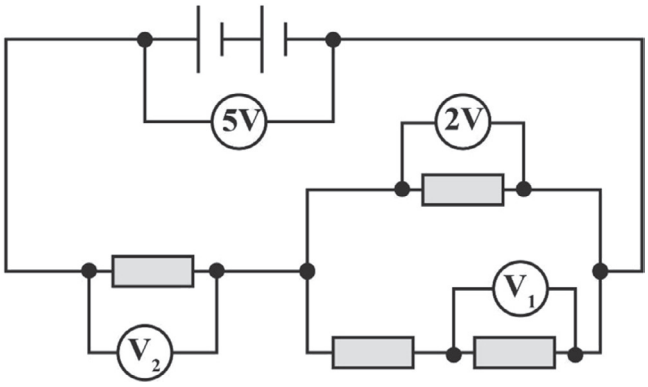
a. The values of currents (I_1) and (I_3). (4 marks)

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Question 2 continued

b. The value of (E). (2 marks)

18) In the circuit shown below, all the resistors are identical (R).



Find the reading of voltmeters (V_1) and (V_2). (Show your work) (4 marks)

19) **a.** Write one use of capacitors in electric circuits. (1 mark)

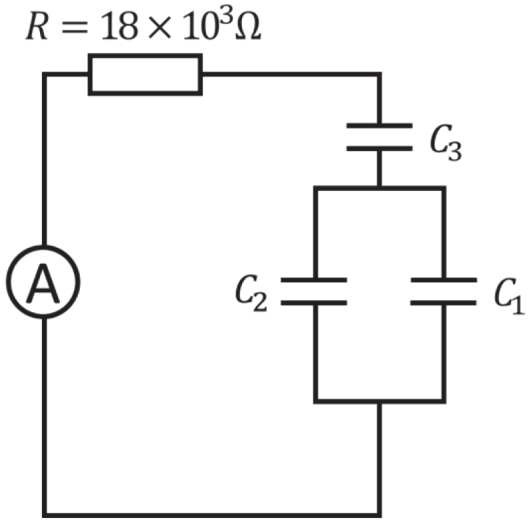
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Question 2 continued

b. The figure below shows an electric circuit with three identical capacitors, each with (200×10^{-6} F), that are fully charged by a (12 V) battery.



During the discharging process calculate:

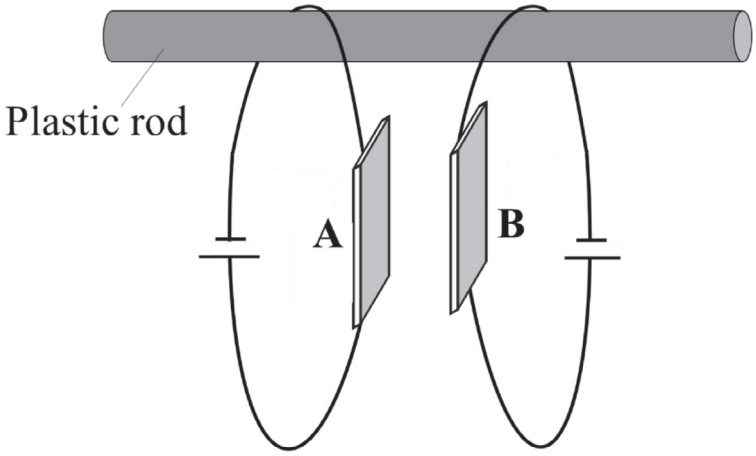
(i) The time constant (τ). (3 marks)

(ii) The time when the voltage is equal to ($V = 12e^{-3}$ volts) (1 mark)

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Question 2 continued

20) a. The figure below shows two conducting plates (A and B) hanging by a plastic rod.

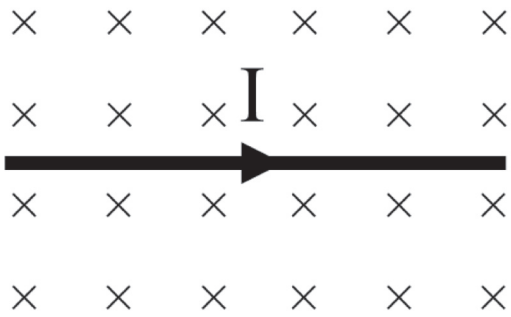


The magnetic force between the plates will be: (2 marks)

☐ Attraction. ☐ Repulsion. **(Choose the correct answer)**

Explain your answer.

b. The figure below shows a wire of length (0.5 m) carrying a current of (3 A) held at a right angle to the magnetic field. The wire experiences a magnetic force of magnitude (30×10^{-3} N).



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

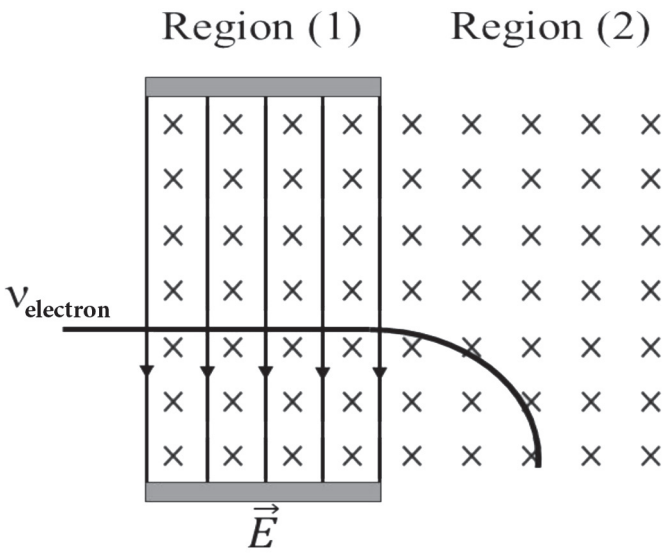
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Question 2 continued

c. The figure below shows an electron that moves through two different regions (1) and (2) with a speed of (1.32×10^6 m/s).



If the electric field in region (1) is (9.0×10^4 V/m), calculate the radius of the circular bath at region (2)? (2 marks)

21) a. Write four factors that affect the Hall voltage. (4 marks)

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Question 2 continued

b. A Hall probe is placed at a right angle to a uniform magnetic field and a Hall voltage of $V_H = 45 \times 10^{-3}$ (V) is measured.

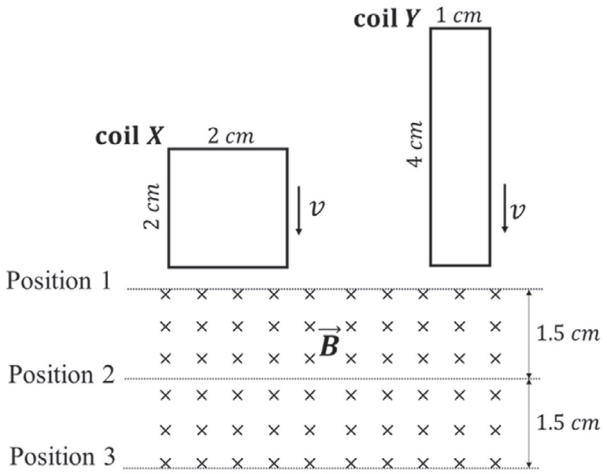
Calculate the value of the Hall voltage if the thickness of the slice is doubled?

(2 marks)

22 a. (i) Write the unit which is equivalent to ($T.m^2$). (1 mark)

(ii) State Faraday's law: (1 mark)

b. The figure below shows two coils (X and Y) each of a single-turn. They are passing with the same speed (v) through a region of a uniform magnetic field.



(i) When the coils just reach position 2, which of them will have the greater value of the magnetic flux (ϕ)? (2 marks)

☐ Coil **X** ☐ Coil **Y** **(Choose the correct answer)**

Explain your answer.

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Question 2 continued

(ii) If the magnetic flux density is (B = 0.5 T). Calculate the magnitude of the magnetic flux through (coil Y) when it just reaches position 3. (3 marks)

23) a. Figure (1) below shows the variations of the input voltage (V_{in}) and the output voltage (V_{out}) of a circuit where part of it is shown in figure (2).

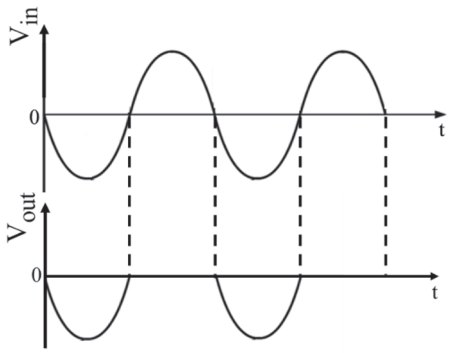


Figure (1)

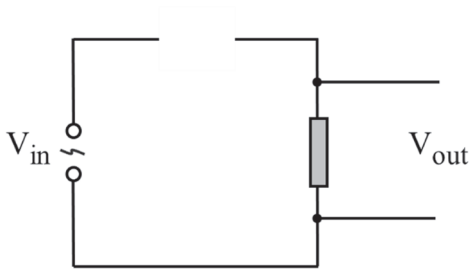
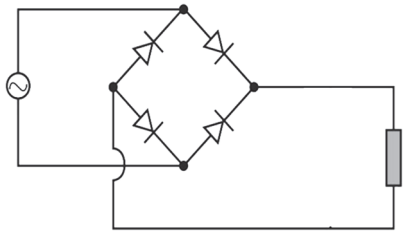


Figure (2)

In figure (2) **draw** the missing necessary component in the gap, and mark the positive terminal of (V_{in}) with a (+) in the first half cycle. (2 marks)

b. The figure opposite shows a four-diode (Bridge) circuit which is used for rectification.



If the supply voltage is represented by the equation: $V = 50 \sin(\pi t)$.

(i) Find $V_{r.m.s}$ (1 mark)

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Question 2 continued

(ii) What is the type of rectification is obtained using this circuit? (1 mark)

24) a. Write two types of transformers. (2 marks)

b. A transformer with a turn ratio of ($\frac{N_s}{N_P}$ = 10) is powered by a source of (120 V and 5A).

(i) Find is the current of the secondary coil (I_s)? (2 marks)

(ii) Find the peak value of the primary voltage. (2 marks)

[End of Examination]

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FORMULA AND CONSTANTS

Electricity

$P = VI$	$V = IR$	$R = \frac{\rho L}{A}$	$Q = ne$	$P = I^2R$
$V = \frac{W}{Q}$	$I = I_1 + I_2$	$Q = It$	$P = \frac{W}{t}$	$V_{out} = \frac{V_{in}R_1}{R_1+R_2}$
$E = V_1 + V_2$	$I = Anvq$	$P = \frac{V^2}{R}$	$W = IVt$	$emf = IR + Ir$

Capacitance

$E = W = \frac{Q^2}{2C}$	$E = W = \frac{1}{2}QV$	$C = C_1 + C_2$	$C = \frac{Q}{V}$	$\tau = RC$
$E = W = \frac{1}{2}CV^2$	$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$	$x = x_o e^{-t/\tau}$	$lnx = lnx_o - \frac{1}{RC}t$	

Magnetic fields and electromagnetism

$r = \frac{mv}{Bq}$	$F_E = qE$	$F = qvBsin\theta$	$v = \frac{E}{B}$
$\frac{e}{m_e} = \frac{2V}{B^2r^2}$	$F = BIl\,sin\,\theta$	$KE = \frac{1}{2}mv^2$	$V_H = \frac{BI}{(ntq)}$

Electromagnetic induction

$\Phi = BAcos\theta$	$\Phi = BAsin\theta$	$\mathcal{E} = \frac{-\Delta(N\Phi)}{\Delta t}$

Alternating current

$V_{r.m.s} = V_0/\sqrt{2}$	$I_{r.m.s} = I_0/\sqrt{2}$	$\frac{N_S}{N_P} = \frac{V_S}{V_P} = \frac{I_P}{I_S}$	$\omega = \frac{2\pi}{T}$
$P = {I_{r.m.s}}^2 R$	$P = I_{r.m.s}V_{r.m.s}$	$x = x_0 sin\omega t$	

CONSTANTS

$e = 1.6 \times 10^{-19} C$	$m_e = 9.11 \times 10^{-31} kg$	$m_P = 1.67 \times 10^{-27} kg$	g = 9.8 m/s²

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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)

للعام الدراسي ١٤٤٥ - ١٤٤٦ هـ - ٢٠٢٣ / ٢٠٢٤ م

الدور الثاني - الفصل الدراسي الأول

تنبيه:
- المادة: الفيزياء.
- الأسئلة في (١٧) 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) What is the unit of potential difference?

⬭ Ampere. ⬭ Coulomb.

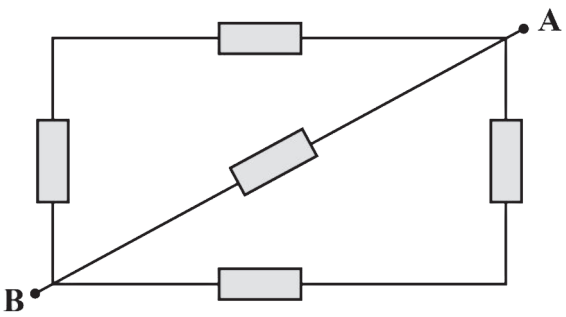
⬭ Volt. ⬭ Joule.

2) Which of the following quantities is conserved in Kirchhoff's Second Law?

⬭ Charge. ⬭ Energy.

⬭ Mass. ⬭ Momentum.

3) Five resistors each (10 Ω) are connected as shown in the figure below. What is the equivalent resistance between A and B?



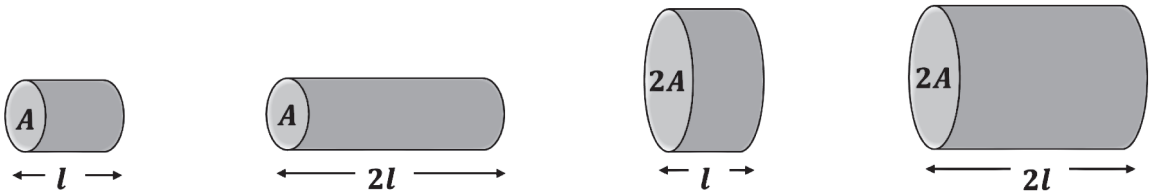
⬭ 0.2 Ω

⬭ 5.0 Ω

⬭ 10 Ω

⬭ 50 Ω

4) The four wires below are made of the same material.
Which one has the lowest resistance at room temperature?



(A) (B) (C) (D)

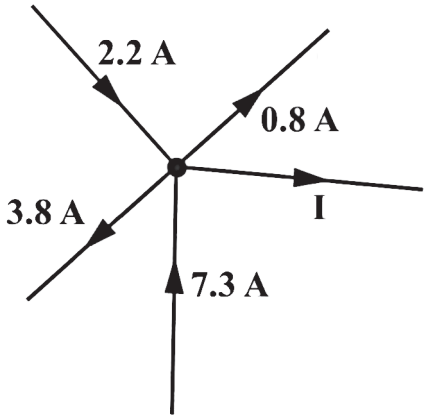
⬭ A ⬭ B

⬭ C ⬭ D

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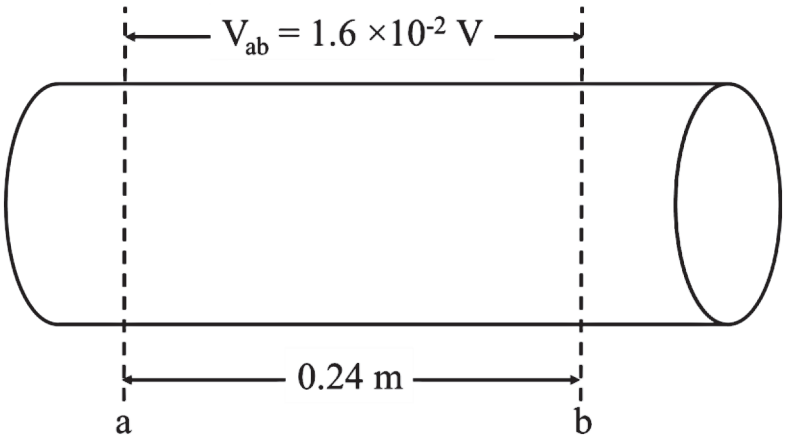
Question 1 continued

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



- ☐ 2.07 A
- ☐ 4.9 A
- ☐ 9.5 A
- ☐ 14.1 A

6) The figure below shows a cylindrical copper cable that carries a current of (1.20 A). What is the cross-sectional area (A) of the cable? ($\rho_{copper} = 1.72 \times 10^{-8}\ \Omega.m$).



- ☐ $1.3 \times 10^{-7}\ m^2$
- ☐ $3.1 \times 10^{-7}\ m^2$
- ☐ $1.3 \times 10^{-5}\ m^2$
- ☐ $3.1 \times 10^{-4}\ m^2$

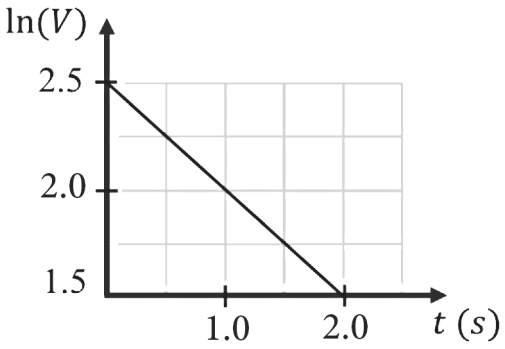
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Question 1 continued

7) The graph below shows the variation of (lnV) versus (t) for a discharging capacitor.



What is the value of the potential difference across the capacitor when it is fully charged?

- ☐ 2.0 V
- ☐ 2.5 V
- ☐ 6.0 V
- ☐ 12 V

8) What is the shape of the path for a charge entering a uniform magnetic field at a right angle?

- ☐ Parabolic.
- ☐ Straight.
- ☐ Circular.
- ☐ Helical.

9) A wire carrying a current (I) is placed at a right angle to a uniform magnetic field of flux density (B), experiences a magnetic force (F).

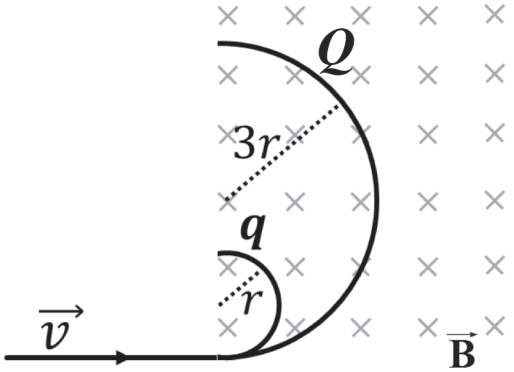
If the magnetic flux density is increased to ($4\ B$) and the current is reduced to ($0.25\ I$), what will be the magnetic force?

