سلطنة عُمان
وزارة التربية والتعليم

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٣٩/١٤٤٠ هـ - ٢٠١٨ / ٢٠١٩ 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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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) A piece of pure semiconducting material and another of metal are stated to experience a rise in temperature. What will happen to their resistance?

	Semiconducting material	Metal material
⬭	Increase	Increase
⬭	Decrease	Decrease
⬭	Decrease	Increase
⬭	Increase	Decrease

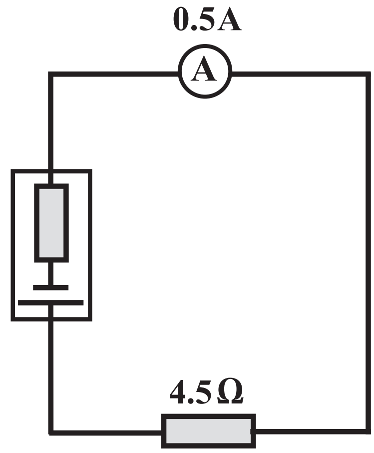
2) Which of the following is equivalent to the potential difference unit?

⬭ A/C ⬭ J/C
⬭ F/C.s ⬭ C/s

3) A headlight of (40 W) is connected with a battery of potential deference (12 V).
What is the value of the resistance of the headlight?

⬭ 2.5 Ω ⬭ 3.6 Ω
⬭ 4.5 Ω ⬭ 5.2 Ω

4) In the circuit opposite, when another resistance of (9 Ω) is added in series with the (4.5 Ω) resistance, the current will changes from (0.5 A) to (0.2 A).
What is the value of the internal resistance of the battery?

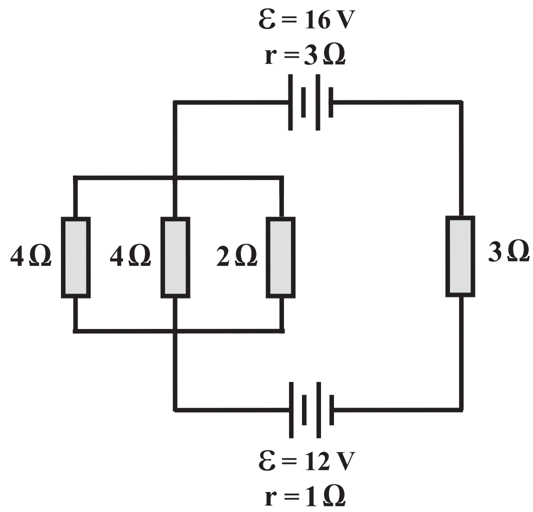


⬭ 1 Ω ⬭ 1.5 Ω
⬭ 2 Ω ⬭ 0.8 Ω

Question 1 continued

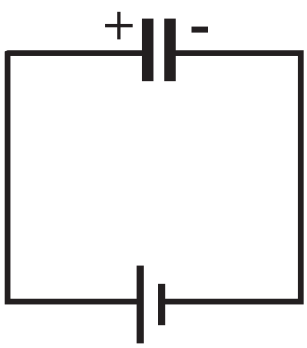
5) The diagram below shows different resistors connected with different batteries which have internal resistances. What is the value and direction of the electric current passing through the circuit?

	Value of the current in (A)	Direction of the current
⬭	0.5	Counter Clockwise
⬭	3.5	Counter Clockwise
⬭	0.5	Clockwise
⬭	3.5	Clockwise

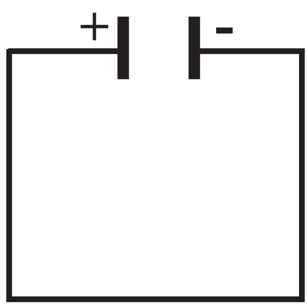


6) Parallel air filled plates capacitor is fully charged using a battery, as shown in figure (a), when the battery is removed from the electrical circuit and the distance between the plates of the capacitor is increased, as shown in figure (b).

What will happen to the charge stored on each plate?



(a)



(b)

⬭ Increases.

⬭ Decreases.

⬭ Becomes zero.

⬭ Does not change.

