سلطنة عمان
وزارة التربية والتعليم

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)
للعام الدراسي ١٤٤٠/١٤٣٩ هـ - ٢٠١٨ / ٢٠١٩ 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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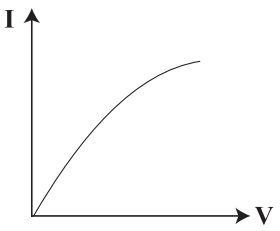
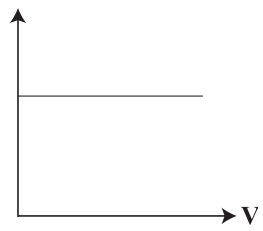
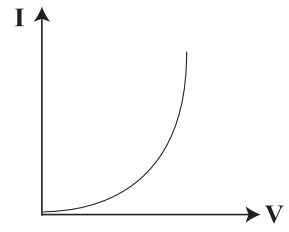
Question 1: Multiple Choice Items (14 marks)

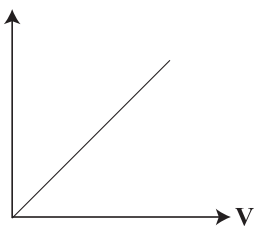
There are 14 multiple-choice items worth one mark each.
Shade in the bubble (○) next to the **best** answer for each item.

1) Which graph represents how the current varies with the potential difference for a diode in a forward bias circuit?

○ 

○ 

○ 

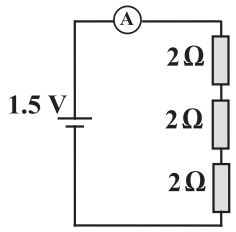
○ 

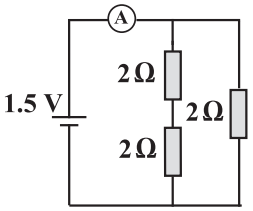
2) "The flow of electric charge carriers through a point in (1 s) in which there is a constant current of (1 A)" is defined as:

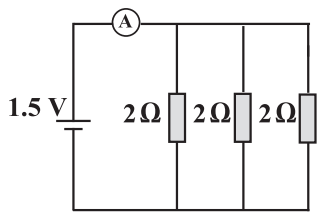
○ Watt ○ Ohm

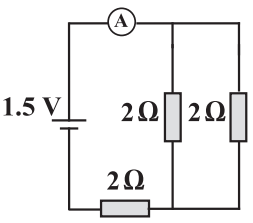
○ Volt ○ Coulomb

3) In which of the following circuits the ammeter reads (0.5 A)?

○ 

○ 

○ 

○ 

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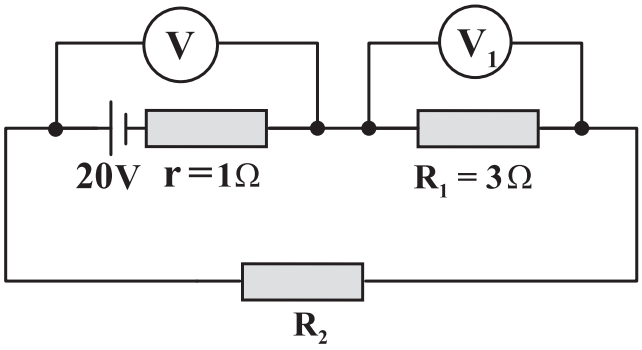
Question 1 continued

4) A current of (1.6 A) flows in a wire. How many electrons will pass a point in (3 s)?

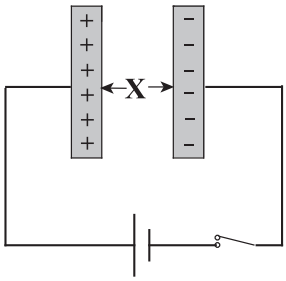
- ☐ 1.0×10^{19} *electrons*
- ☐ 3.0×10^{18} *electrons*
- ☐ 12.0×10^{18} *electrons*
- ☐ 3.0×10^{19} *electrons*

5) In the opposite circuit if (V_1 = 7.5V), what will be the value of the potential difference (V)?