- ☐ F/4
- ☐ F/2
- ☐ F
- ☐ 2F

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Question 1 continued

10) The figure below shows the behavior of two particles (Q and q) with a different specific charge $(\frac{Q}{m_Q})$ and $(\frac{q}{m_q})$, respectively, entering a uniform magnetic field of flux density (B) with the same speed.



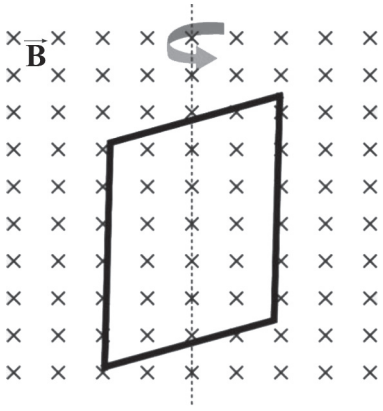
Two particles (Q and q)

Which of the statements below is correct?

- ☐ $(\frac{Q}{m_Q}) = (\frac{q}{m_q})$
- ☐ $(\frac{Q}{m_Q}) = 3(\frac{q}{m_q})$
- ☐ $(\frac{Q}{m_Q}) = \frac{2}{9}(\frac{q}{m_q})$
- ☐ $(\frac{Q}{m_Q}) = \frac{1}{3}(\frac{q}{m_q})$

11) The figure opposite shows a rectangular conducting loop of area (A) rotating around its long axis in a uniform magnetic field of flux density (B).

Which of the following statements **is correct** about the magnitude of the magnetic flux (ϕ) that passes through the area?



- ☐ Always equal to zero.
- ☐ Always equal to (BA).
- ☐ Its maximum value is (BA).
- ☐ Its minimum value is (BA).

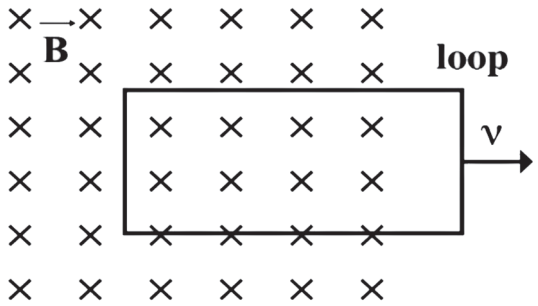
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Question 1 continued

12) The figure below shows a rectangular loop moving out of a uniform magnetic field region with a constant velocity (v).



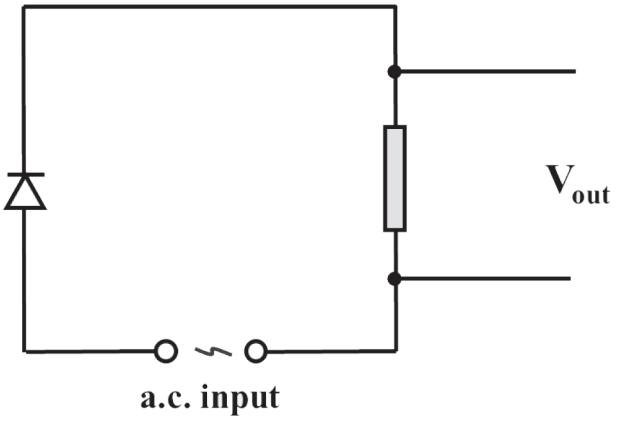
Which of the following **is correct** about the current induced in the loop:

	Magnitude of the Induced current	Direction of the induced current
☐	Constant	counter clockwise
☐	Constant	clockwise
☐	Varying	counter clockwise
☐	Varying	clockwise

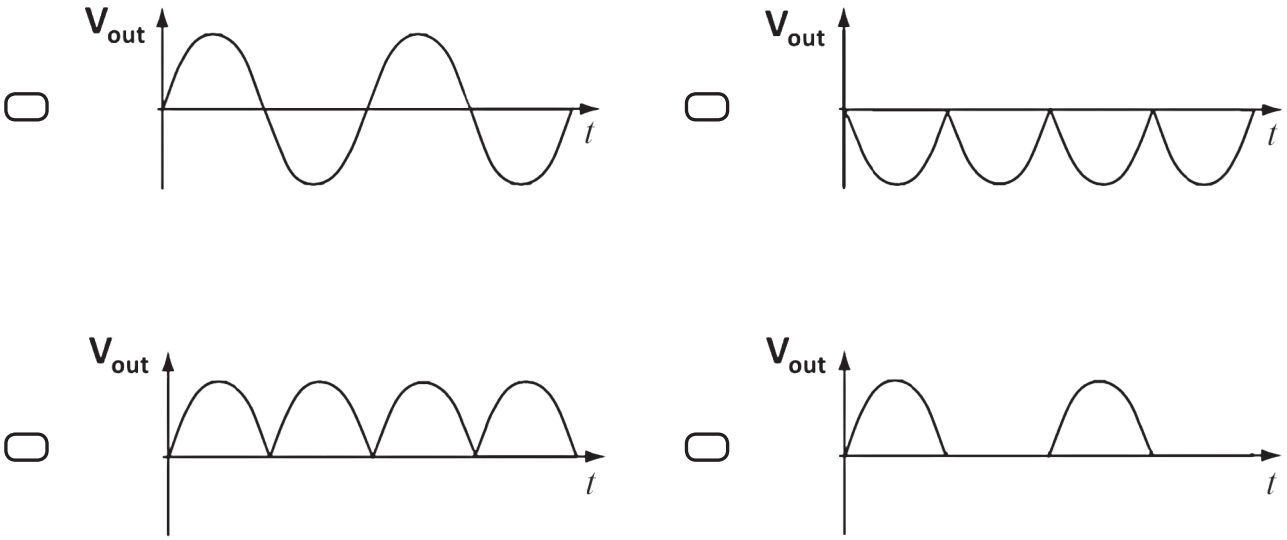
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Question 1 continued

13) The figure below shows an electric circuit.



Which of the following figures **is correct** for the output voltage versus time?



14) An ideal transformer has (50 turns) in the primary coil and (2000 turns) in the secondary coil. The input current of the transformer is (12 A). What is the output current?

- ☐ 0.2 A
- ☐ 0.3 A
- ☐ 3.3 A
- ☐ 480 A

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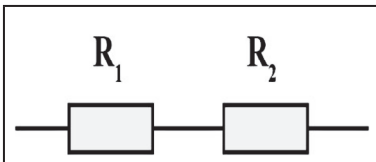
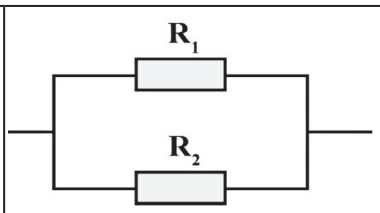
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Question 2: EXTENDED QUESTIONS (56 marks)

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.

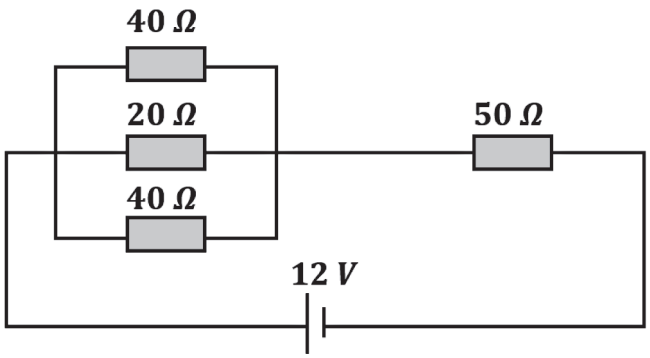
15) In the table below, compare the differences between the two types of resistor connections in an electric circuit: (6 marks)

		
Type of connection **(Series or Parallel)**	_____	_____
Voltage across each resistor **(Different or Same)**	_____	_____
Current through each resistor **(Different or Same)**	_____	_____

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Question 2 continued

16) The figure below shows an electric circuit.



Calculate the following:

a. The total resistance of the circuit. (3 marks)

b. The current supplied by the source. (2 marks)

17) **a.** State Kirchhoff's first law. (1 mark)

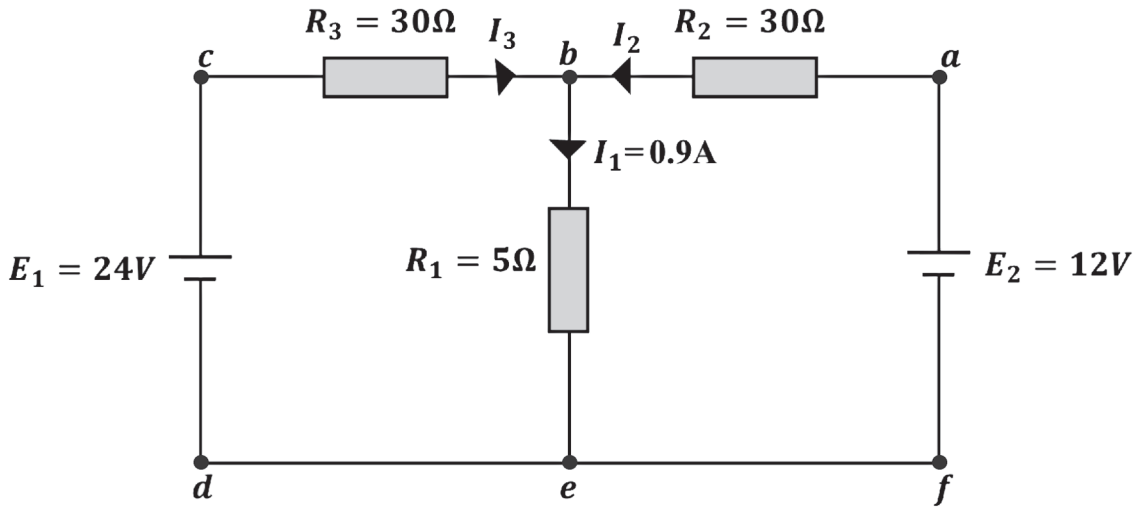
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Question 2 continued

b. The figure below shows an electric circuit.



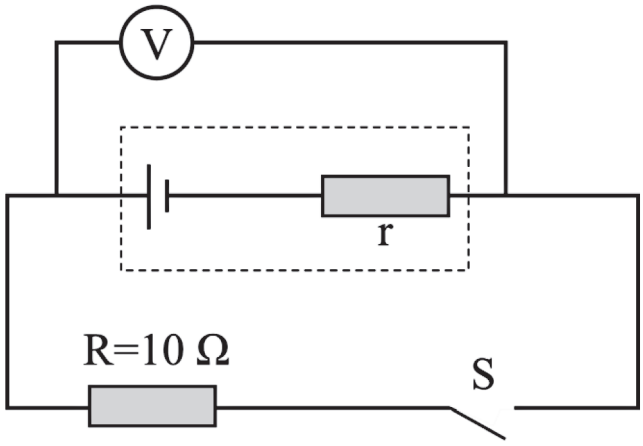
Find the value of currents (I_2) and (I_3) passing through the circuit. (4 marks)

c. Calculate the power dissipated in (R_1). (2 marks)

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Question 2 continued

18) A student sets up the circuit shown below to obtain the value of the internal resistance of the battery.



With the switch (S) open, the student noted that the reading on the voltmeter is (9 V). Then, the student closed the switch (S) and noted that the reading on the voltmeter is now (7.8 V).

Calculate the value of the internal resistance of the battery. (4 marks)

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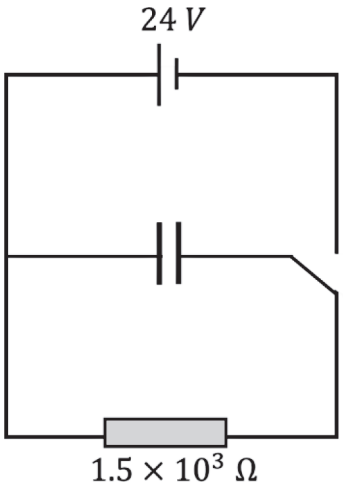
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Question 2 continued

19) a. Define Farad. (1 mark)

b. The figure below shows an electric circuit with a fully charged capacitor.



For the discharging process:

(i) Calculate the current at the first time constant ($t = \tau$). (3 marks)

(ii) If you want to increase the time constant of the circuit by adding a resistor to the circuit, **what type of resistor's connection** should be used? (1 mark)

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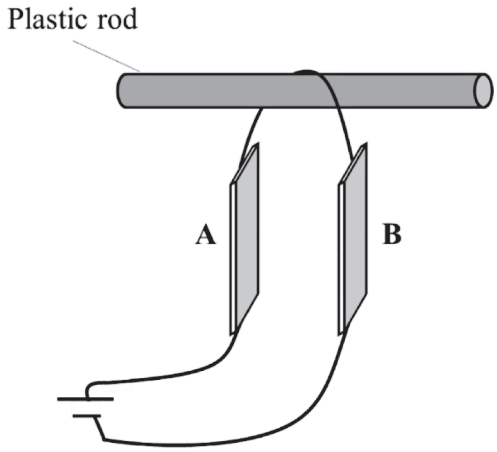
Question 2 continued

20) a. Define the following: (2 marks)

(i) Tesla:

(ii) Magnetic field density:

b. The figure below shows two conducting plates (A) and (B) hanging by a plastic rod and attached together to a circuit.



The magnetic force between the plates will be: (2 marks)

▭ Attraction. ▭ Repulsion. (Choose the correct answer)

Explain your answer.

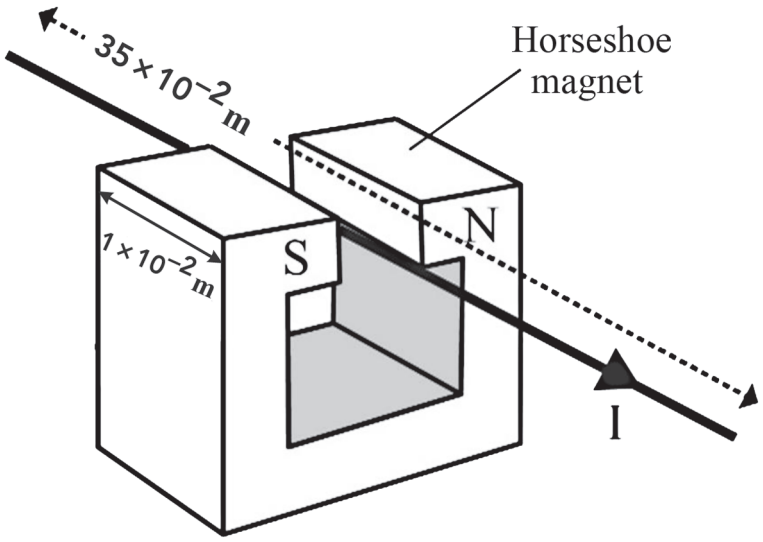
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Question 2 continued

c. A wire is placed between the poles of a horseshoe magnet with a magnetic flux density of (2.3×10^{-2} T) and carrying a current of (3.5 A) as shown in the figure below.



(i) The direction of the magnetic force acting on the wire is: (1 mark)

☐ Upwards. ☐ Downwards. (Choose the correct answer)

(ii) Calculate the value of the magnetic force acting on the wire. (2 marks)

21) a. Write two factors that affect the magnetic force in a current carrying wire. (2 marks)

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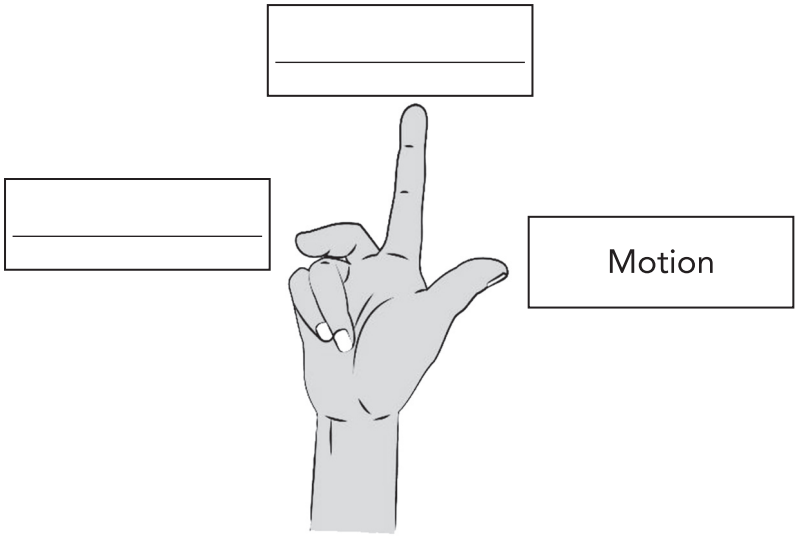
Question 2 continued

b. An electron of mass (m_e) moves in a circular path in a uniform magnetic field of magnetic flux density of ($2.7 \times 10^{-5}\,\mathrm{T}$). If the distance travelled during one revolution is ($2\pi r$), were (r) is the radius of the circular path.

Find the time taken by the electron to complete one revolution. (3 marks)

22) a. The figure below shows Fleming's right-hand rule.

Label what each finger represents. (2 marks)



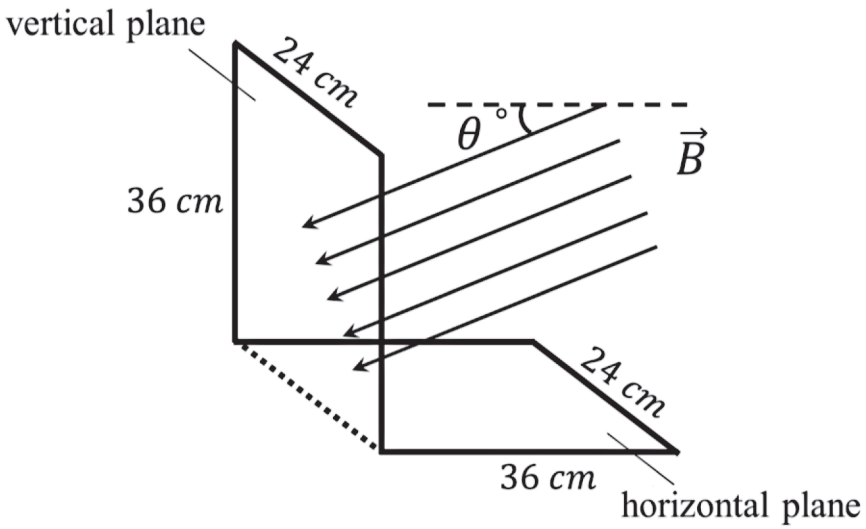
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Question 2 continued

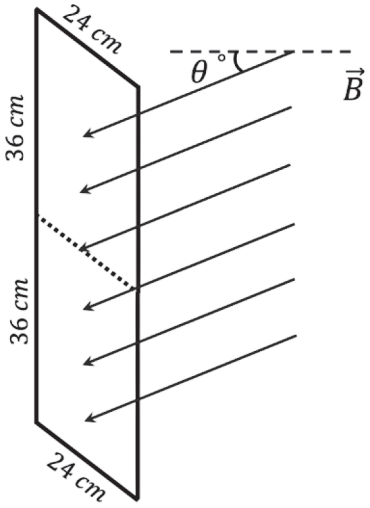
b. The figure below shows a rectangular loop of wire that has been bent into a L shape and placed in a uniform magnetic field of ($B = 3.2 \times 10^{-2}\,T$).