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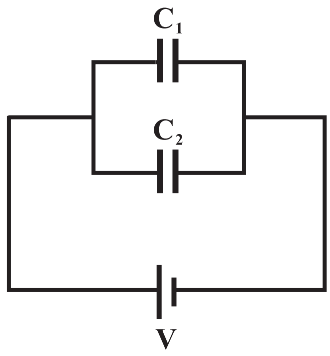
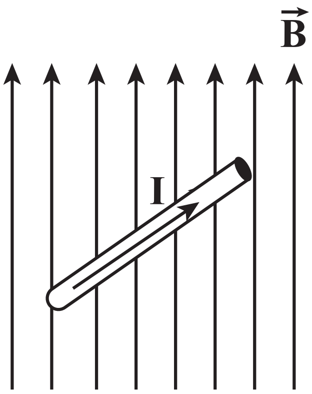
Question 1 continued

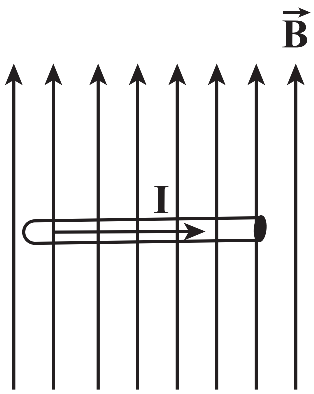
7) Two capacitors (C_1) and (C_2) are charged by using a battery as shown in the figure below. If (C_1) is charged by (Q) Colombes and (C_2) is charged by (Q/3) Colombes what will be the relation between (C_1) and (C_2)?

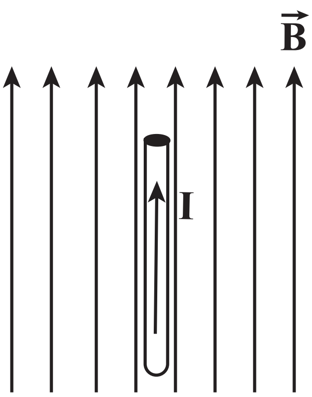


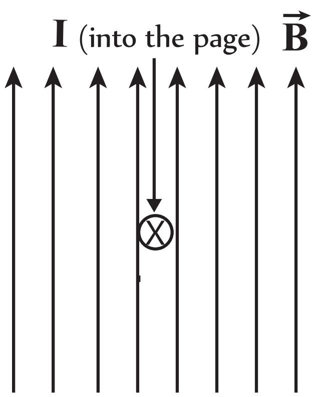
- ▢ $C_1 = 3C_2$
- ▢ $C_1 = C_2$
- ▢ $C_2 = 3C_1$
- ▢ $C_2 = 2C_1$

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

▢ 

▢ 

▢ 

▢ 

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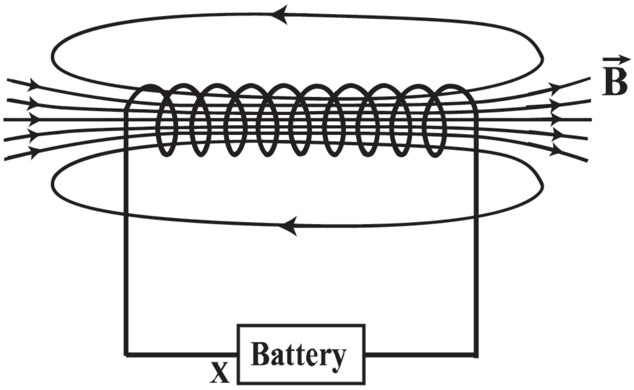
Question 1 continued

9) The opposite diagram shows a solenoid coil connected to a battery.

What is the direction of the current in the circuit, and what is the polarity of terminal (X) of the battery?

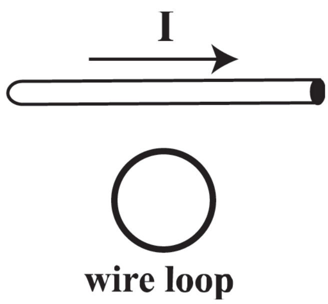


	Polarity of terminal (X)	Direction of the current
▢	Positive	Clockwise
▢	Positive	Counter clockwise
▢	Negative	Clockwise
▢	Negative	Counter clockwise

10) Two long parallel wires with same current (I) are placed in the air. The force acting per unit length on each wire is (F/L) when the distance between them is (d).
When the distance is reduced by (0.5 m), the force per unit length became 1.5 (F/L).
What is the value of (d)?

- ▢ 0.75 m
- ▢ 1 m
- ▢ 1.5 m
- ▢ 2 m

11) A long straight wire carries a current (I), and a small loop of wire rests in the plane of the page as shown in the figure opposite. Which of the following **will not** induce a current in the loop?