- ☐ 12.5 V
- ☐ 15.5 V
- ☐ 17.5 V
- ☐ 21.5 V

6) A parallel plate capacitor which has distance (x) between the plates is connected to a battery with voltage (V). If the distance (x) is doubled, what will happen to the capacitance of the capacitor?

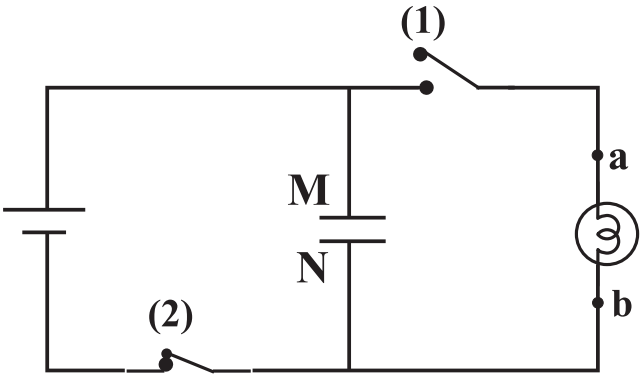


- ☐ Decrease.
- ☐ Increase.
- ☐ Increase then decrease.
- ☐ Decrease then increase.

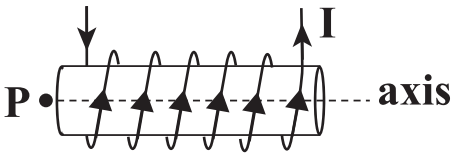
Question 1 continued

7) The circuit below is used to charge a capacitor. After the capacitor has been charged, switch (1) was **closed** and switch (2) was **opened**. What would be the type of charge on plate M and the direction of the current in the bulb?

	charge on plate M	direction of current across the bulb
☐	Positive	a to b
☐	negative	a to b
☐	Positive	b to a
☐	negative	b to a

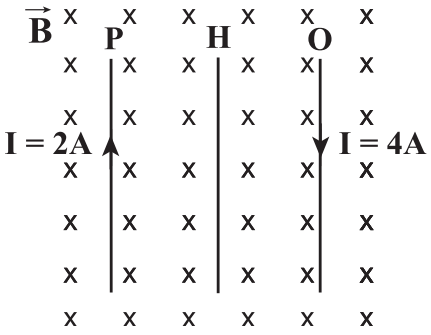


8) The figure opposite shows a long solenoid with current (I) passing through it. What is the direction of the magnetic field lines at point (P) along its axis?



- ☐ To the right.
- ☐ Upward.
- ☐ To the left.
- ☐ Downward.

9) Three wires (P) ,(H) ,(O) are placed in a magnetic field (B) as shown in the figure opposite. What is the direction of the resultant force on wire (H)?

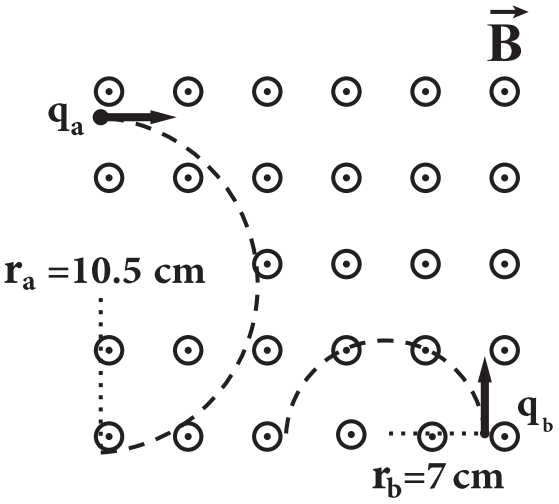


- ☐ To the right.
- ☐ Upward.
- ☐ To the left.
- ☐ Downward.

Question 1 continued

10) Two charged particles (a) and (b) with same masses enter a uniform magnetic field (B) with the same speed as shown in the figure below, which of the following is correct about charges (q_a) and (q_b) of the two particles?