(i) If the magnetic flux in the vertical plane is ($\phi = 2.11 \times 10^{-3}\,Wb$), find the angle between the magnetic field and the perpendicular to the plane (θ)

(3 marks)

(ii) Find the magnetic flux through the rectangular loop if it is bend again as shown in the figure below. (2 marks)

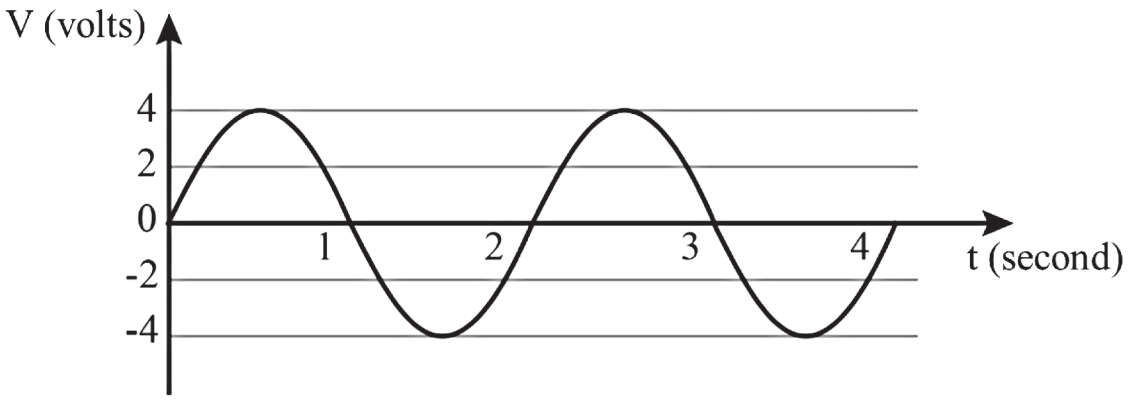


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Question 2 continued

23) a. Write two types of a.c. current rectification methods. (2 marks)

b. The figure below shows the voltage (V) versus time for an a.c source.



(i) Determine the equation of (V) in terms of (t). (2 marks)

(ii) If the a.c. source is connected to a (12 Ω) resistor, calculate the mean power dissipated in the resistor. (3 marks)

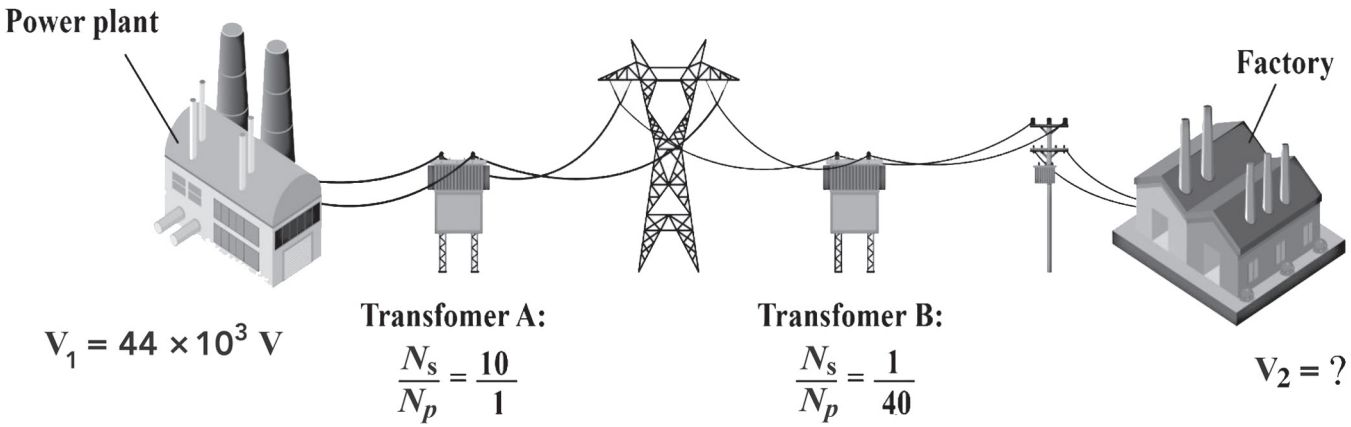
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Question 2 continued

24) The figure below shows the electrical system connection between a power plant and a factory.



a. Which transformer (A) or (B) is a step-down transformer? (1 mark)

b. If the voltage generated by the power plant has a value of ($V_1 = 44 \times 10^3$ V), calculate the voltage reaches the factory (V_2). (2 marks)

[End of Examination]

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FORMULA AND CONSTANTS

Electricity

$P = VI$	$V = IR$	$R = \frac{\rho L}{A}$	$Q = ne$	$P = I^2R$
$V = \frac{W}{Q}$	$I = I_1 + I_2$	$Q = It$	$P = \frac{W}{t}$	$V_{out} = \frac{V_{in}R_1}{R_1+R_2}$
$E = V_1 + V_2$	$I = Anvq$	$P = \frac{V^2}{R}$	$W = IVt$	$emf = IR + Ir$

Capacitance

$E = W = \frac{Q^2}{2C}$	$E = W = \frac{1}{2}QV$	$C = C_1 + C_2$	$C = \frac{Q}{V}$	$\tau = RC$
$E = W = \frac{1}{2}CV^2$	$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$	$x = x_o e^{-t/\tau}$	$lnx = lnx_o - \frac{1}{RC}t$	

Magnetic fields and electromagnetism

$r = \frac{mv}{Bq}$	$F_E = qE$	$F = qvBsin\theta$	$v = \frac{E}{B}$
$\frac{e}{m_e} = \frac{2V}{B^2r^2}$	$F = BIl\sin\theta$	$KE = \frac{1}{2}mv^2$	$V_H = \frac{BI}{(ntq)}$

Electromagnetic induction

$\phi = BAcos\theta$	$\phi = BAsin\theta$	$E = \frac{-\Delta(N\Phi)}{\Delta t}$

Alternating current

$V_{r.m.s} = V_0/\sqrt{2}$	$I_{r.m.s} = I_0/\sqrt{2}$	$\frac{N_S}{N_P} = \frac{V_S}{V_P} = \frac{I_P}{I_S}$	$\omega = \frac{2\pi}{T}$
$P = {I_{r.m.s}}^2 R$	$P = I_{r.m.s}V_{r.m.s}$	$P = \frac{V_{r.m.s}^2}{R}$	$x = x_0 sin\omega t$

CONSTANTS

$e = 1.6\times10^{-19}C$	$m_e = 9.11\times10^{-31}kg$	$m_P = 1.67\times10^{-27}kg$	$g = 9.8\ m/s^2$

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امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٤٤ هـ - ٢٠٢٢ / ٢٠٢٣ م

الدور الأول - الفصل الدراسي الأول

تنبيه:
- المادة: الفيزياء.
- الأسئلة في (١٨) 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 called:

⬭ Current. ⬭ Coulomb.

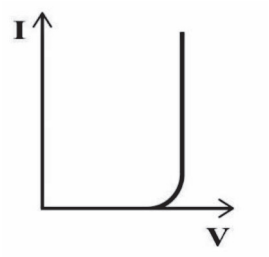
⬭ Drift velocity. ⬭ Potential difference.

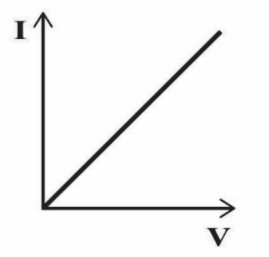
2) A copper wire of ($4 \times 10^{-6}\,m^2$) cross-sectional area, has a free electron number density of ($6.02 \times 10^{28}\,m^{-3}$). If the current through the wire is (1A), what is the average drift speed of the electrons?

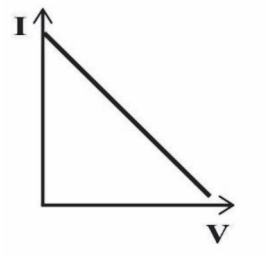
⬭ $2.41 \times 10^{23}\,m/s$ ⬭ $3.85 \times 10^{4}\,m/s$

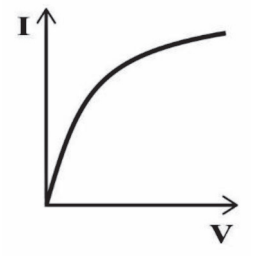
⬭ $2.60 \times 10^{-5}\,m/s$ ⬭ $4.15 \times 10^{-24}\,m/s$

3) Which of the following graphs represents the (I-V) characteristic graph of a semiconductor diode?

⬭ 

⬭ 

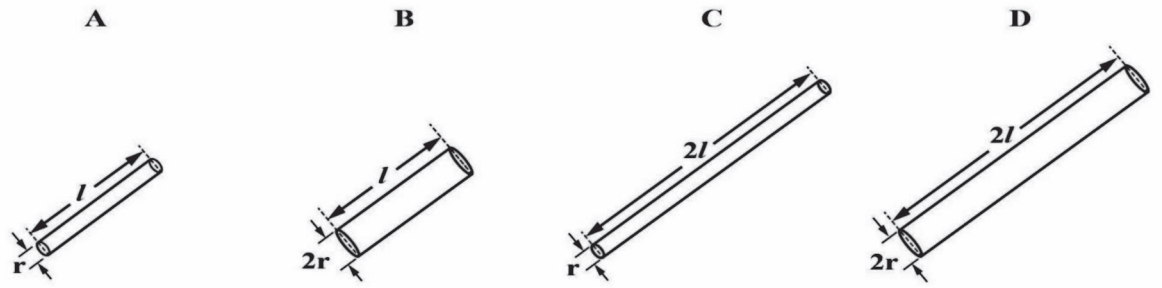
⬭ 

⬭ 

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Question 1 continued

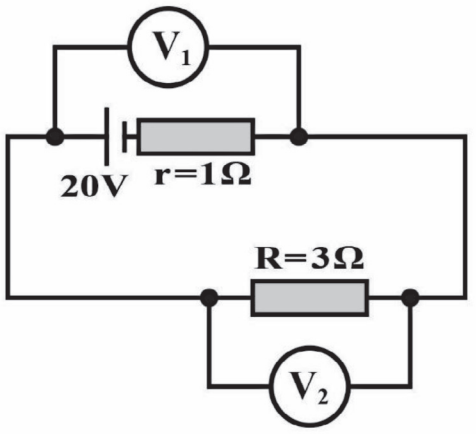
4) The figures below show four different copper wires (A, B, C and D) at room temperature.



Which wire has the **highest** resistance?

- ☐ A
- ☐ B
- ☐ C
- ☐ D

5) The figure opposite shows an electric circuit. If the reading of voltmeter (V_2) is (15.0V), what is the reading of voltmeter (V_1)?



- ☐ 12.0V
- ☐ 15.0V
- ☐ 17.0V
- ☐ 20.0V

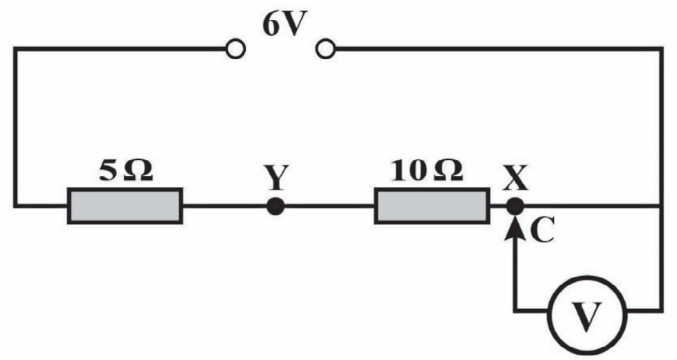
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Question 1 continued

6) The figure below shows a potential divider circuit.

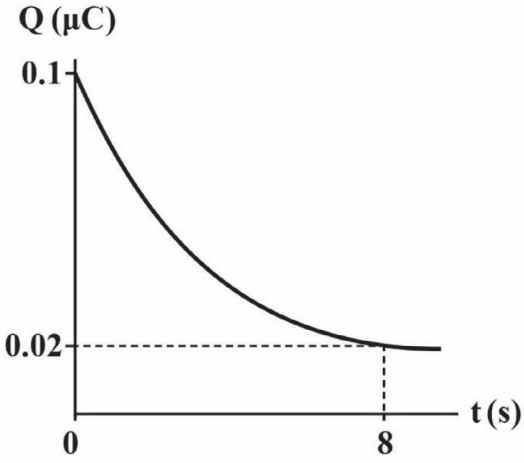


As the sliding terminal (C) is moved from point (X) to point (Y),what is the change in the voltmeter reading?

- ☐ 0V
- ☐ 2V
- ☐ 4V
- ☐ 6V

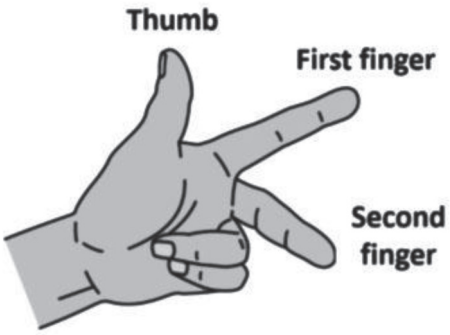
7) The graph opposite shows the charge (Q) against time (t) for a capacitor discharge.

What is the time constant (RC) for the circuit?



- ☐ 5.0s
- ☐ 3.5s
- ☐ 0.30s
- ☐ 0.20s

8) The figure opposite shows Fleming's left-hand rule. What does the **second finger** indicate?

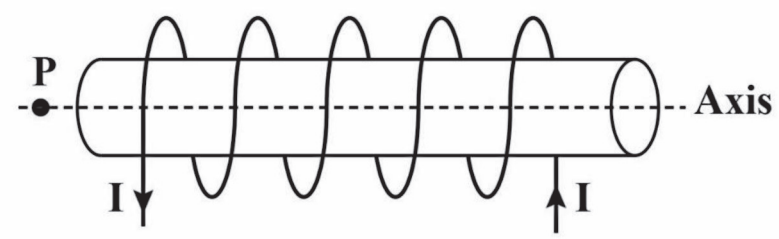


- ☐ Motion.
- ☐ Force.
- ☐ Field.
- ☐ Current.

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Question 1 continued

9) The figure below shows a coil carrying current (I).



What is the direction of the magnetic field lines at point (**P**) along its axis?

- ↑
- ↓
- ←
- →

10) A proton and an electron are moving with the same speed in a circular path of radius (r_p) and (r_e) respectively in a uniform magnetic field perpendicular to their velocity.

Which of the following description is correct?

	Direction of their paths	Radius of their paths
○	Same	$r_p > r_e$
○	Same	$r_p < r_e$
○	Opposite	$r_p > r_e$
○	Opposite	$r_p < r_e$

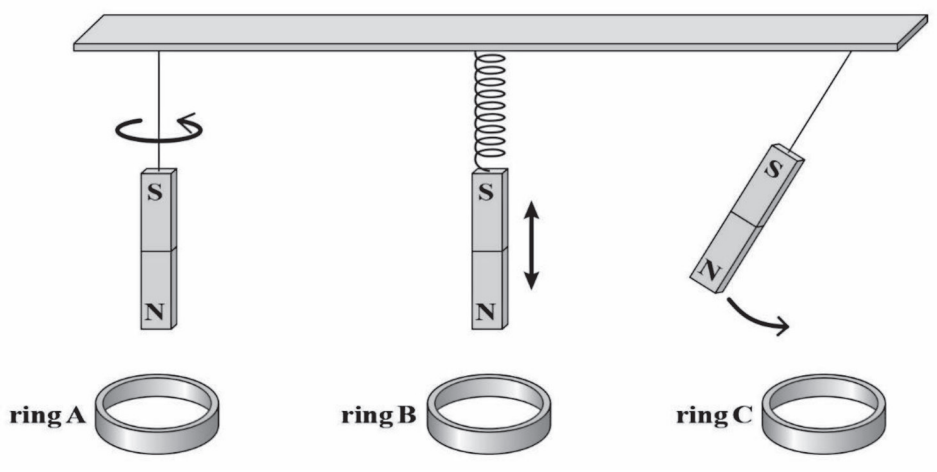
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Question 1 continued

11) The figure below shows three identical bar magnets suspended above three closed metallic rings (**A**, **B**, and **C**) which move as shown by the arrows.



In which ring will the current be induced?

- ☐ A and B only.
- ☐ B and C only.
- ☐ A and C only.
- ☐ A only.

12) Which of the following is equivalent to **Weber** (Wb)?

- ☐ $T.m^2$
- ☐ T/m^2
- ☐ $V.s^2$
- ☐ V/s^2

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Question 1 continued

13) Figure (1) shows an electric circuit and figure (2) shows the graph of input voltage (V_{in}) against time (t).