- ▢ Increasing the current in the straight wire.
- ▢ Moving the loop in the direction parallel to the wire.
- ▢ Moving the loop far away from the wire while rotating it.
- ▢ Rotating the loop so that it becomes perpendicular to the plane of the page.

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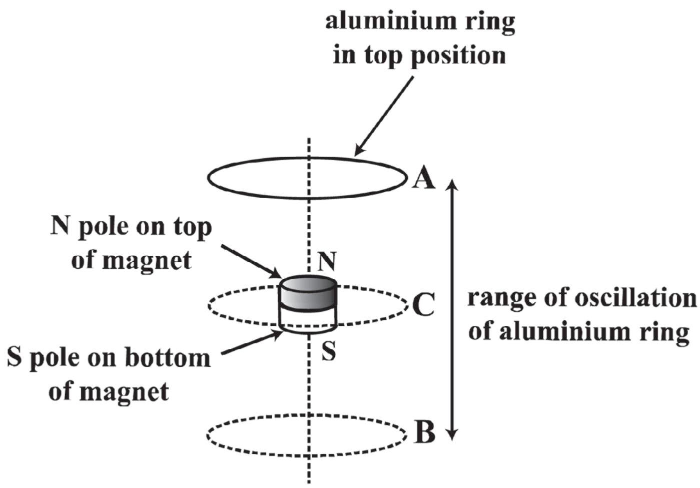
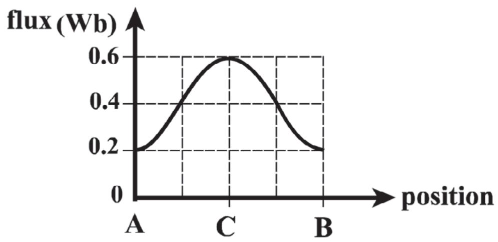
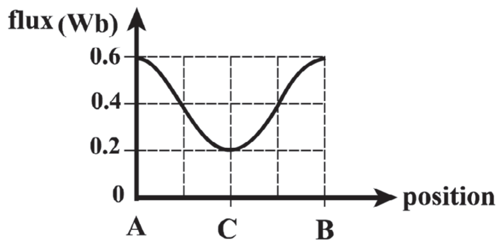
Question 1 continued

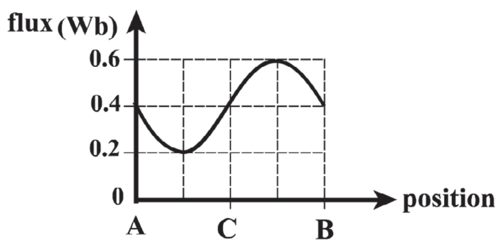
12) A Student conducts an experiment by oscillating aluminum ring vertically between two points (A) and (B). A strong, small magnet bar is fixed at a point at the midway between (A) and (B) as shown in the below figure.

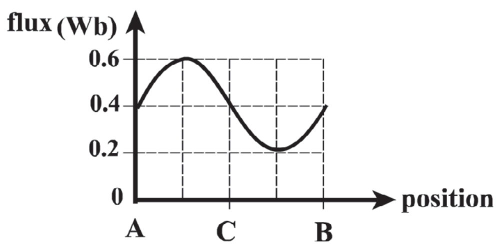


Which of the following graphs shows the magnetic flux through the ring at each position?

▢ 

▢ 

▢ 

▢ 

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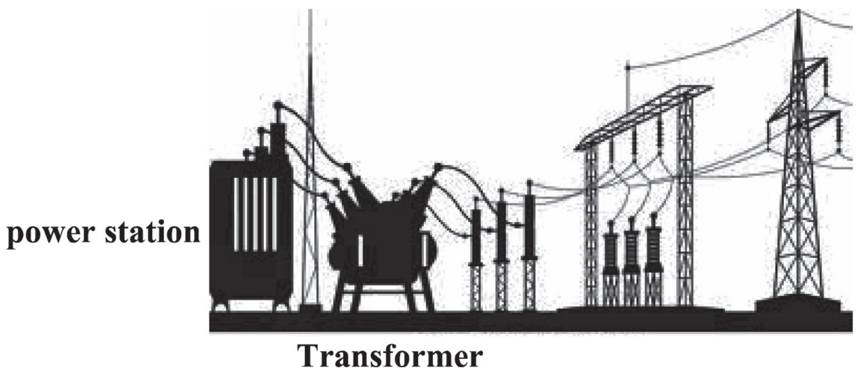
Question 1 continued

13) Which of the following statements describe the ideal transformer correctly?