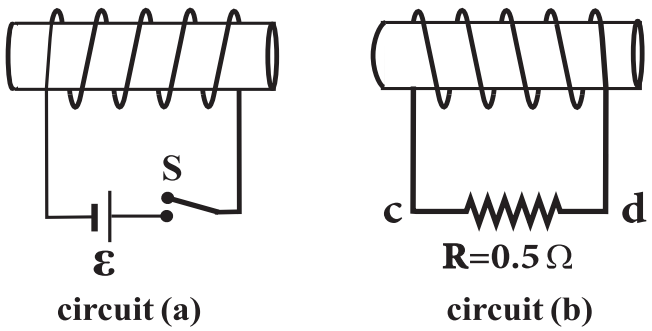
	$\lvert \frac{q_b}{q_a} \rvert$	q_a	q_b
☐	0.66	positive	negative
☐	1.5	negative	positive
☐	0.66	negative	positive
☐	1.5	positive	negative



11) What are the Eddy currents?

- ☐ Induced currents due to a high magnetic flux.
- ☐ Induced currents due to a high magnetic flux density.
- ☐ Induced currents in a metal by steady magnetic flux.
- ☐ Induced currents that vary in magnitude and direction.

12) The figure below shows two circuits (a) and (b). While switch (S) in circuit (a) is closed within (0.6 s), the magnetic field increased in circuit (b) to (0.4 T).



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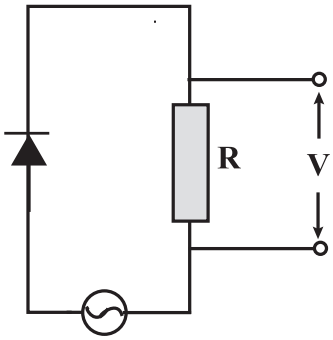
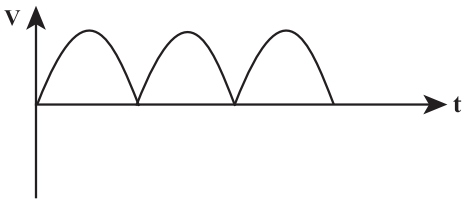
Question 1 continued

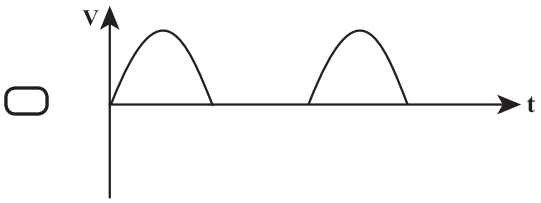
If the coil in circuit (b) has a cross section area of (0.30 m^2) and 5 turns, what will be the value of the current (I) across the resistance (R) and its direction?

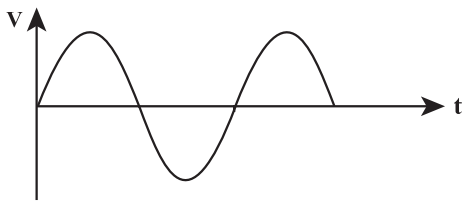
	I (A)	Direction of (I)
○	1.2	$c \longrightarrow d$
○	2	$c \longrightarrow d$
○	1.2	$d \longrightarrow c$
○	2	$d \longrightarrow c$

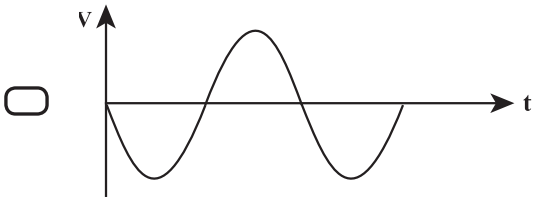
13) Which of the following graphs shows the output voltage (V) versus time (t) a cross the resistor (R) shown in the opposite figure?



○ 

○ 

○ 

○ 

Question 1 continued

14) A step-down transformer has a turn's ratio of $\left(\frac{1}{100}\right)$. A voltage of amplitude (170 V) is applied to the primary coil. If the current in the primary coil is (1 mA). What will be the current (I_s) and the voltage (V_s) in the secondary coil?

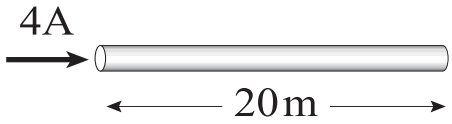
	I_s(mA)	V_s(Volt)
☐	100	0.017×10^2
☐	100	0.017×10^6
☐	0.01	0.017×10^2
☐	0.01	0.017×10^6

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.