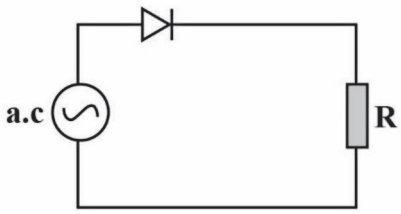


Figure (1)

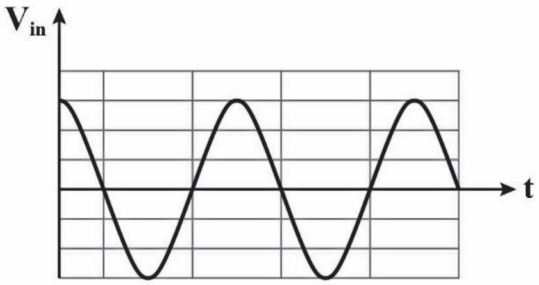
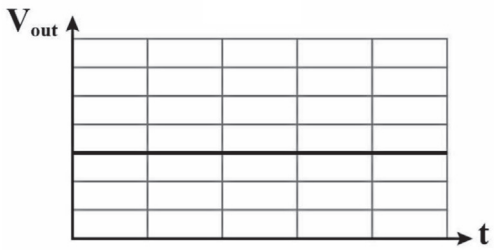
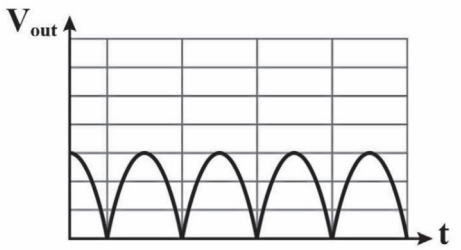
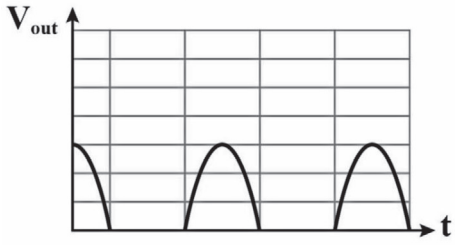


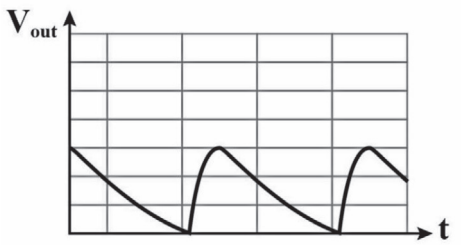
Figure (2)

Which of the following graphs represents correctly the voltage across the resistor versus time?









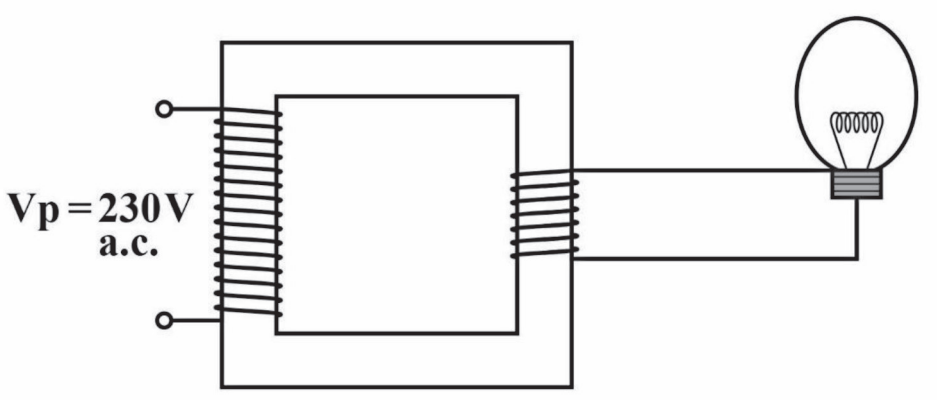
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Question 1 continued

14) A bulb rated at (12V, 60W) is connected to an ideal transformer as shown in the figure below.



What is the current through the primary coil?

- ☐ 0.26A
- ☐ 0.35A
- ☐ 3.75A
- ☐ 5.00A

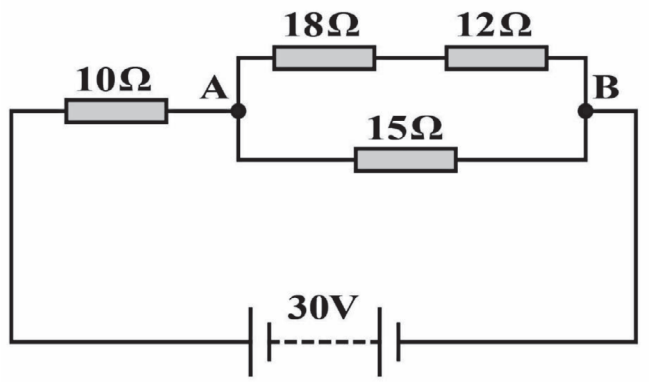
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Question 2: EXTENDED QUESTIONS (56 marks)

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) The figure below shows an electric circuit.



a. Define electric current. (1 mark)

b. Calculate the total resistance of the circuit. (3 marks)

c. Calculate the total current. (2 marks)

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Question 2 continued

16) a. In the table below, compare between the effects of increasing temperature on the resistance of a metal, and a semiconductor. (2 marks)

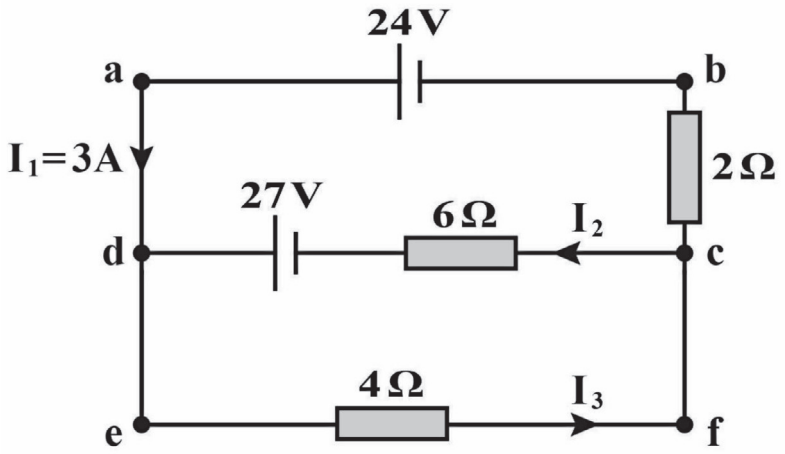
Resistance of a metal	Resistance of a semiconductor

b. When four identical resistors are connected in series with a power supply, the dissipated power is (25W). If they are connected in parallel with the same power supply, calculate the dissipated power. (5 marks)

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Question 2 continued

17) The figure below shows an electric circuit.



a. State Kirchhoff's first law. (1 mark)

b. Calculate the value of currents (I_2) and (I_3). (4 marks)

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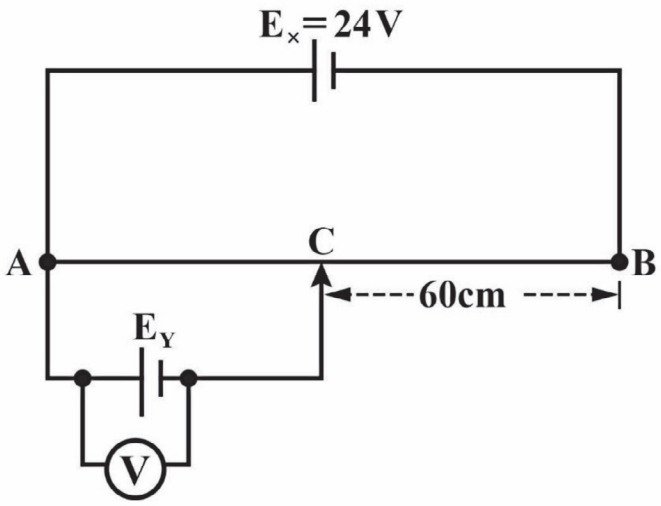
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Question 2 continued

18) a. Write the two types of the diode connection in an electric circuit. (2 marks)

b. The figure below shows a circuit of potentiometer. The length of potentiometer wire (100cm) and the balance is at point (C).



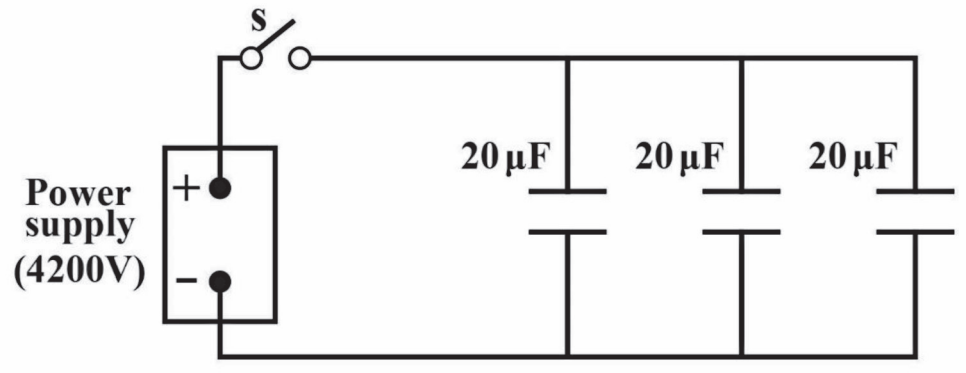
(i) Write one use of a potentiometer. (1 mark)

(ii) Find the reading of the voltmeter. (3 marks)

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Question 2 continued

19) The figure below shows an electric circuit with three uncharged capacitors.



a. Define capacitance (C). (1 mark)

b. When switch (S) is closed, calculate the total capacitance. (2 marks)

c. If the three capacitors are reconnected in series, what will happen to the total stored energy in the combination? (1 mark)

▭ Increase. ▭ Decrease. ▭ Stay the same.

(Choose the correct answer)

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Question 2 continued

20) a. Define magnetic flux density (B). (1 mark)

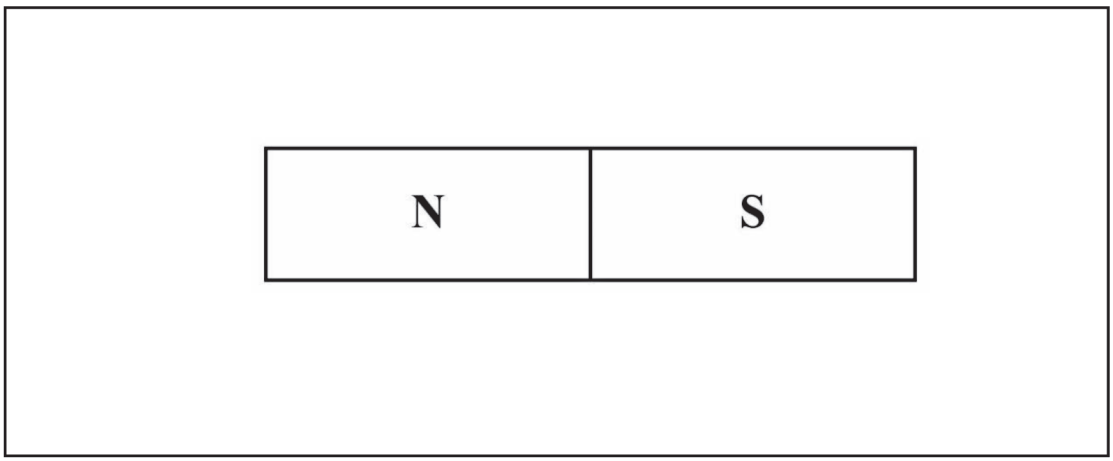
b. A proton has a velocity of (1.96×10^7m/s) and is moving perpendicular to a uniform magnetic field of magnetic flux density (2.5T).

Calculate the following:

(i) The magnetic force on the proton. (2 marks)

(ii) The radius of its circular path. (2 marks)

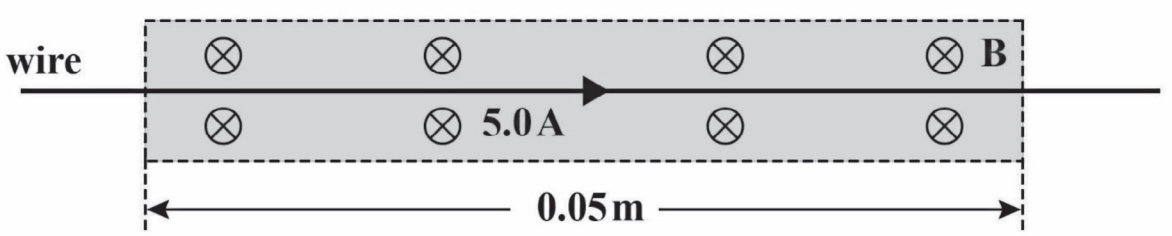
c. On the figure below draw magnetic field patterns with the correct direction around the permanent magnet. (3 marks)



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Question 2 continued

21) The figure below shows a straight wire placed in a uniform magnetic field of a flux density (60mT).



a. Calculate the magnitude of the magnetic force acting on the wire? (2 marks)

b. What is the direction of the magnetic force on the wire? (1 mark)

c. If the magnetic field lines become parallel to the wire, calculate the change in the magnetic force (ΔF). (2 marks)

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Question 2 continued

22) Figure (1) below shows a square conducting loop of side (l)entering a uniform magnetic field of magnetic flux density (B) with a constant velocity (v). Figure (2) below shows the graph of the magnetic flux (Φ) through the loop versus distance (X).

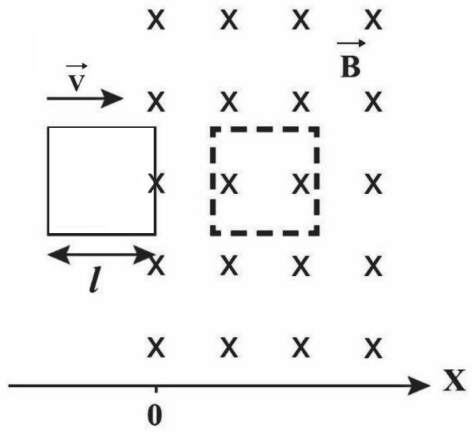


Figure (1)

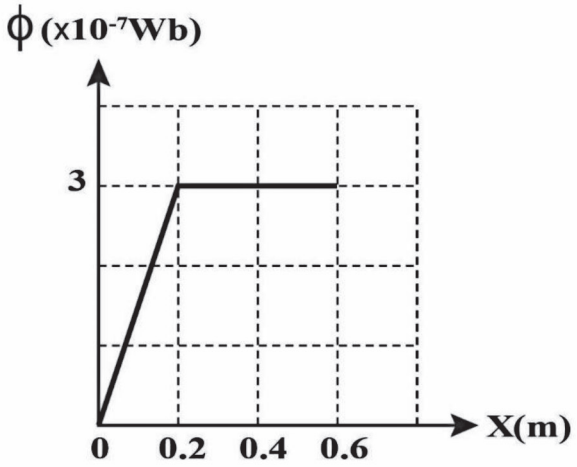


Figure (2)

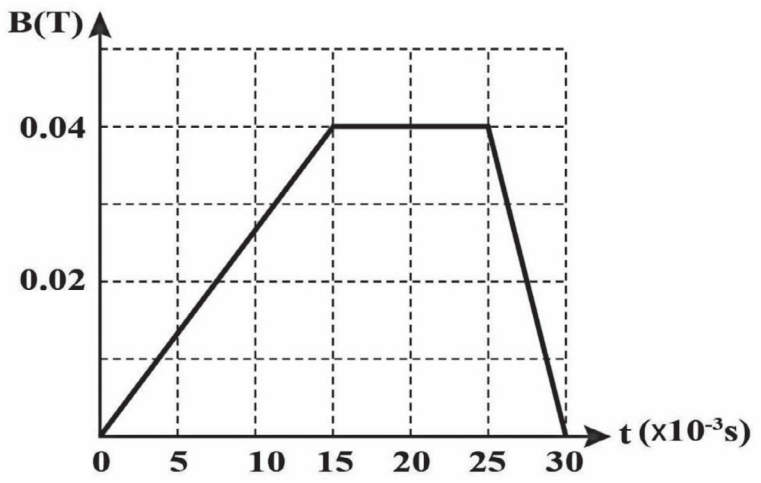
Calculate the area of the loop. (2 marks)

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Question 2 continued

23) a. State Faraday's Law. (2 marks)

b. A single-turn circular loop is placed in a uniform magnetic field perpendicular to its plane. The magnetic flux density through the loop varies with time as shown in the figure below.



If the **highest** induced e.m.f. in the loop is (0.03V), calculate the area of the loop. (4 marks)

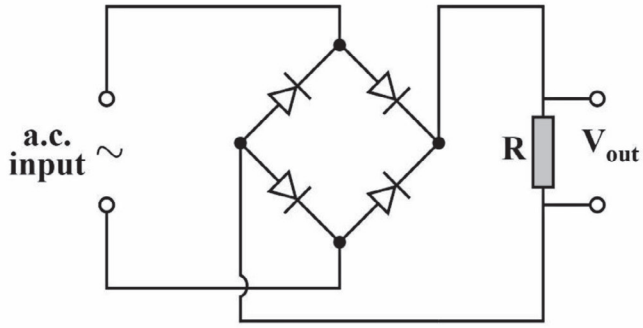
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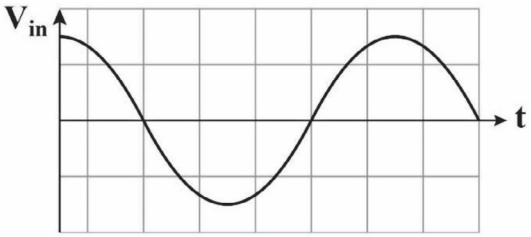
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Question 2 continued

24) Figure (1) shows an electric circuit with a bridge rectifier. Figure (2) shows the variation of the input voltage with time.



Figure(1)



Figure(2)

a. What is the function of the bridge rectifier? (1 mark)

b. On the axis below, draw the output voltage (V_{out}) through the resistor (R).

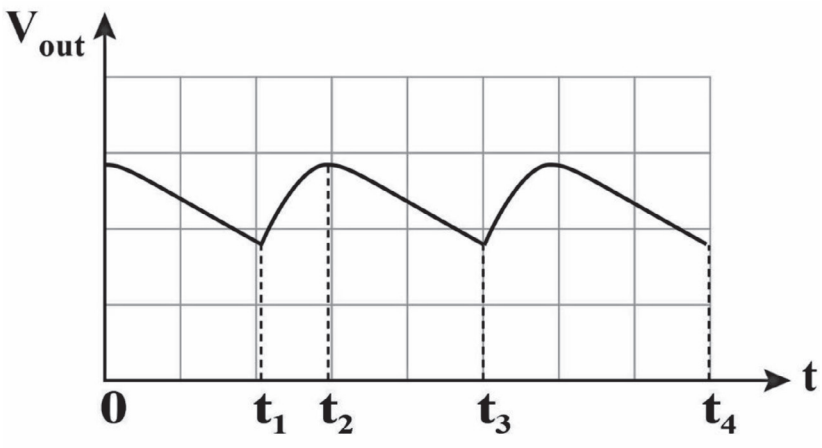
(3 marks)



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Question 2 continued

c. When a capacitor is connected in parallel with the resistor in the previous circuit, the output potential difference (V_{out}) across the resistor varies with the time as shown in the figure below.



(i) What is the name of this process? (1 mark)

_____

(ii) Write the time interval during which the capacitor is **discharge only**? (1 mark)

From _____ to _____ .