- ▢ The power in both secondary and primary coils have the same value.
- ▢ The frequency in both secondary and primary coils have the same value.
- ▢ The induced (e.m.f) in both secondary and primary coils have the same value.
- ▢ The rate of change of magnetic flux in both secondary and primary coils have the same value.

14) The figure below shows a power station used to transmit electrical energy over long distances.



Which of these transformers is the best to be used?

	Number of turns on primary coil	Number of turns on secondary coil
▢	2000	200
▢	500	2000
▢	200	2000
▢	2000	500

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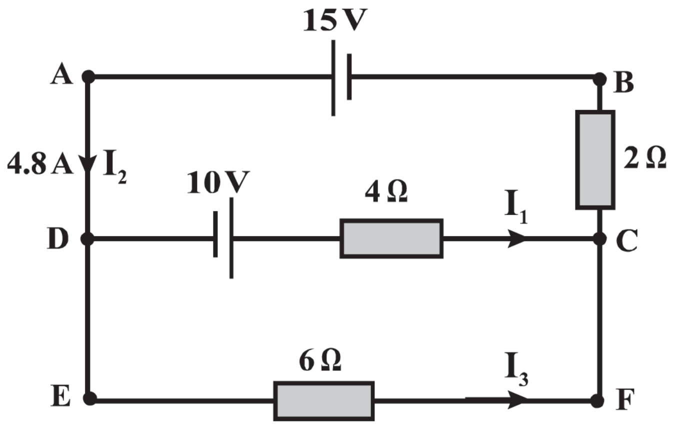
Question 2: EXTENDED QUESTIONS (56 marks)

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 electrical circuit.



a. Calculate the value of the currents (I_1) and (I_3)? (4 marks)

b. Find the potential difference between the points (B) and (C). (2 marks)

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Question 2 continued

c. Considering the transformation of energy, what is meant by "the potential difference across a bulb = 1 V"? (2 marks)

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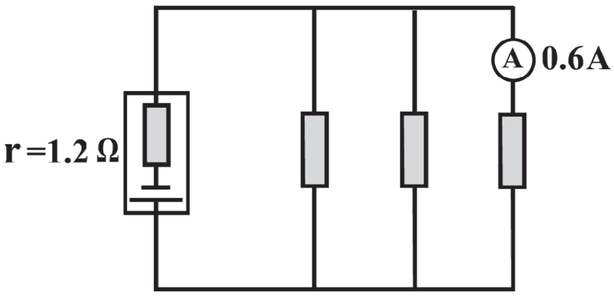
16) The figure below shows three equal resistances connected in parallel to (5.76 V) battery with internal resistance (r) and ammeter (A).



a. The terminal potential difference is always less than the electromotive force when the power supply delivers a current. State the reason. (1 mark)

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b. Calculate the resistance (R) of each resistor in the circuit. (4 marks)

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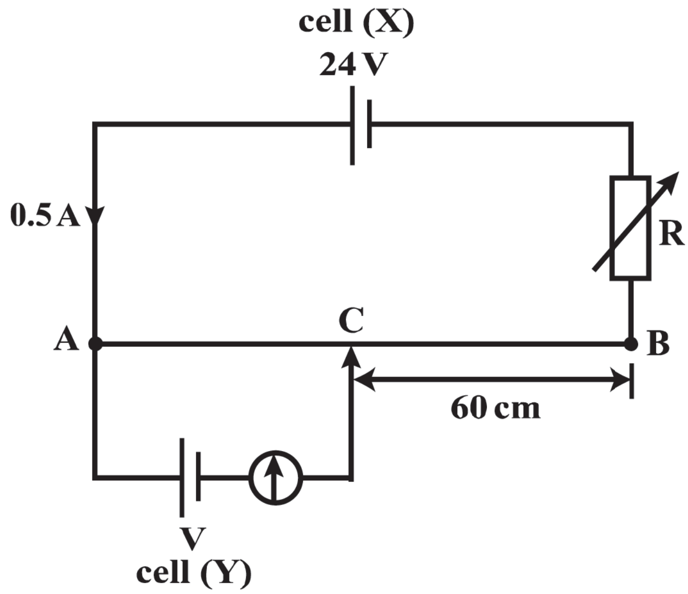
Question 2 continued