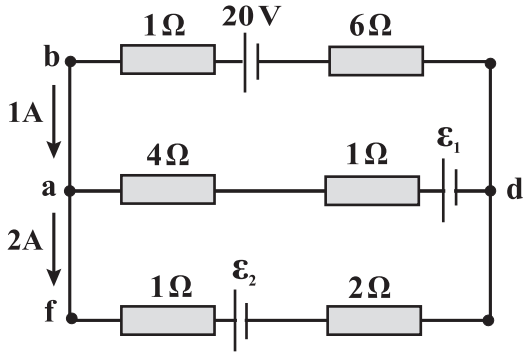
15) The figure below shows a (20 m) long wire with a radius of (1mm). When a current of (4 A) passes through it, the potential difference between its ends equal to (0.8 V).



a. State three factors that effect on the resistance of the wire? (3 marks)

b. Calculate the resistivity of the wire. (3 marks)

16) Study the circuit shown below, then answer the following question:

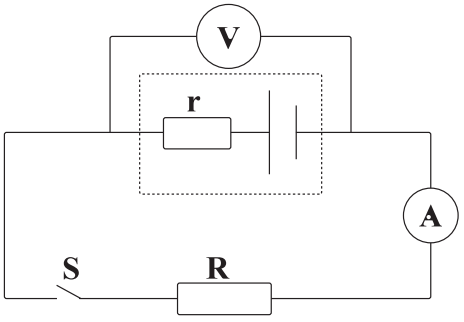


a. State Kirchhoff's second law. (1 mark)

Question 2 continued

b. Find the values of ($\mathcal{E}_1$) and ($\mathcal{E}_2$) (5 marks)

17) In the figure opposite when switch (S) is open the voltmeter reads (3.08 V) and when the switch is closed the voltmeter's reading drops to (2.97 V) and the ammeter reads (1.65 A)



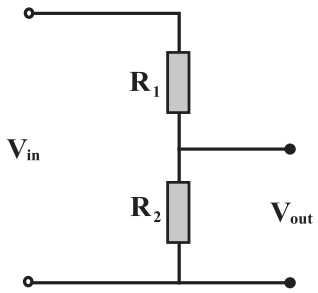
a. Define electromotive force. (2 marks)

Question 2 continued

b. Find the internal resistance of the battery. (2 marks)

18) The diagram opposite shows two resistors connected in an electric circuit.

If $R_1 = R_2$ show that: $V_{out} = \frac{V_{in}}{2}$ (4 marks)



Question 2 continued

19) Figure (a) below shows the graph of the charge (Q) versus the time (t) for the equivalent capacitance in the electric circuit shown in figure (b).

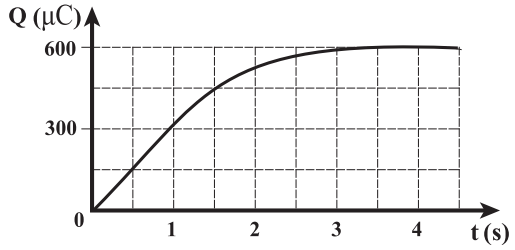


Figure (a)

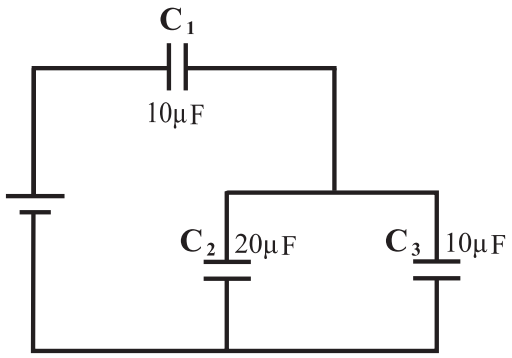


Figure (b)

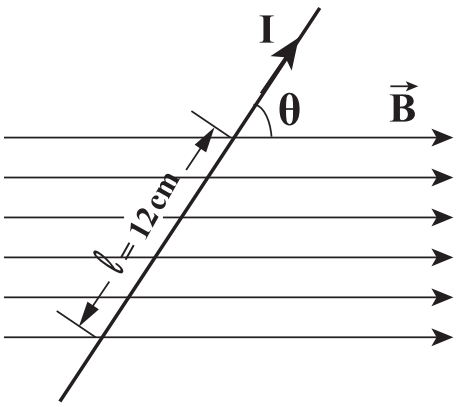
a. What is meant by capacitance? (2 marks)

b. Find the total capacitance between plates (X) and (Y). (2 marks)

c. Find the potential difference between points (x) and (y)? (1 mark)

d. Find the energy stored in the capacitor (C_3). (2 marks)

Question 2 continued



20) A (30 A) current currying wire is placed in a magnetic field (B) of (0.90 T) as shown in the figure opposite.