(iii) If the resistance of the resistor is increased, what will happen to the ripple in the above graph? (1 mark)

- ☐ Will become smaller.
- ☐ Will become larger.

(Choose the correct answer)

[End of Examination]

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FORMULA AND CONSTANTS

Electricity

CONSTANTS	$P = VI$	$V = IR$	$R = \frac{\rho L}{A}$	$Q = ne$
$e = 1.6 \times 10^{-19}\text{C}$	$P = I^2R = \frac{V^2}{R}$	$V = \frac{W}{Q}$	$I = I_1 + I_2$	$Q = It$
	$P = \frac{W}{t}$	$V_{out} = \frac{V_{in}R_1}{R_1+R_2}$	$\varepsilon = V_1 + V_2$	$I = Anvq$
	$emf = IR + Ir$	W = IVt	$\left(\frac{E_X}{E_Y} = \frac{L_X}{L_Y}\right) \text{or} \left(\frac{E_B}{E_A} = \frac{L_B}{L_A}\right)$	

Capacitance

	$E = W = \frac{Q^2}{2C}$	$E = W = \frac{1}{2}QV$	$C = C_1 + C_2$	$C = \frac{Q}{V}$
	$E = W = \frac{1}{2}CV^2$	$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$	$x = x_o\, e^{-(t/RC)}$	$\tau = RC$

Magnetic fields and electromagnetism

CONSTANTS	$r = \frac{mv}{Bq}$	$F_E = qE$	$F = qvBsin\theta$	$v = \frac{E}{B}$
$e = 1.6 \times 10^{-19}\text{C}$ $m_e = 9.11 \times 10^{-31}kg$ $m_P = 1.67 \times 10^{-27}kg$	$\frac{e}{m_e} = \frac{2V}{B^2r^2}$	$F = BIlsin\theta$	$V_H = \frac{BI}{ntq}$	

Electromagnetic induction

	$\Phi = BAcos\theta$	$\Phi = BAsin\theta$	$\varepsilon = \frac{-d(N\Phi)}{dt}$

Alternating current

	$P = I^2R$	$P = IV$	$\frac{N_S}{N_P} = \frac{V_S}{V_P} = \frac{I_P}{I_S}$

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

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٤٤ هـ - ٢٠٢٢ / ٢٠٢٣ م

الدور الثاني - الفصل الدراسي الأول

تنبيه:
- المادة: الفيزياء.
- الأسئلة في (١٤) 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) What is the unit of electric charge called?

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

2) Which of the following quantities are conserved in Kirchhoff's laws?

	Kirchhoff's first law	Kirchhoff's second law
○	Charge	Current
○	Charge	Energy
○	Energy	Current
○	Energy	Energy

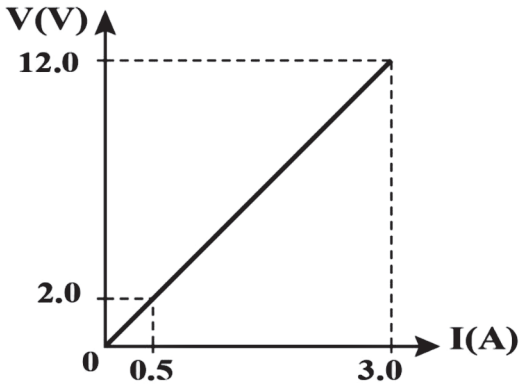
3) A power source supplies energy of (4.8 J) to electrons through a resistor in a circuit. If the potential difference across the resistor is (2.0 V), how many electrons flow through this resistor?

- ○ 1.5×10^{19} electrons
- ○ 3.0×10^{19} electrons
- ○ 2.4×10^{19} electrons
- ○ 6.0×10^{19} electrons

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Question 1 continued

4) The figure opposite shows the graph of potential difference versus current for a wire at constant temperature.



What is the resistance of the wire?

- ☐ 0.25 Ω
- ☐ 1 Ω
- ☐ 4 Ω
- ☐ 10 Ω

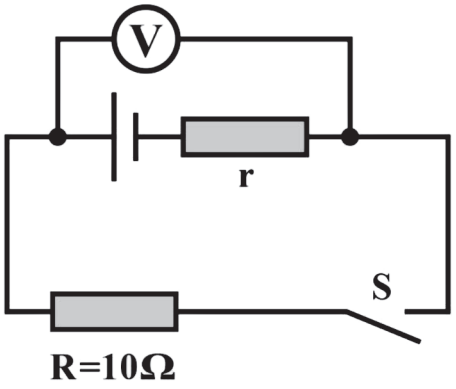
5) The table below shows the properties of two wires (K and M).

	Resistivity (ρ)	Length (l)	Cross-sectional area (A)
Wire (**K**)	ρ	l	A
Wire (**M**)	$\frac{\rho}{2}$	l	2A

What is the ratio of their resistance $\left(\frac{R_K}{R_M}\right)$?

- ☐ $\frac{1}{4}$
- ☐ $\frac{1}{2}$
- ☐ $\frac{2}{1}$
- ☐ $\frac{4}{1}$

6) The figure opposite shows an electric circuit. When the switch (S) is opened, the voltmeter reads (1.45 V) and when it is closed, the reading is (1.26 V).



What is the internal resistance of the battery (r)?

- ☐ 0.66 Ω
- ☐ 1.51 Ω
- ☐ 1.30 Ω
- ☐ 1.90 Ω

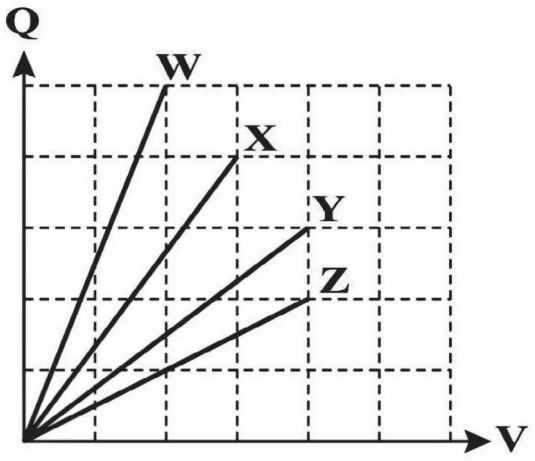
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Question 1 continued

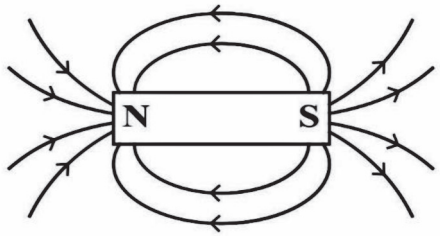
7) The figure below shows the graph of charge (Q) versus potential difference (V) for four capacitors (**W**, **X**, **Y** and **Z**).

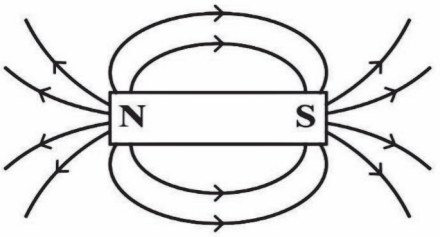


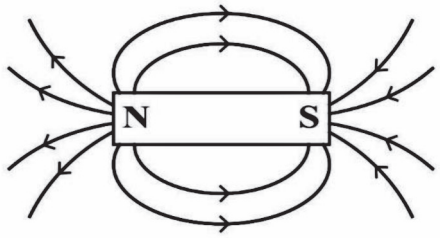
If each capacitor is discharged through the same resistor (R), which capacitor will have the **highest** time constant (RC)?

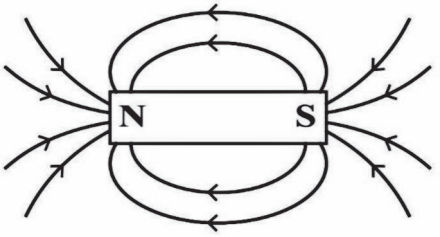
- ☐ W
- ☐ X
- ☐ Y
- ☐ Z

8) Which of the following figures shows the magnetic field patterns around a permanent magnet?

- ☐ 

- ☐ 

- ☐ 

- ☐ 

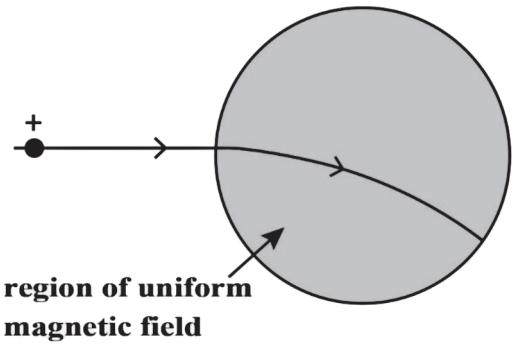
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Question 1 continued

9) A positive charge enters a region of a uniform magnetic field as shown in the figure opposite.

What is the direction of the magnetic field?

- ▢ Upward.
- ▢ Out of the page.
- ▢ Downward.
- ▢ Into the page.



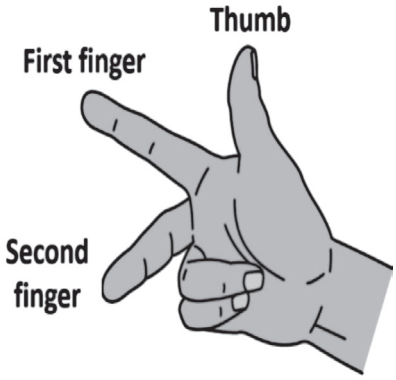
10) Two protons, (X and Y), travel with different velocities at right angle to a uniform magnetic field and experience a magnetic force ($\mathrm{F_X}$ and $\mathrm{F_Y}$) respectively.

If the ratio the of the radius of their paths $\left(\frac{r_\mathrm{X}}{r_\mathrm{Y}}\right)$ is $\left(\frac{1}{2}\right)$, what is the ratio of $\left(\frac{F_\mathrm{X}}{F_\mathrm{Y}}\right)$?

- ▢ $\frac{1}{4}$
- ▢ $\frac{1}{2}$
- ▢ $\frac{2}{1}$
- ▢ $\frac{4}{1}$

11) The figure opposite shows Fleming's right-hand rule.
What does the **first finger** indicate?

- ▢ Direction of motion.
- ▢ Induced current.
- ▢ Magnetic field.
- ▢ Magnetic force.



12) A circular conducting loop with a radius of (2.50×10^{-2} m) is placed in a uniform magnetic flux density of (0.625 T). If the magnetic flux through the coil is (1.00×10^{-4} Wb), what is the angle (θ) between the magnetic field lines and the normal to the loop?

- ▢ 89°
- ▢ 85°
- ▢ 78°
- ▢ 75°

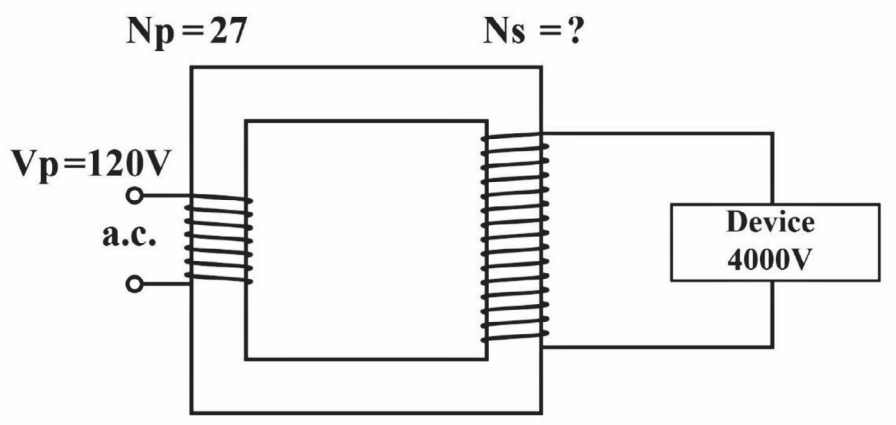
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Question 1 continued

13) The figure below shows an ideal transformer connected to a device.



How many turns are on the secondary coil (N_s)?

- ☐ 54 turns
- ☐ 148 turns
- ☐ 900 turns
- ☐ 18000 turns

14) A power company transfers an electric power over a distance of (100 km) through a wire that has a resistance of (0.25) Ohms per kilometer. If the current through the wire is (60 A), what is the power loss in the wire?

- ☐ 144 W
- ☐ 20736 W
- ☐ 36500 W
- ☐ 90000 W

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Question 2: EXTENDED QUESTIONS (56 marks)

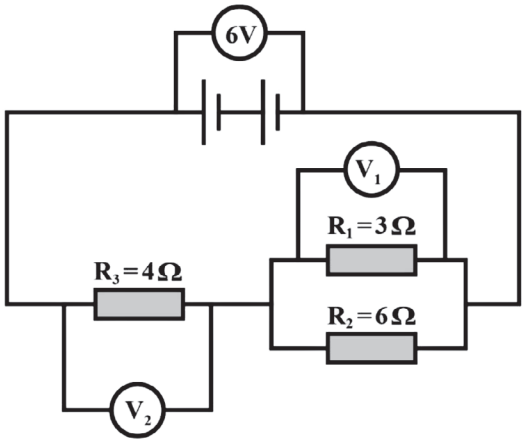
Write your answer for each of the following questions in the space provided.

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

15) a. Write the three factors that affect the resistance of metallic wire. (3 marks)

b. Name the two types of diode connection in electric circuits. (2 marks)

c. The figure opposite shows an electric circuit.



(i) Calculate the total resistance of the circuit. (3 marks)

(ii) Find the readings of the voltmeters (V_1) and (V_2). (3 marks)

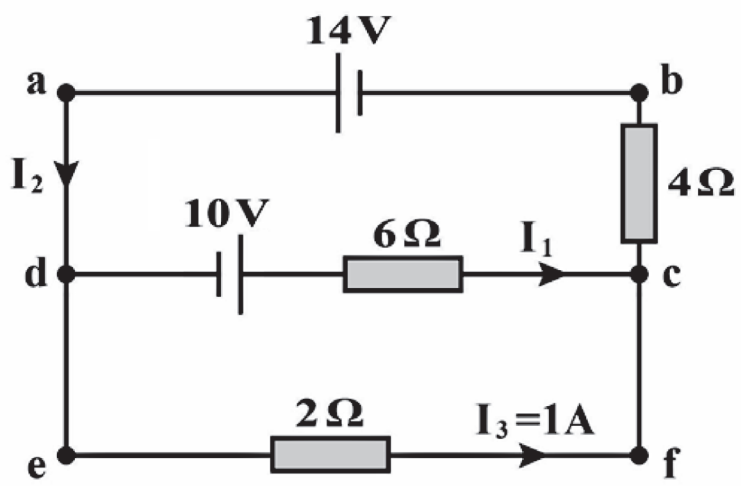
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Question 2 continued

16) The figure below shows an electric circuit.



Calculate the value of currents (I_1) and (I_2) passing through the circuit. (4 marks)

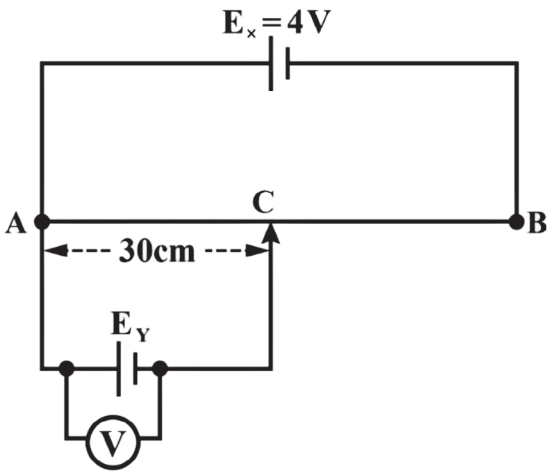
17) **a.** What is the effect of increasing the temperature on the resistance of metals and semiconductors? (2 marks)

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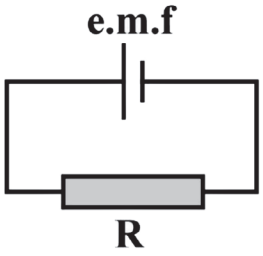
Question 2 continued

b. The figure opposite shows a circuit of a potentiometer. The length of the potentiometer wire (100 cm) and the balance is at point (C).

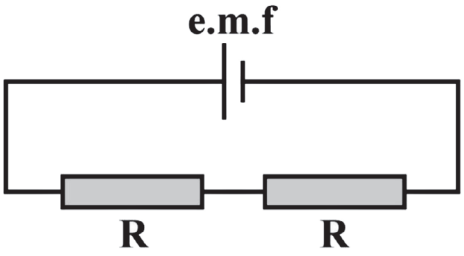
Find the reading of the voltmeter. (2 marks)



18) The figure below shows two circuits with identical resistors and the same e.m.f.



Circuit (1)



Circuit (2)

If the dissipated power across the resistor in circuit (1) is (P_1), what is the total dissipated power in circuit (2) (P_2) in terms of (P_1)? (5 marks)

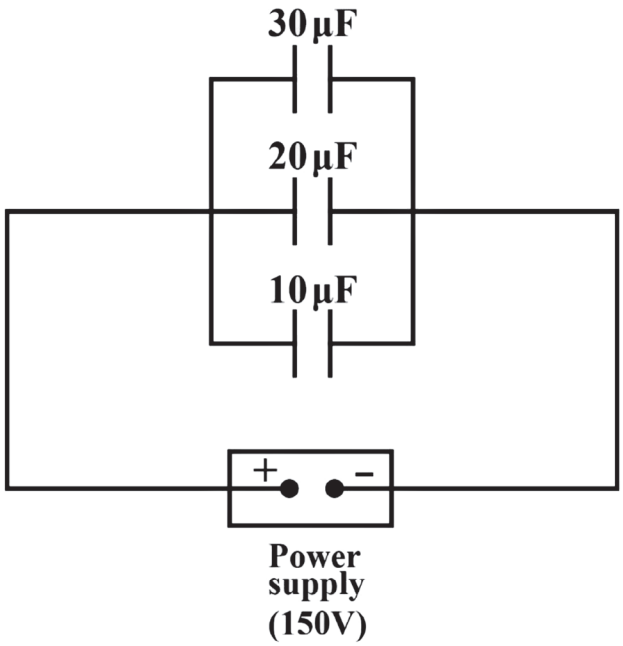
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Question 2 continued

19) The figure below shows an electric circuit.



a. Write one use of capacitors in electric circuits. (1 mark)

b. Calculate the total stored energy in the above combination of capacitors. (2 marks)

c. If one capacitor is removed, what will happen to the total stored energy in the above combination? (1 mark)

☐ Increase. ☐ Decrease. ☐ Stay the same.