17) The diagram below shows a potentiometer wire of length (100 cm) and a resistance of (10 Ω), connected in series with a variable resistance (R). The emf of cell (X) is (24 V) whith a negligible internal resistance. Cell (Y) of emf (V) is balanced at point (C) of the potentiometer wire.



a. What is a potentiometer? (1 mark)

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b. Calculate the e.m.f of cell (Y) which has a negligible internal resistance. (4 marks)

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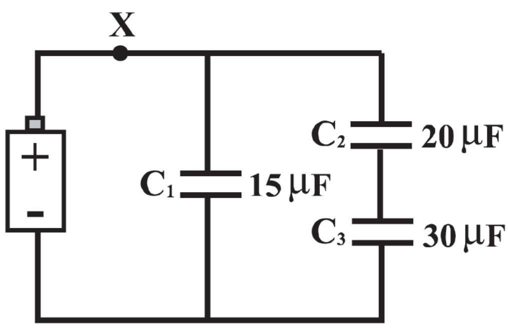
Question 2 continued

c. What would happen to the balance point (C), if the variable resistance (R) increases? (2 marks)

☐ Shifts to the right ☐ shifts to the left ☐ nothing change

Explain your answer.

18) The figure below shows three capacitors connected in an electric circuit. The charge (Q) in capacitor (C_1) is (7.5 µC).



a. Name two uses of capacitors in an electric circuit. (2 marks)

b. Find the potential difference across the battery. (2 marks)

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Question 2 continued

c. Calculate the quantity of the charge that pass through point (X) when all the capacitors are fully charged. (2 marks)

d. Find the potential difference across capacitor (C_2). (1 mark)

19) An electron was accelerated through a potential difference of (4000 V) to enter a region of uniform magnetic field (B) in perpendicular direction. The electron moved in a circular path of radius (7×10^{-4} m).

a. Explain why there is a low-pressure gas in the Fine-beam tube. (2 marks)

b. Calculate the flux density of the magnetic field. (3 marks)

Question 2 continued

20) Figure (a) below shows two parallel wires carrying the same current in the same direction, and figure (b) shows the relation between the force acting per unit length on each wire and the distance between them.

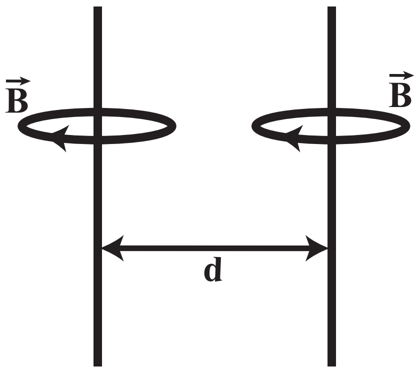

Figure (a)

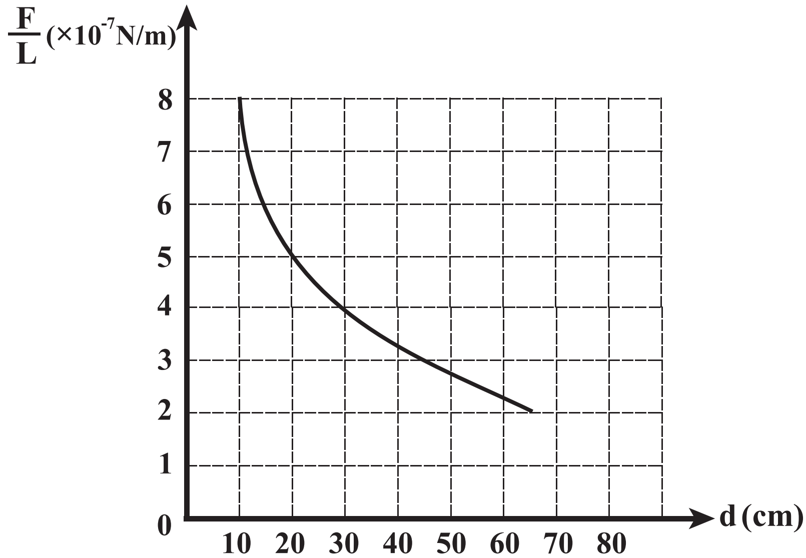

Figure (b)

a. Draw the direction of the current in each wire on figure (a) shown above. (2 marks)

b. Calculate the current (I) flowing in each wire, at d = 25 cm. (3 marks)

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c. Calculate the magnetic flux density (B) when the wires were separated by a distance of (25 cm). (3 marks)

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Question 2 continued

21) A coil wire of area $(0.4\ m^2)$ has (300) turns and a resistance of $(25\ \Omega)$ is placed in a magnetic field that varies with time as shown in figure (b) below. The variation of the magnetic field of the coil with time is shown in figure (a).