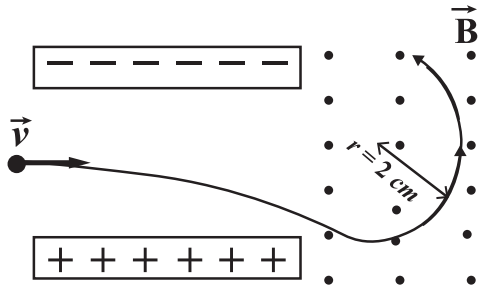
a. State two factors that affects the magnetic force on the current carrying wire. (2 marks)

b. If the exerted force on the wire is (2.8 N), find the angle between the direction of the current and the magnetic field (B)? (2 marks)

c. Show by drawing on the figure below, how should the wire be placed in the magnetic field in order to experience the minimum force? (2 marks)

Question 2 continued

21) A charged particle has a mass of (6.0×10^{-26} kg), enters an electric field between two parallel plates where the electric field strength is (3000 V/m), then it enters a uniform magnetic field of (1.8 T) as shown in the figure below.



a. What is the type of the charge of the particle. (1 mark)

b. If the electric force exerted on the particle between the plates is (250 N), find the charge of the particle. (2 marks)

c. Calculate the speed of the particle in the magnetic field (3 marks)

d. State the condition needed for a charge particle to move in a circular path in a magnetic field. (1 mark)

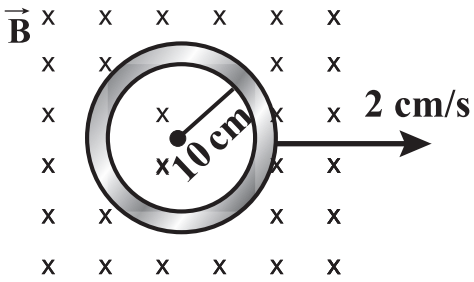
Question 2 continued

22) A square loop of wire has (1 turn) and (0.75 m) each side, placed in a uniform magnetic field of (0.32 T) with an angle of (30°).

a. What is meant by change in a magnetic flux linkage? (2 marks)

b. Calculate the change in the magnetic flux linkage if the angle between the loop and the magnetic field is increased by (40°). (4 marks)

23) A circular conducting loop is located inside a region of a uniform magnetic field of (1.25 T). Calculate the magnetic flux when half of the coil is inside the magnetic field. (2 marks)



Question 2 continued

24) A transformer is connected to (120V) AC line to supply voltage (12V) to an elctronic device. The load resistance for the device is (5 Ω).

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

b. Calculate the current in the primary coil. (3 marks)

c. Calculate the power delivered to the device. (1 mark)

d. If you take this electronic device to another country where the electrical output is (240V) instead of (120V), what changes you have to do to the transformer in order to protect your device from damage? (1 mark)

[End of Examination]