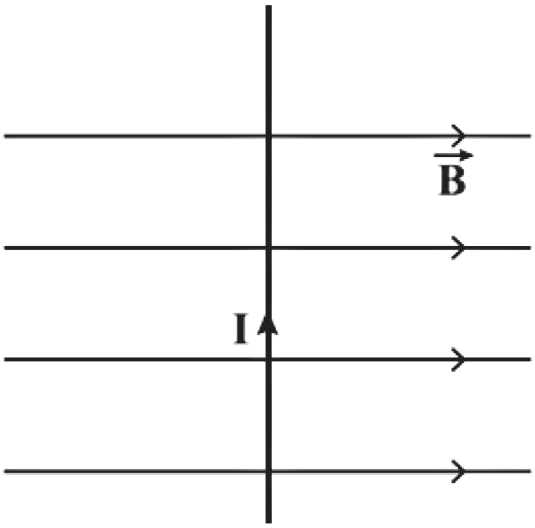
(Choose the correct answer)

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Question 2 continued

20) a. Write four factors that affect the magnitude of the magnetic force on a long straight current-carrying wire. (4 marks)

b. A wire carries a current of (3.0 A) and is placed inside a magnetic field of magnetic flux density of (0.50 T) as shown in the figure below.



(i) If the length of the wire inside the field is (4 cm), calculate the magnetic force acting on the wire. (2 marks)

(ii) What is the direction of the magnetic force on the wire? (1 mark)

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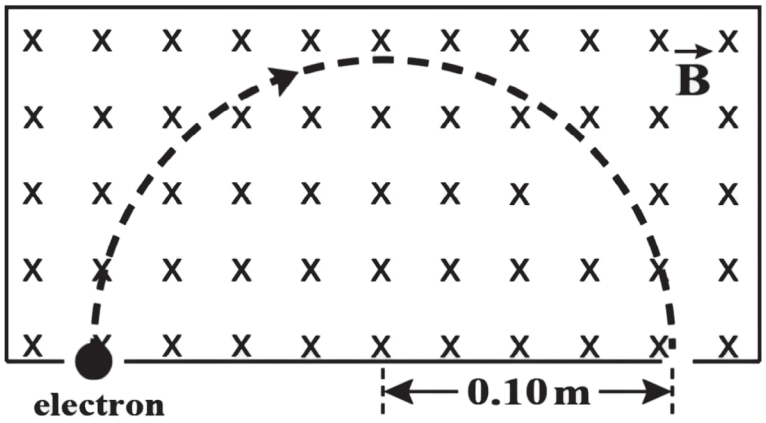
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Question 2 continued

(iii) If the wire is parallel to the magnetic field lines, calculate the change in the magnetic force (ΔF) that acts on the wire. (2 marks)

21) An electron enters a region of a uniform magnetic field of a magnetic flux density (2×10^{-3} T) and follows a circular path as shown in the figure below.



a. Calculate the velocity of the electron in the magnetic field. (2 marks)

b. When an electric field of strength (702.5×10^2 V m^{-1}) is applied perpendicular to the magnetic field, prove by calculation that the electron will move in a straight line (without deflection). (2 marks)

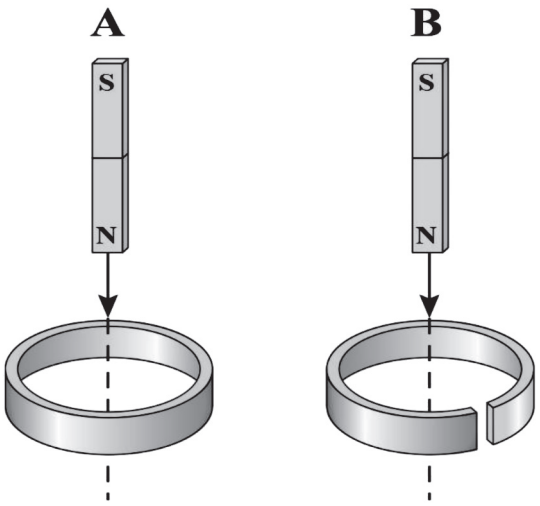
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Question 2 continued

22 **a.** Define magnetic flux. (1 mark)

b. The figure opposite shows two identical bar magnets (**A** and **B**) dropped from the same height through two conducting rings.

Which magnet will pass through the ring faster? (2 marks)



▢ **A** ▢ **B**

(Choose the correct answer)

Explain your answer.

c. State Lenz's law. (1 mark)

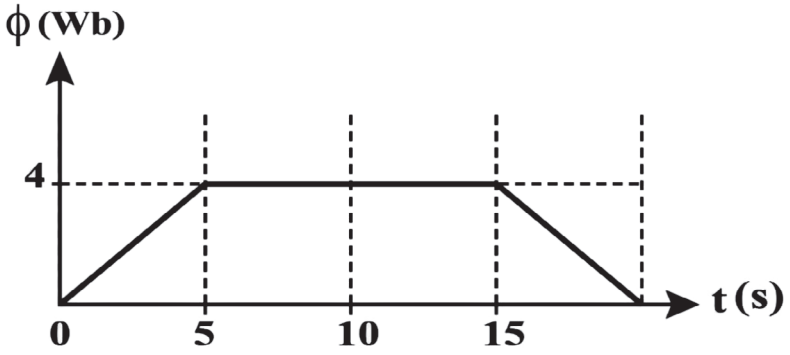
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Question 2 continued

23) A rectangular single-turn loop moves at constant velocity perpendicular to a uniform magnetic field . The figure below shows a graph of the variation of the magnetic flux through the coil from the time it enters the field until it leaves the field completely.



a. At which time interval the induced (e.m.f.) is zero? (2 marks)

From t = _____ (s) **to** t = _____ (s)

b. If the area of the loop is (2×10^{-2} m^2), calculate the magnitude of the magnetic flux density (B). (2 marks)

_____

_____

24) **a.** Name the two types of transformers. (2 marks)

_____

_____

b. An electric power is delivered from the power station to the house through cables of resistance (100 Ω). If the current through the cable is (40 A), calculate the power dissipated in the cables. (2 marks)

_____

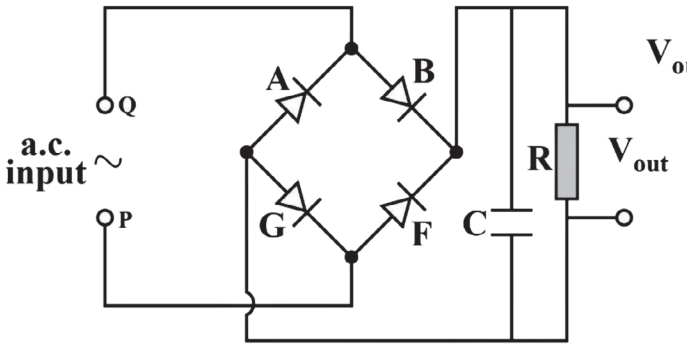
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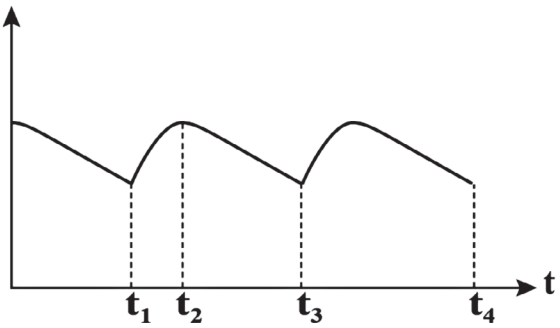
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Question 2 continued

c. Figure (1) shows a full-wave bridge rectifier. Figure (2) shows the variation of the output voltage (V_{out}) with time (t) across the resistor (R).



Figure(1)



Figure(2)

(i) When terminal (P) of the power supply is positive, which diodes are connecting the current? (1 mark)

_____

(ii) Write the time interval during which the capacitor is charged only. (1 mark)

_____

(iii) If another capacitance of the capacitor is doubled, what will happen to the ripple in the above graph? (1 mark)

▭ Will become smaller. ▭ Will become larger.

(Choose the correct answer)

[End of Examination]

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FORMULA AND CONSTANTS

Electricity

CONSTANTS	$P = VI$	$V = IR$	$R = \frac{\rho L}{A}$	$Q = ne$
$e = 1.6 \times 10^{-19} C$	$P = I^2R = \frac{V^2}{R}$	$V = \frac{W}{Q}$	$I = I_1 + I_2$	$Q = It$
	$P = \frac{W}{t}$	$V_{out} = \frac{V_{in}R_1}{R_1+R_2}$	$\varepsilon = V_1 + V_2$	$I = Anvq$
	$emf = IR + Ir$	W = IVt	$\left(\frac{E_X}{E_Y} = \frac{L_X}{L_Y}\right) \text{or} \left(\frac{E_B}{E_A} = \frac{L_B}{L_A}\right)$	

Capacitance

	$E = W = \frac{Q^2}{2C}$	$E = W = \frac{1}{2}QV$	$C = C_1 + C_2$	$C = \frac{Q}{V}$
	$E = W = \frac{1}{2}CV^2$	$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$	$x = x^o e^{-(t/RC)}$	$\tau = RC$

Magnetic fields and electromagnetism

CONSTANTS	$r = \frac{mv}{Bq}$	$F_E = qE$	$F = qvBsin\theta$	$v = \frac{E}{B}$
$e = 1.6 \times 10^{-19} C$ $m_e = 9.11 \times 10^{-31} kg$ $m_P = 1.67 \times 10^{-27} kg$	$\frac{e}{m_e} = \frac{2V}{B^2r^2}$	$F = BIlsin\theta$	$V_H = \frac{BI}{ntq}$	

Electromagnetic induction

	$\Phi = BAcos\theta$	$\Phi = BAsin\theta$	$\varepsilon = \frac{-d(N\Phi)}{dt}$	

Alternating current

	$P = I^2R$	$P = IV$	$\frac{N_S}{N_P} = \frac{V_S}{V_P} = \frac{I_P}{I_S}$

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مُسَوَّدَة

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امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٤٣ هـ - ٢٠٢١ / ٢٠٢٢ م

الدور الأول - الفصل الدراسي الأول

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 Items (14 marks)

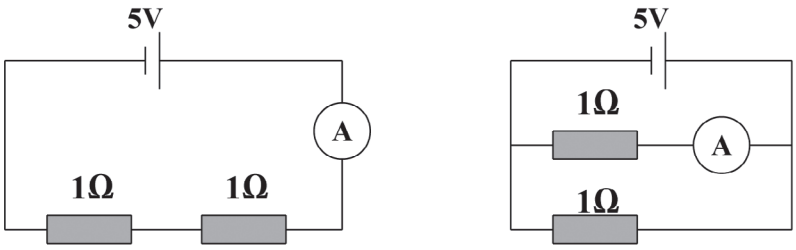
There are 14 multiple choice items worth one mark each.
Shade in the bubble (⬭) next to the **best** answer for each item.

1) The rate of flow of an electric charge past a point is called:

⬭ Coulomb. ⬭ Current.

⬭ Mean drift velocity. ⬭ Number density.

2) The figure below shows two circuits (1) and (2), with two identical resistors.



Which row in the table below describes the circuit that has the higher ammeter reading and the circuit with lower combined resistance?

	Circuit with higher ammeter reading	Circuit with lower combined resistance
⬭	1	1
⬭	1	2
⬭	2	1
⬭	2	2

3) How many electrons pass in (2s) across a conductor carrying a current of (1A)?

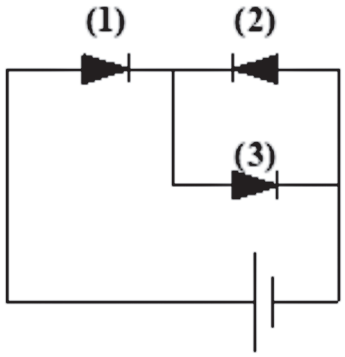
⬭ 6.25×10^{19} ⬭ 1.25×10^{19}

⬭ 6.25×10^{18} ⬭ 1.25×10^{18}

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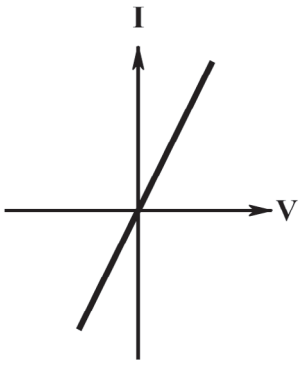
Question 1 continued

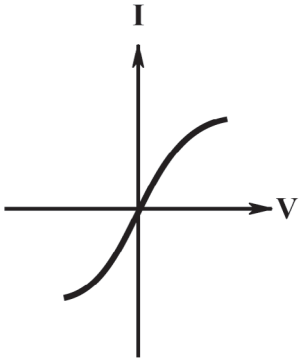
4) The figure below shows a circuit with three diodes (1, 2 and 3).Which diodes will allow the current to pass through?

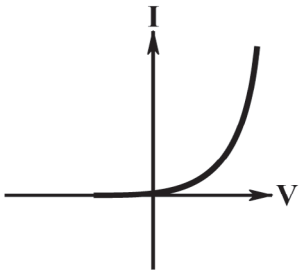


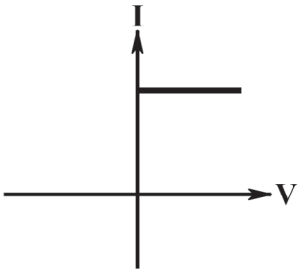
- ☐ 1 only
- ☐ 2 only
- ☐ 1 & 3 only
- ☐ 2 & 3 only

5) Which of the following graphs represents the I-V characteristics curve of a diode?

☐ 

☐ 

☐ 

☐ 

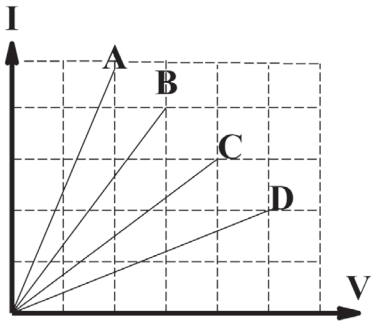
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Question 1 continued

6) The figure below shows (I-V) graphs for the same metal at different temperatures (A, B, C and D). Which temperature is the highest?



- ☐ A
- ☐ B
- ☐ C
- ☐ D

7) (10) identical capacitors of capacitance (10 μF) each, are connected together in parallel then in series. What is the ratio that can be obtained between their total capacitance ($C_{parallel} : C_{series}$)?

- ☐ (1:10)
- ☐ (10:1)
- ☐ (1:100)
- ☐ (100:1)

8) All of the following statements are **true** about the magnetic field lines of a permanent magnet **except**:

- ☐ They never touch or cross each other.
- ☐ They come out of north pole and end go into south pole.
- ☐ They are closest where the magnetic field is strongest.
- ☐ The direction of the lines inside the magnet is from the north pole to the south pole.

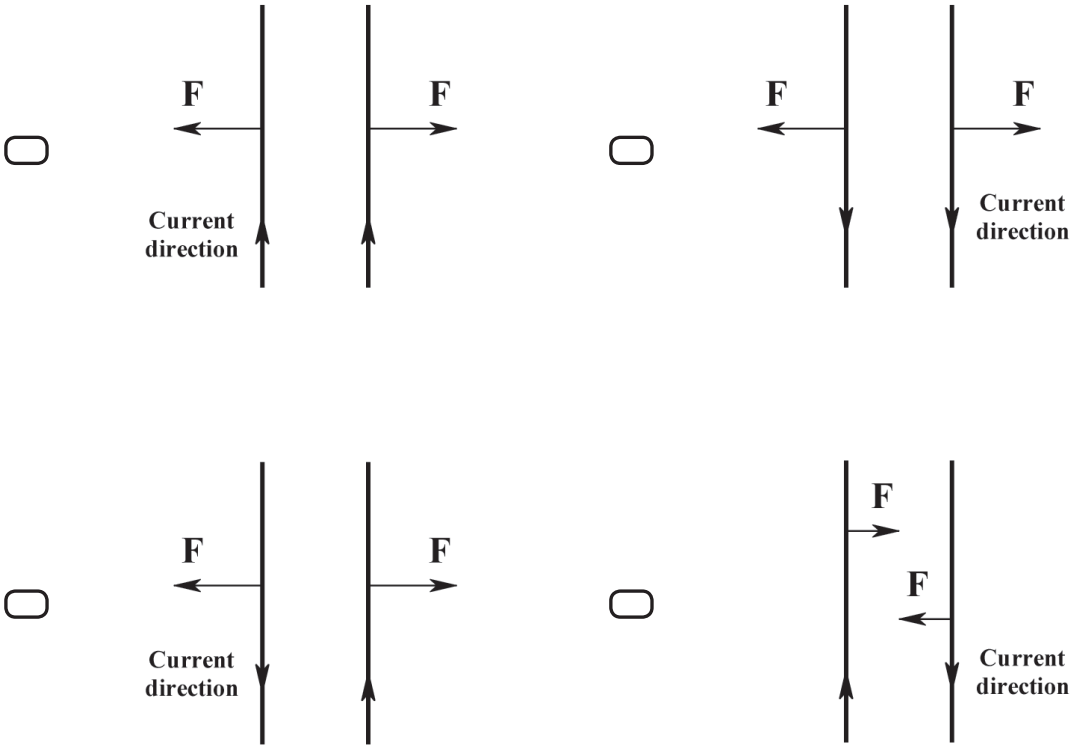
9) When a charged particle (q) moves with a velocity (v) at right angle to a magnetic field (B), it is affected by a magnetic force (F). At what angle will the magnetic force become $\left(\frac{F}{2}\right)$?

- ☐ 30°
- ☐ 45°
- ☐ 90°
- ☐ 180°

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Question 1 continued

10) The figures below show two parallel current-carrying wires. Which figure correctly shows the direction of the magnetic force (F) between the wires?



11) An electron and a proton enter the same magnetic field (B) with the same kinetic energy. What is the ratio of the radii of their circular paths $\left(\frac{r_p}{r_e}\right)$?