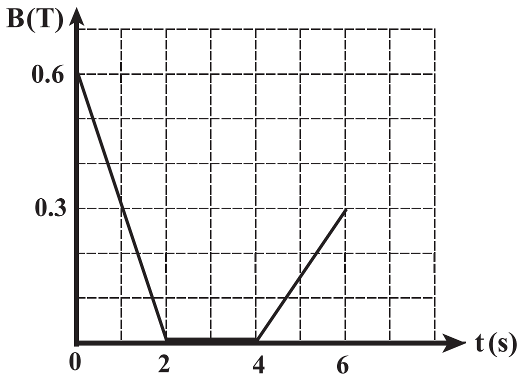

Figure (a)

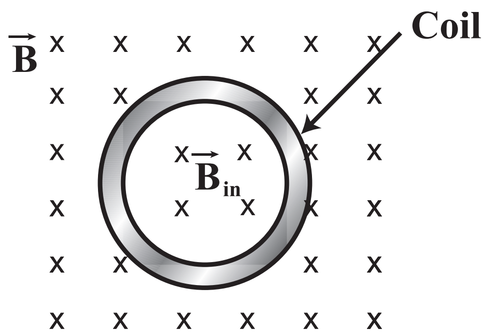

Figure (b)

a. State Faraday's law? (2 marks)

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b. Find the magnetic flux through the coil at $(t = 0\,s)$ (2 marks)

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c. In the first two seconds, the magnetic field is decreasing as shown in the graph in figure (b). Answer the following questions:

(i) What is the direction of the induced current (clockwise or counterclockwise) during this period? (1 mark)

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Question 2 continued

(ii) Find the e.m.f? (2 marks)

(iii) Find the magnitude of the current? (1 mark)

22) A transformer is connected to (120 V) AC line to supply a voltage of (12 V) to an electronic device. The load resistance in the secondary coil is (5 Ω).

a. Write three sources of energy loss in a transformer. (3 marks)

b. Calculate the current in the primary coil. (2 marks)

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Question 2 continued

c. Calculate the power delivered to the device. (2 marks)

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d. If you take this electronic device to another country where the electrical out-put is (240 V) instead of (120 V), what changes you have to make on the transformer to protect your device from damage? (1 mark)

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[End of Examination]

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FORMULA AND CONSTANTS

	Electricity			
CONSTANTS	$P = VI$	$V = IR$	$R = \frac{\rho L}{A}$	$Q = ne$
$e = 1.6 \times 10^{-19} C$	$P = I^2 R$	$V = \frac{W}{Q}$	$I = I_1 + I_2$	$Q = It$
	$P = \frac{W}{t}$	$V_{out} = \frac{V_{in} R_1}{R_1 + R_2}$	$\varepsilon = V_1 + V_2$	$I = Anvq$
	$P = \frac{V^2}{R}$		$emf = IR + Ir$	
	Capacitance			
CONSTANTS	$E = \frac{Q^2}{2C}$	$E = \frac{1}{2} QV$	$C = C_1 + C_2$	$C = \frac{Q}{V}$
$\varepsilon_o = 8.85 \times 10^{-12} Fm^{-1}$ For air: $\varepsilon_r = 1$		$E = \frac{1}{2} CV^2$	$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$	$C = \varepsilon_o \varepsilon_r \frac{A}{d}$
	Magnetic fields and electromagnetism			
CONSTANTS	$r = \frac{mv}{Bq}$	$F_E = qE$	$F = \frac{\mu_o I_1 I_2 l}{2\pi d}$	$F = qvB\sin\theta$
$\mu_o = 4\pi \times 10^{-7} T.m/A$ $e = 1.6 \times 10^{-19} C$ $m_e = 9.11 \times 10^{-31} kg$	$v = \frac{E}{B}$	$F_B = Bqv$	$\frac{e}{m_e} = \frac{2V}{B^2 r^2}$	$F = BIl\sin\theta$
	$B = \frac{\mu_o I}{2\pi d}$			
	Electromagnetic induction			
		$\Phi = BA\cos\theta$	$\Phi = BA\sin\theta$	$\varepsilon = \frac{-d(N\Phi)}{dt}$
	Alternating current			
		$P = I^2 R$	$P = IV$	$\frac{N_S}{N_P} = \frac{V_S}{V_P} = \frac{I_P}{I_S}$