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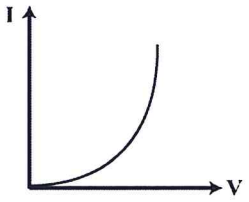
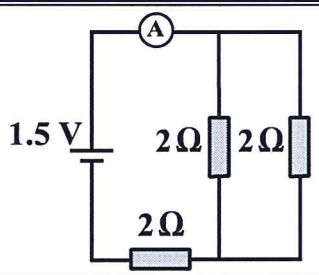
FORMULA AND CONSTANTS				
	Electricity			
CONSTANTS	$P = VI$	$V = IR$	$R = \frac{\rho L}{A}$	$Q = ne$
$e = 1.6 \times 10^{-19} C$	$P = I^2R$	$V = \frac{W}{Q}$	$I = I_1 + I_2$	$Q = It$
	$P = \frac{W}{t}$	$V_{out} = \frac{V_{in}R_1}{R_1+R_2}$	$\varepsilon = V_1 + V_2$	$I = Anvq$
	$P = \frac{V^2}{R}$		$emf = IR + Ir$	
	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: ε_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	$r = \frac{mv}{Bq}$	$F_E = qE$	$F = \frac{\mu_o I_1 I_2 l}{2\pi d}$	$F = qvBsin\theta$
$\mu_o = 4\pi \times 10^{-7} T.m/A$ $e = 1.6 \times 10^{-19} C$ $m_e = 9.11 \times 10^{-31} kg$	$v = \frac{E}{B}$	$F_B = Bqv$	$\frac{e}{m_e} = \frac{2V}{B^2r^2}$	$F = BIlsin\theta$
	Electromagnetic induction			
		$\Phi = BAcos\theta$	$\Phi = BAsin\theta$	$\varepsilon = \frac{-d(N\Phi)}{dt}$
	Alternating current			
		$P = I^2R$	$P = IV$	$\frac{N_S}{N_P} = \frac{V_S}{V_P} = \frac{I_P}{I_S}$

مُسَوَّدَة

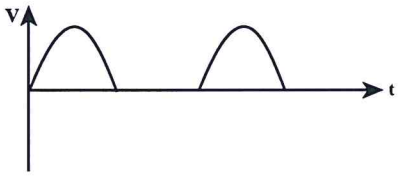
Physics 2018/2019 Bilingual Exam - 1st Semester, 1st Session

Marking Guide

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(14 marks)

Item	Answer	Answer	Mark	C.L	OB
1	c		1	K	1.2.f
2	d	Coulomb	1	K	1.1.a 1.1.c
3	d		1	A	1.4.f
4	d	3.0×10^{19} *electrons*	1	A	1.1.b
5	c	17.5 V	1	R	1.3.d
6	a	decreases	1	K	2.1.c 2.1.e
7	a	Positive | a to b	1	A	2.1.i
8	c	To the left	1	K	3.2 (a,c)
9	a	To the right	1	A	3.4 (a,b)
10	d	1.5 | positive | negative	1	R	3.3 (a,d)

ANSWERS TO MULTIPLE CHOICE QUESTIONS CONTENUED :(14 marks)

11	d	Induced currents that vary in magnitude and direction.	1	K	4.1.i
12	b	2 | $c \rightarrow d$	1	R	4.1.g
13	b		1	K	5.3.d
14	a	100 | 0.017×10^2	1	A	5.1.b

ANSWERS TO EXTENDED QUESTIONS : (56 marks)

Item	Part	Answer	Mark	OB
15	a	1- The length of the wire. 2- The cross-sectional area of the wire. 3- The type of the wires material.	3	1.2.j
	b	$R = \frac{V}{I}$ $= \frac{0.8}{4} = 0.2\ \Omega$ $R = \rho \frac{L}{\pi r^2} \rightarrow \rho = R \frac{\pi r^2}{L}$ $\rho = \frac{0.2 \times \pi \times \left(1 \times 10^{-3}\right)^2}{20}$ $= 3.14 \times 10^{-8}\ \Omega.m$	1 1 1	1.2.j
16	a	The sum of electromotive forces in a closed circuit is equal to the sum of the potential differences.	1	1.4.b
	b	At branch (a) supposing (I) flows from (d) to (a): $I + 1 = 2A$ $I = 2 - 1 = 1A$ Taking loop (adcba): $(4 \times 1) + (1 \times 1) - \varepsilon_1 - (6 \times 1) + 20 - (1 \times 1) = 0$ $4 + 1 - \varepsilon_1 - 6 + 20 - 1 = 0$ $\varepsilon_1 = 18V$ Taking loop (bfecb): $(2 \times 1) - \varepsilon_2 + (2 \times 2) - (6 \times 1) + 20 - (1 \times 1) = 0$ $2 - \varepsilon_2 + 4 - 6 + 20 - 1 = 0$ $\varepsilon_2 = 19V$	1 1 1 1 1	1.4.h