- $\frac{m_p}{m_e}$
- $\frac{m_e}{m_p}$
- $\sqrt{\frac{m_p}{m_e}}$
- $\sqrt{\frac{m_e}{m_p}}$

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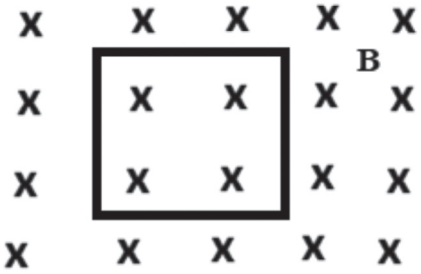
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Question 1 continued

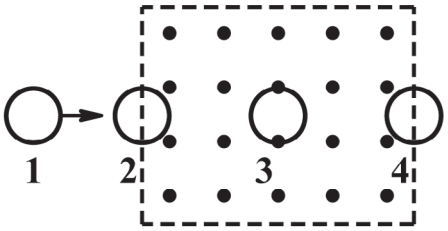
12) The figure below shows a square conducting loop of area ($0.1m^2$) is placed in a uniform magnetic field with a flux density of ($0.8 \times 10^{-3}\ T$). What is the magnetic flux (ϕ)?

- ☐ $0.8 \times 10^{-4}\ Wb$
- ☐ $4.0 \times 10^{-4}\ Wb$
- ☐ $1.6 \times 10^{-4}\ Wb$
- ☐ $3.2 \times 10^{-4}\ Wb$

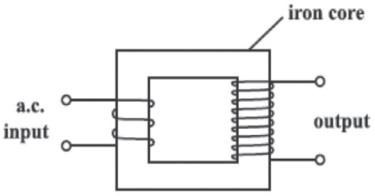


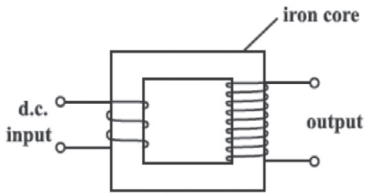
13) The figure below shows a circular loop that moves at a constant velocity through a uniform magnetic field. At which position the direction of induced current is **clockwise**?

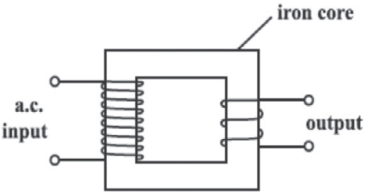
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

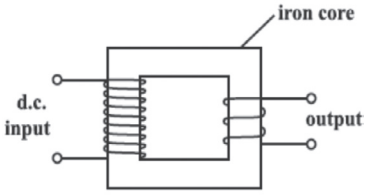


14) Which of the following transformers is worked as step-down transformer?

☐ 

☐ 

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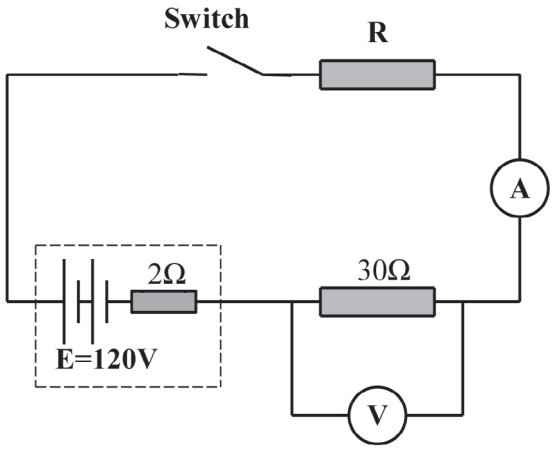
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Question 2: EXTENDED QUESTIONS (56 marks)

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) The figure below shows an electric circuit.



a. State Ohm's law? (1 mark)

b. When the switch is closed, the reading of the voltmeter is (60V). Calculate the resistance (R). (4 marks)

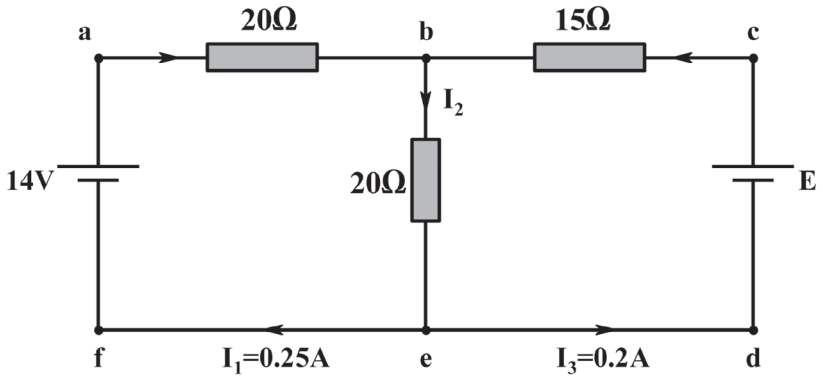
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Question 2 continued

16) The figure below shows an electric circuit.



a. State Kirchhoff's first law. (1 mark)

b. Find the value of (I_2). (3 marks)

c. Calculate the value of the electromotive force (E). (3 marks)

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Question 2 continued

17) a. Write three factors that affect the resistance of a wire. (3 marks)

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

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

(ii) How much time is needed for an electron to move from one end of the wire to the other? (2 marks)

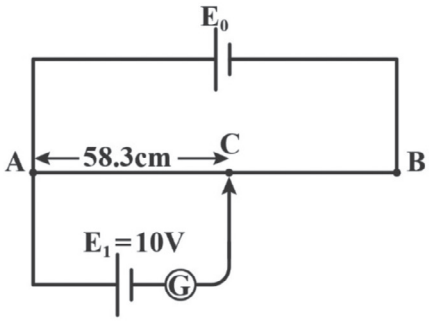
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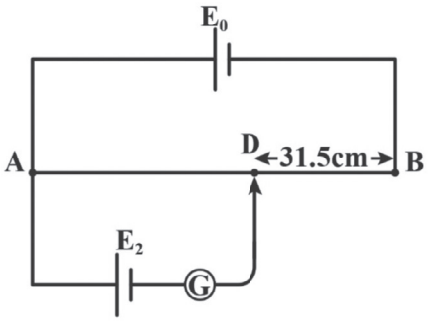
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Question 2 continued

18) Figures (1) and (2) below show the circuits of the same potentiometer for comparison between two e.m.f.s (E_1 and E_2). The balance points in each circuit are at (C) and (D).



Figure(1)



Figure(2)

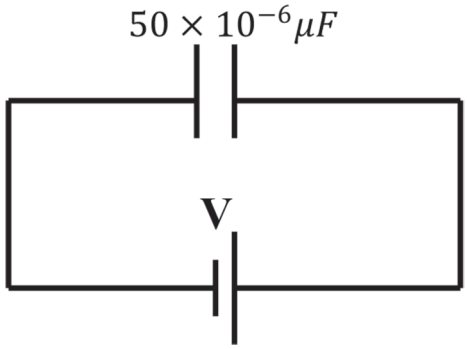
a. What is a potentiometer? (1 mark)

b. If the length of the resistance wire (AB) of a potentiometer is (100 cm), find (E_2). (3 marks)

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Question 2 continued

19) The figure below shows a capacitor of ($6 \times 10^{-9}\ C$) charge.



a. Define the capacitance. (1 mark)

b. Calculate the energy stored in the capacitor. (3 marks)

c. If another capacitor is connected in series with the above capacitor, what will happen to the total energy stored in the capacitors? **(Choose the correct answer)** (1 mark)

☐ Increase ☐ Decrease ☐ Stay the same

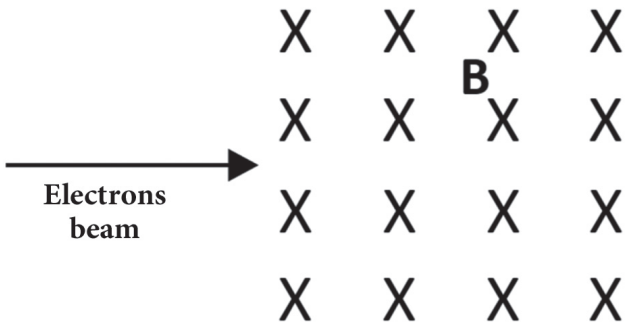
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Question 2 continued

20) The figure below shows a beam of electrons that enter a region of magnetic field of flux density (4.5×10^{-3} T). The electrons travel in a circular path of radius (0.02 m) inside the magnetic field (B).



a. Write two ways of producing magnetic fields. (2 marks)

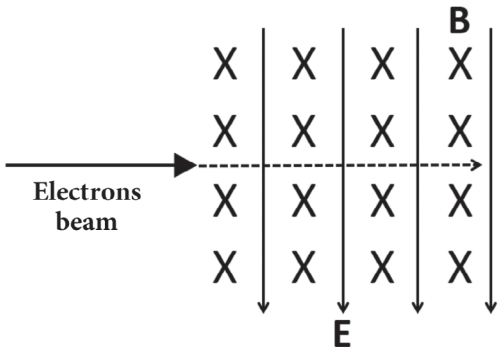
b. What is the direction of the magnetic force that acts on the electron as it enters the field? (1 mark)

c. Calculate the magnitude of the electron's velocity in the field. (3 marks)

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Question 2 continued

d. A uniform electric field of strength (E) is applied in the region of the magnetic field as shown in the figure below.



Calculate the value of (E) that makes the electrons beam move in a straight line.

(2 marks)

21) a. Write three factors that affect the magnitude of the magnetic force acting on a current carrying wire. (3 marks)

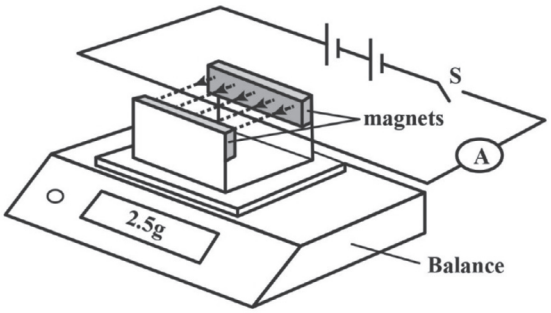
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Question 2 continued

b. The figure below shows a fixed horizontal wire passing centrally between the poles of a permanent horseshoe magnet of (0.3 T) magnetic flux density. The magnet is placed on a top-plan balance which records a mass of (2.5 g). When the switch (S) is open.



(i) When the switch (S) is closed a current of (2.2 A) flows in the wire and the balance records a mass of (10 g). Calculate the length of the wire in the magnetic field. (3 marks)

(ii) If the current is reduced, what will happen to the reading of the balance? **(Choose the correct answer)** (1 mark)

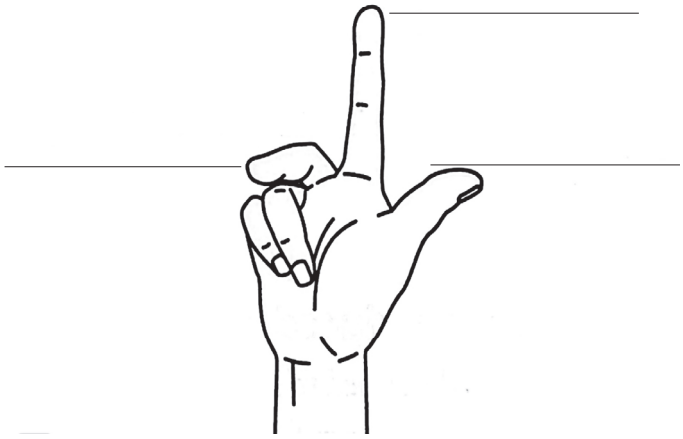
☐ Increase ☐ Decrease ☐ Stay the same

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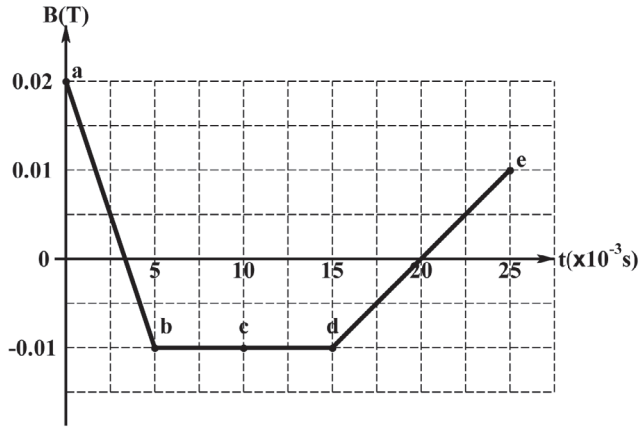
Question 2 continued

22) **a.** The figure below shows Fleming's right-hand rule. Label what each finger represents. (3 marks)



b. A uniform magnetic field of flux density (B) is applied perpendicularly to the plane of a circular conducting loop of (2 turns) with a resistance of (0.4 Ω). If the magnitude of the magnetic flux is increased at a rate of (31×10^{-3} Wb/s), calculate the induced current in the loop. (4 marks)

23) The figure below shows a graph of magnetic flux density (B) against time (t) for a conducting loop placed perpendicularly in the magnetic field. The loop has an area of (0.0011 m^2) and (155) turns.



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Question 2 continued

a. State Faraday's law of electromagnetic induction. (1 mark)

b. Calculate the induced e.m.f. at the time interval **(de)**. (2 marks)

24) A power station produces a current of (833.3 A) and transmits it to a city through an electric transmission line. The line has a resistance of (0.2 Ω).

a. The alternating current is used for electricity supply. Explain why. (1 mark)

b. Calculate the power dissipated through the transmission line. (2 marks)

[End of Examination]

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FORMULA AND CONSTANTS

Units	FORMULA			CONSTANTS
Electricity	$V = IR$	$Q = Ne$	$Q = It$	$e = 1.6\times10^{-19}C$ $m_p = 1.67\times10^{-27}kg$ $m_e = 9.11\times10^{-31}kg$ $g = 10ms^{-2}$
	$I = Anve$	$E = V_1 + V_2$	$I = I_1 + I_2$	
	$emf = E = IR + Ir$	$R = R_1{+}R_2$	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$	
	$P = IV = RI^2 = \frac{V^2}{R} = \frac{W}{t}$		$V = \frac{W}{Q}$	
	$R = \rho\frac{l}{A}$	$V_{out} = \left(\frac{R_2}{R_1 + R_2}\right)V_{in}$		
	$\frac{E_X}{E_y} = \frac{AC}{AD} = \frac{l_X}{l_y}$			
Capacitance	$C = C_1 + C_2$	$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$	$C = \frac{Q}{V}$	
	$W = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{1}{2}\frac{Q^2}{C}$			
Magnetic fields and electromagnetism	$F = BIlsin\theta$		$F = QvBsin\theta$	
	$v = \frac{E}{B}$	$r = \frac{mv}{Be}$	$\frac{e}{m} = \frac{2V}{r^2B^2}$	
Electromagnetic induction	$\Phi = BAcos\theta = BAsin\theta$		$emf = E = \frac{N(\Delta\Phi)}{\Delta t}$	
Alternating current	$\frac{N_S}{N_P} = \frac{V_S}{V_P} = \frac{I_P}{I_S}$		$P = IV = RI^2$	

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امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٤٣ هـ - ٢٠٢١ / ٢٠٢٢ م

الدور الثاني - الفصل الدراسي الأول

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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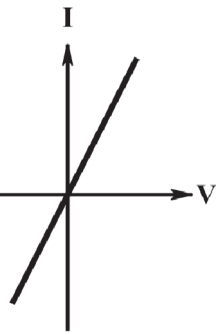
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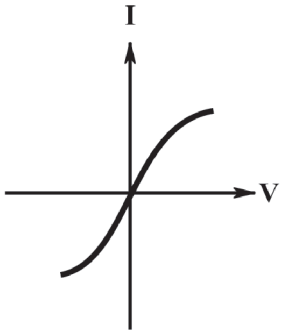
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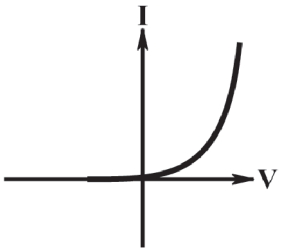
Question 1: Multiple Choice Items (14 marks)

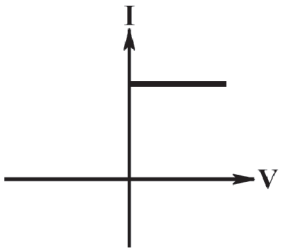
There are 14 multiple choice items worth one mark each.
Shade in the bubble (⬭) next to the **best** answer for each item.

1) Which of the following graphs represents the I-V characteristics curve for a filament lamp?

⬭ 

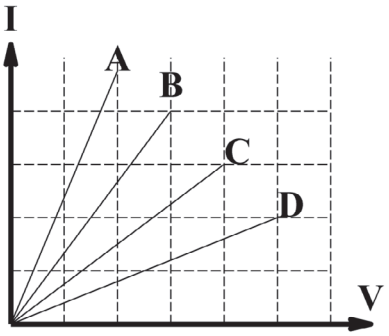
⬭ 

⬭ 

⬭ 

2) The figure below shows (I-V) graph for four different metals (A, B, C and D) at the same temperature. If all have the same length (l) and cross-sectional area (A), which wire will have the largest resistivity (ρ)?

⬭ A
⬭ B
⬭ C
⬭ D



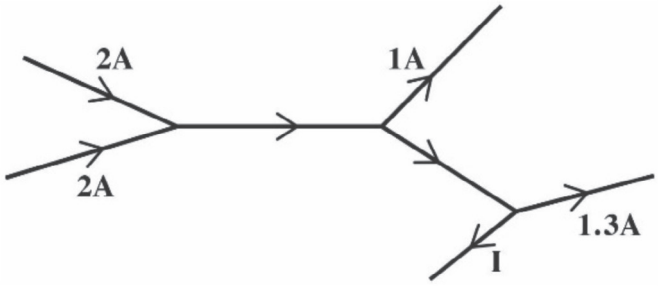
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Question 1 continued

3) When (n) identical resistors are connected in series their equivalent resistance is (16) times their equivalent resistance when they are connected in parallel. What is the number of the resistors (n)?

- ☐ 2
- ☐ 4
- ☐ 8
- ☐ 16

4) The figure below shows part of an electrical circuit. What is the magnitude of the current (I)?



- ☐ 1.0 A
- ☐ 1.3 A
- ☐ 1.7 A
- ☐ 3.7 A

5) Which of the following statements define the **e.m.f** of a battery?

- ☐ The chemical energy stored in the battery.
- ☐ The amount of charge the battery can pump.
- ☐ The maximum current that the battery can supply.
- ☐ The energy transfers (work done) per unit charge.

6) A (60 W) lamp is working on a (220 V) power supply. What is the current supply to the lamp?