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مُسَوَّدَة

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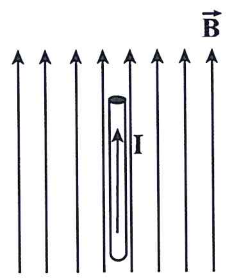
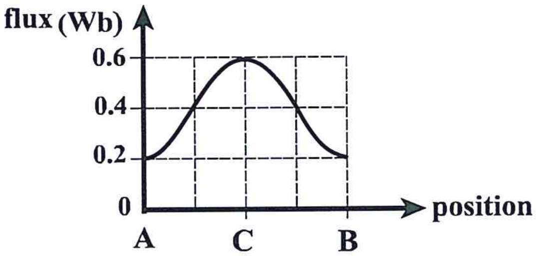
Physics 2018/2019 Bilingual Exam - 1st Semester, 2nd Session

Marking Guide

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(14 marks)

Item	Answer	Answer	Mark	C.L	OB
1	c	Decrease / Increase	1	K	1.2h
2	b	J/C	1	K	1.2c
3	b	3.6 Ω	1	A	1.2 k
4	b	1.5 Ω	1	A	1.4g 1.4h
5	a	0.5 / Counter Clockwise	1	R	1.3d
6	d	Does not change.	1	K	2.1e 2.1c
7	a	$C_1 = 3C_2$	1	A	2.1f 2.1g
8	c		1	K	3.4d
9	d	Negative / Counter Clockwise	1	A	3.2e
10	c	1.5 m	1	R	3.4f

ANSWERS TO MULTIPLE CHOICE QUESTIONS CONTINUED :(14 marks)

Item	Answer	Answer	Mark	C.L	OB
11	b	Moving the loop in the direction parallel to the wire.	1	K	4.1d
12	a		1	R	4.1b
13	a	The power in both secondary and primary coils have the same value.	1	K	5.1 (a,b)
14	c	200 2000	1	A	5.1 b

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB
15	a	▪ From Loop (ABCD):		A	1.4h
		$-15 + 2I_2 + 4I_1 - 10 = 0$	1		
		$-15 + 9.6 + 4I_1 - 10 = 0$			
		$-15.4 + 4I_1 = 0$			
		$I_1 = 3.85$ A	1		
		OR:			
		$15 + 10 - 4I_1 - 2I_2 = 0$ $25 - 9.6 - 4I_1 = 0$ $I_1 = 3.85$A			
		▪ From Loop (ADCB):			
		$I_2 = I_1 + I_3$			
		$4.8 = 3.85 + I_3$	1		
		$I_3 = 0.95$A	1		
	b	$V = IR$		A	1.2a
		$V = 4.8 \times 2$	1		
		$= 9.6$V	1		
	c	1J of electrical energy converted to heat and light for each coulomb of charge that pass through the bulb	2	K	1.2a

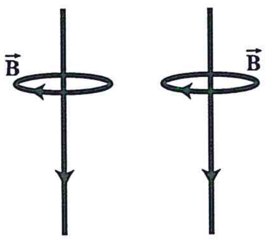
ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB
16	a	Because of the existence of the potential difference across the internal resistance	1	K	1.3c
	b	$I_t = 1_1 + 1_2 + 1_3$ $= 0.6 + 0.6 + 0.6 = 1.8A$ $E = I_t (r + R_t)$ $R_t = \frac{5.76}{1.8} - 1.2 = 2\Omega$ $\frac{1}{R_t} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} = \frac{3}{R}$ $\frac{1}{2} = \frac{3}{R}$ $R = 6\Omega$	 1 1 1 1	A	1.3d
17	a	Potentiometer is a variable resistor connected as potential divider to give a continuously variable output voltage.	1	K	1.5a
	b	$L_{AC} = 100 - 60 = 40\ cm$ $\frac{L_{AB}}{L_{AC}} = \frac{R_{AB}}{R_{AC}}$ $\frac{100}{40} = \frac{10}{R_{AC}}$ $R_{AC} = 4\Omega$ $\varepsilon = I.R_{AC} = 0.5 \times 4$ $= 2V$	1 1 1 1	A	1.5b