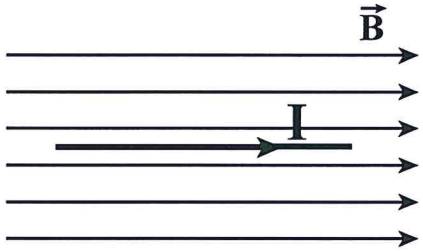
ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	OB
17	a	The electrical energy gained by each coulomb of charge that passes through the power supply. **or** emf = energy converted from other forms to electrical/charge	2	1.3.a
	b	$Ir = \varepsilon - IR$ $r = \frac{\varepsilon - IR}{I}$ $= \frac{3.08 - 2.97}{1.65}$ $= 0.067\Omega$	 1 1	1.3.c 1.3.d
18		$R_1 = R_2 = R$ $V_{out} = \frac{V_{in} R_1}{R_1 + R_2}$ $V_{out} = \frac{V_{in} R}{2R}$ $\therefore V_{out} = \frac{V_{in}}{2}$	1 1 1 1	1.5.a

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	OB
19	a	The charge stored on one plate per unit potential difference between the plates. **Or:** The ratio of charge to potential for a conductor.	2	2.1.a
	b	$C'_{(2,3)} = C_2 + C_3$ $\therefore C'_{(2,3)} = 20\mu + 10\mu$ $= 30\mu F$	 1 1	2.1.f 2.1.g
	c	$V_{(2,3)} = \frac{Q}{C'_{(2,3)}}$ $= \frac{600\ \mu C}{30\mu F} = 20V$	 1	2.1.c
	d	$E = \frac{1}{2} \times C_3 V^2$ $= \frac{1}{2} \times 10 \times 10^{-6} \times 20^2$ $= 2 \times 10^{-3} J$	 1 1	2.1.h

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	OB
20	a	1- The length of the wire. 2- The magnetic field strength. 3- The direction between the wire and the magnetic field. (Any two factors from the above)	2	3.4.a 3.4.c
	b	$\sin\theta = \frac{F}{BIL}$ $\sin\theta = \frac{2.8}{0.9 \times 30 \times 0.12}$ $\theta = 59.79°$	 1 1	3.4.b
	c		2	3.4.b
21	a	negative charge.	1	3.3.a
	b	$q = \frac{F}{E}$ $= \frac{250}{3000}$ $= 8.3 \times 10^{-2}\ C$	 1 1	3.3.b

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	OB
21	c	$r = \frac{mv}{qB} \rightarrow v = \frac{rqB}{m}$ $\therefore v = \frac{2\times 10^{-2} \times 8.3 \times 10^{-2} \times 1.8}{6.0 \times 10^{-26}}$ $= \frac{2.99\times10^{-3}}{6.0 \times 10^{-26}} = 4.98 \times 10^{22}\ m/s$	2 1	3.3.d
	d	When the velocity is perpendicular with the magnetic field.	1	3.3.c
22	a	The product of the change in magnetic flux ($\Delta\phi$) and the number of turns (N) of a conductor involved in the change in the flux.	2	4.1.c
	b	$\varphi_1 = ABsin\theta$ $= 0.75 \times 0.75 \times 0.32\ sin30$ $= 0.09$Wb $\varphi_2 = ABsin\theta$ $= 0.75 \times 0.75 \times 0.32\ sin70$ $= 0.17$Wb Change in the magnetic flux linkage $=N\Delta\varphi$ $= 1\times (0.17- 0.09)$ $= 0.08$ W	1 1 1 1	4.1.b

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	OB
23	a	$\varphi = ABsin\theta$ $= 0.5 \times (\pi \times 0.1^2) \times 1.25 \sin 90$ $= 0.0196\ Wb$	 1 1	4.1b
24	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 is correct**	3	4.1.c
	b	$I_s = \frac{V_s}{R}$ $= \frac{12}{5} = 2.4A$ $\frac{V_s}{V_p} = \frac{I_p}{I_s} \rightarrow \frac{12}{120} = \frac{I_p}{2.4}$ $I_p = 0.24A$	 1 1 1	4.1.b
	c	$P = V_s I_s$ $= 12 \times 2.4 = 28.8\ Watt$	 1	
	d	Either by increasing the number of turns of primary coil **or** decreasing the number of turns of secondary coil.	1	

End Of Marking Guide