- ☐ 0.27 A
- ☐ 3.67 A
- ☐ 0.54 A
- ☐ 7.33 A

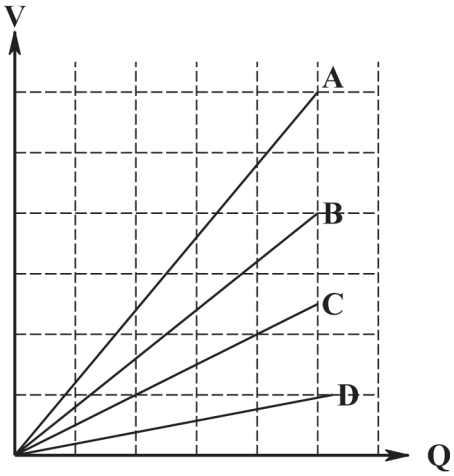
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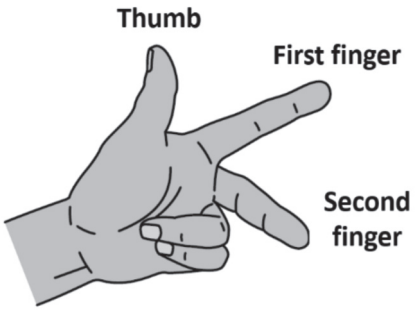
Question 1 continued

7) The figure opposite shows the (V-Q) graph of four capacitors (A, B, C and D). Which capacitor has the highest capacitance?



- ☐ A
- ☐ B
- ☐ C
- ☐ D

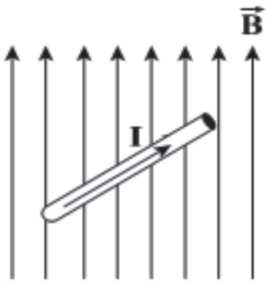
8) The figure below shows Fleming's left-hand rule. What does the first finger indicate?



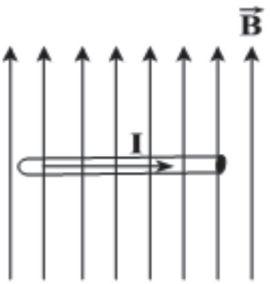
- ☐ Current
- ☐ Field
- ☐ Motion
- ☐ Force

9) A current-carrying wire is placed in a uniform magnetic field (B). In which of the following figures the magnetic force exerted on the wire is the lowest?

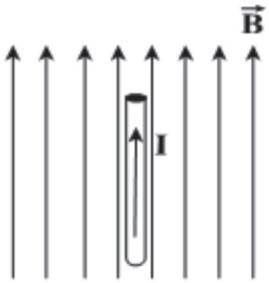
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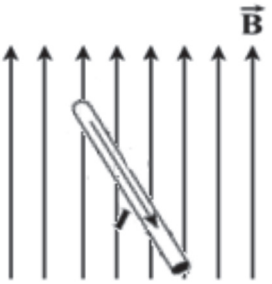
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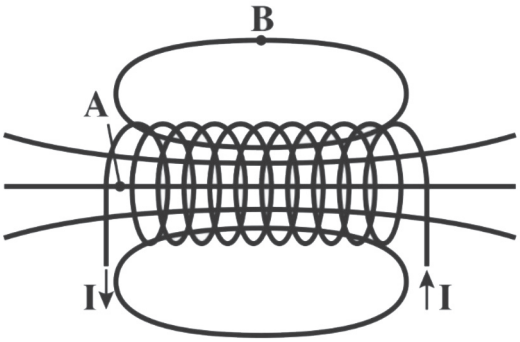


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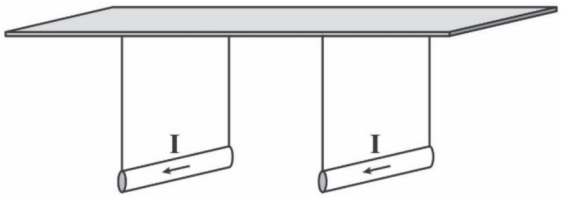
Question 1 continued

10) The figure opposite shows the pattern of the magnetic field due to a current - carrying solenoid. Which row in the table below **correctly** describes the direction of the magnetic field at points (A) and (B)?



	at point (A)	at point (B)
☐	←	←
☐	→	→
☐	←	→
☐	→	←

11) The figure below shows two straight wires suspended by free moving strings. If the two wires carry the same current, what will happen to the wires?



- ☐ They will remain in their places.
- ☐ They will move towards each other.
- ☐ They will move away from each other.
- ☐ They will swing together in the same direction.

12) A coil of area (0.01 m^2) and (500) turns is placed perpendicular to a magnetic field of flux density (2 T). What is the flux linkage?

- ☐ 0.02 Wb
- ☐ 2.50 Wb
- ☐ 5.00 Wb
- ☐ 10.00 Wb

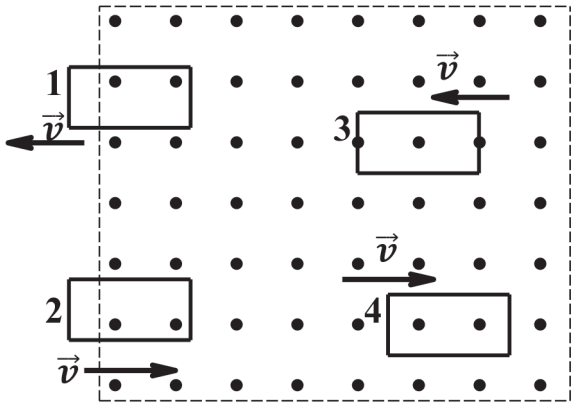
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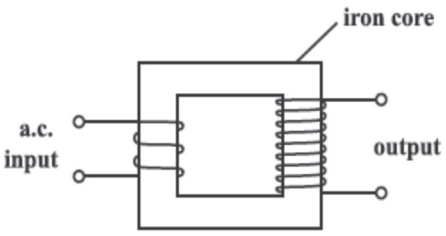
Question 1 continued

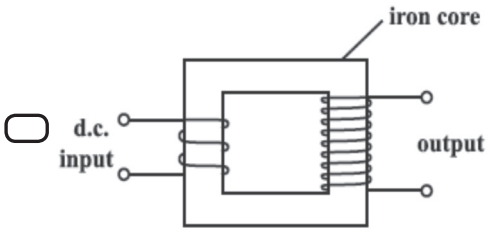
13) The figure below shows four identical rectangular loops moving in the region of a uniform magnetic field with constant velocity. In which loop is the direction of induced current moving **clockwise**?

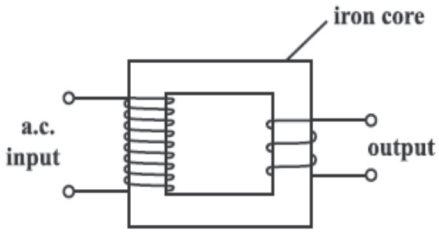
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

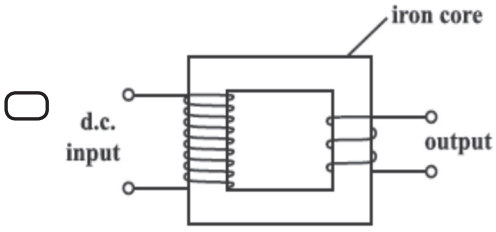


14) Which of the following transformers is the best to be used at an electric power station?

☐ 

☐ 

☐ 

☐ 

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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 four factors affecting the resistance of the conducting wire. (4 marks)

b. A copper wire has a cross-sectional area of (2×10^{-6} m^2) and a charge number density of (8.5×10^{28} m^{-3}). If (0.1 C) pass through the wire in (0.01 s), calculate the mean drift velocity of the electrons. (4 marks)

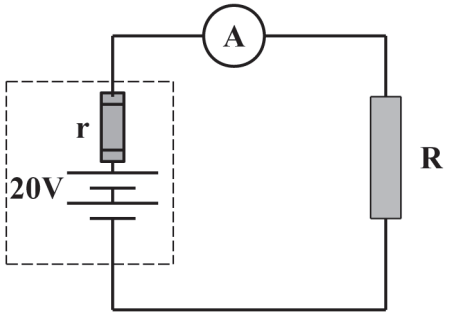
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Question 2 continued

16) The figure below shows an electric circuit with an ammeter reading (3.33 A).



When resistor (R) is replaced by (2 R) the ammeter reading is (1.82 A), find the following:

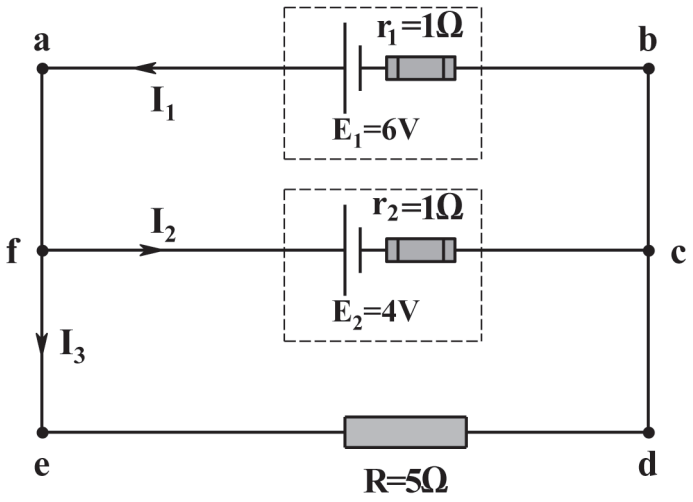
a. Value of (r). (3 marks)

b. Value of (R). (2 marks)

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Question 2 continued

17) The figure below shows an electric circuit.



Calculate the currents (I_1) and (I_2). (5 marks)

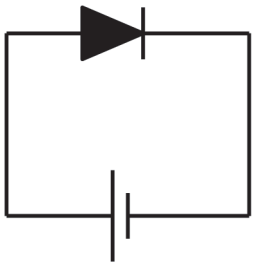
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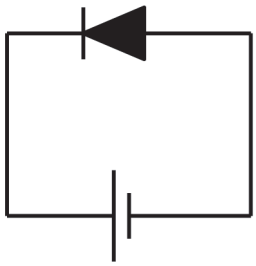
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Question 2 continued

18) a. The figure below shows two ways of connecting diodes in the electric circuits. Write the way of connection under each circuit: (2 marks)

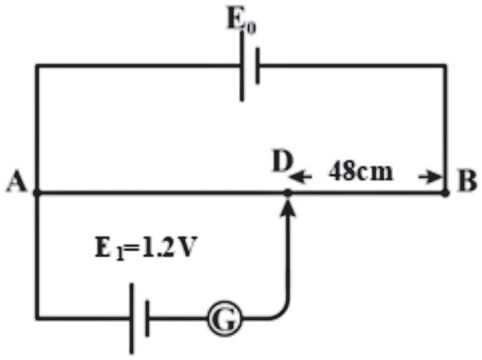


(i) _____



(ii) _____

b. The figure below shows a potentiometer circuit. The length of the resistance wire (AB) is (100 cm).

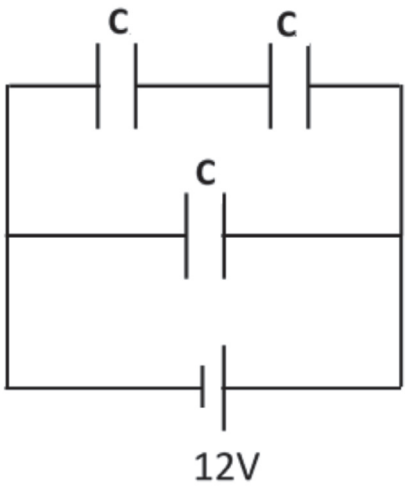


Calculate the (E_0). (3 marks)

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Question 2 continued

19) Three identical capacitors of capacitance (C) are connected as shown in the figure below.



a. Write one use of capacitors in electric circuits. (1 mark)

b. If the total capacitance of the above combination is ($9\ \mu F$), calculate (C). (3 marks)

c. If the power source is replaced by another one of potential difference (6 V), what will happen to the total capacitance of the above combination? (1 mark)

☐ Increase ☐ Decrease ☐ Stay the same

Choose the correct answer

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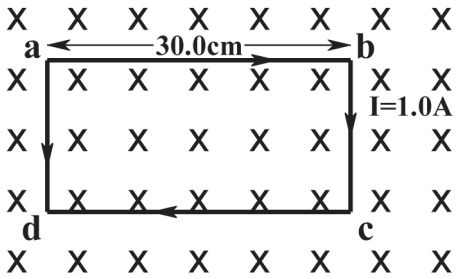
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Question 2 continued

20) a. An electron of mass (m_e) moves in a circular path of radius (r) in a uniform magnetic field (B). Show that the time taken (t) by the electron to make one complete revolution is given by: (3 marks)

$$t = \frac{2\pi m_e}{eB}$$

b. The figure below shows a rectangular loop of wire in a magnetic field.



The magnetic force on the side (ab) is (0.75N) and on the side (bc) is (0.5 N).

(i) Define the magnetic flux density (B). (1 mark)

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

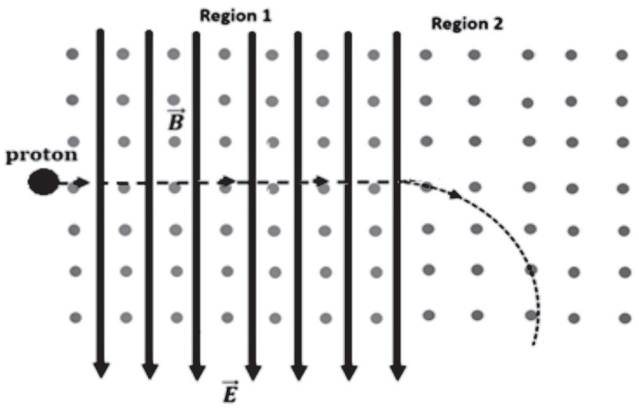
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Question 2 continued

(iii) What is the length of the side (bc)? (1 mark)

21) a. Write four factors that affect the magnitude of the magnetic force acting on a charge moving in a magnetic field. (4 marks)

b. A proton moves through two different regions (1) and (2) with a velocity of (1.52×10^5 m/s) as shown in the figure below.



(i) If the magnetic flux density in this region is (1.2 T). Calculate the magnitude of the electric field strength (E) in region (1). (2 marks)

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Question 2 continued

(ii) In region (2), calculate the radius of the circular path of the proton.

(2 marks)

22) a. Write four factors that affect the magnitude of the induced **e.m.f** in the coil of wire

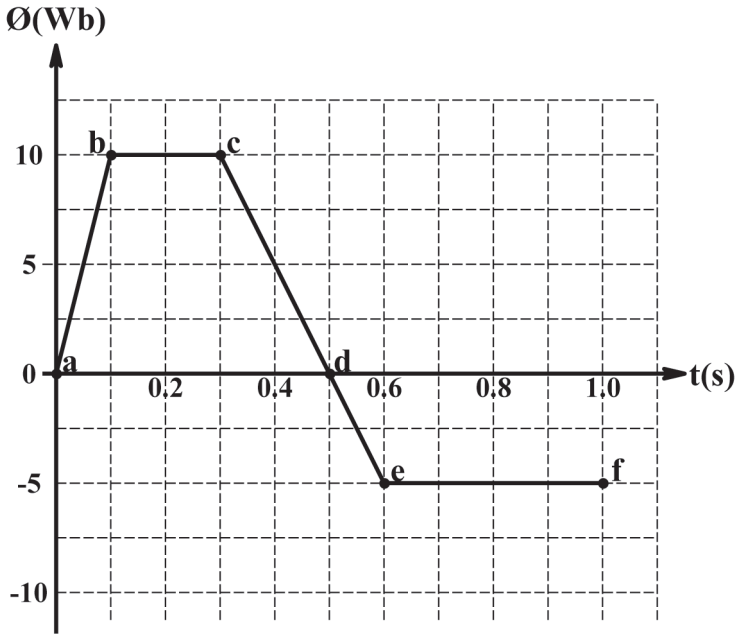
(4 marks)

b. A conducting loop has (100) turns and ($0.13\ m^2$) area is placed in a magnetic field with its plane perpendicular to the field lines. If the induced **e.m.f.** in the loop is ($100\ V$), calculate the rate of change in the magnetic flux density. (2 marks)

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Question 2 continued

23) The figure below shows a graph of magnetic flux (ø) against time (t) through a single conducting loop.



Calculate the induced **e.m.f.** during the time interval (**ce**).

(4 marks)

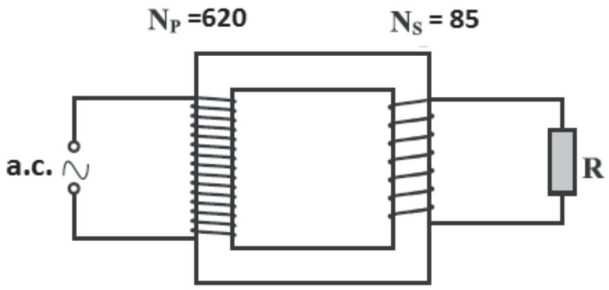
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Question 2 continued

24) The figure below shows an ideal transformer.



a. Why is the core of the transformer laminated? (1 mark)

b. Calculate the current ratio $\left(\frac{I_s}{I_p}\right)$. (2 marks)

[End of Examination]

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FORMULA AND CONSTANTS

Units	FORMULA			CONSTANTS
Electricity	$V = IR$	$Q = Ne$	$Q = It$	$e = 1.6\times10^{-19}C$ $m_p = 1.67\times10^{-27}kg$ $m_e = 9.11\times10^{-31}kg$ $g = 10ms^{-2}$
	$I = Anve$	$E = V_1 + V_2$	$I = I_1 + I_2$	
	$emf = E = IR + Ir$	$R = R_1 + R_2$	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$	
	$P = IV = RI^2 = \frac{V^2}{R} = \frac{W}{t}$		$V = \frac{W}{Q}$	
	$R = \rho\frac{l}{A}$	$V_{out} = \left(\frac{R_2}{R_1 + R_2}\right)V_{in}$		
	$\frac{E_X}{E_y} = \frac{AC}{AD} = \frac{l_X}{l_y}$			
Capacitance	$C = C_1 + C_2$	$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$	$C = \frac{Q}{V}$	
	$W = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{1}{2}\frac{Q^2}{C}$			
Magnetic fields and electromagnetism	$F = BIlsin\theta$		$F = QvBsin\theta$	
	$v = \frac{E}{B}$	$r = \frac{mv}{Be}$	$\frac{e}{m} = \frac{2V}{r^2B^2}$	
Electromagnetic induction	$\Phi = BAcos\theta = BAsin\theta$		$emf = E = \frac{N(\Delta\Phi)}{\Delta t}$	
Alternating current	$\frac{N_S}{N_P} = \frac{V_S}{V_P} = \frac{I_P}{I_S}$		$P = IV = RI^2$	

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