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB
17	c	- shift towards right. - Because when the variable resistance increases the current through the potentiometer will decrease hence potential difference across the (R_{AC}) will decrease too that causes the balance point (C) to shift to right in order to make the p .d across points (A) and (C) equal to (ε) of the battery or to obtain zero reading on the galvanometer	1 1	R	1.5 (a ,b)
18	a	- Store charge on an isolated sphere to achieve high potential. - store electrical energy and discharge it in short time as in flash gun. - To prevent arcing, rather than the charge creating a spark, the charge is stored in capacitor and discharge it gradually at a later time. **(Any two uses each is worth one mark)**	2	K	2.1j
	b	$V_B = V_{C_1} = \frac{Q_1}{C_1}$ $= \frac{7.5\ \mu}{15\ \mu}$ $= 0.5\ Volt$	 1 1	A	2.1g

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB
18	c	$Q_T = C_T V$ $= 27\ \mu F \times 0.5$ $= 13.5\ \mu C$	 1 1	A	2.1b
	d	$Q_2 = Q_T - Q_1$ $= 13.5\ \mu C - 7.5\mu C = 6\mu C$ $V_2 = \frac{Q_2}{C_2}$ $= \frac{6\mu}{20\mu} = 0.3\ V$	 1	A	2.1 (b,g)
19	a	Because it makes the path of electrons visible.	2	K	3.3g
	b	$\frac{e}{m_e} = \frac{2V}{B^2 r^2}$ $B = \sqrt{\frac{2\times400}{1.67\times10^{11}\times(7\times10^{-4})^2}}$ = 0.3T	 2 1	A	3.3f
20	a	 **(one mark for each correct arrow direction)**	2	K	3.4.e

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB
20	b	$\frac{F}{L} = \frac{\mu_o I_1 I_2}{2\pi d}$ $4.5 \times 10^{-7} = \frac{4\pi\times10^{-7}\times I^2}{2\pi\times0.25}$ $I^2 = 0.56$ $I = 0.75$ A	 1 1	A	2.1b
	c	$B = \frac{\mu_o I}{2\pi d}$ $= \frac{4\pi\times10^{-7}\times0.8}{2\pi\times0.25}$ $= 6.4 \times 10^{-7}$ T	 1 1	R	3.4d
21	a	" The e.m.f induced is proportional to the rate of change of magnetic flux linkage"	2	K	4.1f
	b	$\Phi = AB\cos\theta$ $= 0.4 \times 0.6\cos 0$ $= 0.24\ web$	 1 1	A	4.1b
	c-i	clockwise	1	K	4.1f
	c-ii	$\varepsilon = -N\frac{\Delta\Phi}{\Delta t} = -N \times A \times \frac{\Delta B}{\Delta t}$ $= -300 \times 0.4 \times \frac{0-0.6}{2}$ $= 36$ V	 1 1	A	4.1g

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	OB
21	c-iii	$I = \frac{\varepsilon}{R}$ $= \frac{36}{25}$ $= 1.44\ A$	1	R	4.1g
22	a	- loss of magnetic flux between primary and secondary coils. - resistive heating in primary and secondary coils. - heating of the core due to eddy currents. - heating of the core due to repeated magnetization and demagnetization. **(Any three of the above sources, each is worth one mark)**	3	K	5.1c
	b	$I_s = \frac{V_s}{R} = \frac{12}{5} = 2.4A$ $\frac{V_s}{V_p} = \frac{I_p}{I_s}$ $\frac{12}{120} = \frac{I_p}{2.4}$ $I_p = 0.24A$	1 1	A	5.1b
	c	$P = V_s I_s$ $= 12 \times 2.4$ $= 28.8\ Watt$	1 1	A	5.2b

ANSWERS TO EXTENDED QUESTIONS CONTENUED :(56 marks)

Item	Part	Answer	Mark	C.L	OB
	c	**Or:** $P = I^2R$ $P = (2.4)^2 \times 5$ [1] $= 28.8$ Watt [1]		A	5.2b
22	d	Either by increasing the number of turns of primary coil or decreasing the number of turns of secondary coil	1	R	4.1g

End Of Marking Guide