سلطنة عمان
وزارة التربية والتعليم

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)
للعام الدراسي ١٤٣٨/١٤٣٧ هـ - ٢٠١٦ / ٢٠١٧ م
الدور الأول - الفصل الدراسي الأول

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

تعليمات وضوابط التقدم للامتحـان:

- الحضور إلى اللجنة قبل عشر دقائق من بدء الامتحان للأهمية.
- إبراز البطاقة الشخصية لمراقب اللجنـة.
- يمنع كتابة رقم الجلوس أو الاسم أو أي بيانات أخرى تدل على شخصية الممتحن في دفتر الامتحان، وإلا ألغي امتحانه.
- يحظر على الممتحنين أن يصطحبوا معهم بمركز الامتحان كتبا دراسية أو كراسات أو مذكرات أو هواتف محمولة أو أجهزة النداء الآلي أو أي شيء له علاقة بالامتحان كما لا يجوز إدخال آلات حادة أو أسلحة من أي نوع كانت أو حقائب يدوية أو آلات حاسبة ذات صفة تخزينية.
- يجب أن يتقيد المتقدمون بالزي الرسمي (الدشداشة البيضاء والمصر أو الكمة للطلاب والدارسين والزي المدرسي للطالبات واللباس العماني للدارسات) ويمنع النقاب داخل المركز ولجان الامتحان.
- لا يسمح للمتقدم المتأخر عن موعد بداية الامتحان بالدخول إلا إذا كان التأخير بعذر قاهر يقبله رئيس المركز وفي حدود عشر دقائق فقط.
- يتم الالتزام بالإجراءات الواردة في دليل الطالب لأداء امتحان دبلوم التعليم العام.
- 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 - عاصمـة سلطنة عمـــان 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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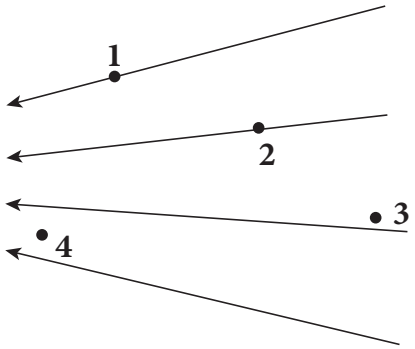
Question 1: Multiple Choice Items (28 marks)

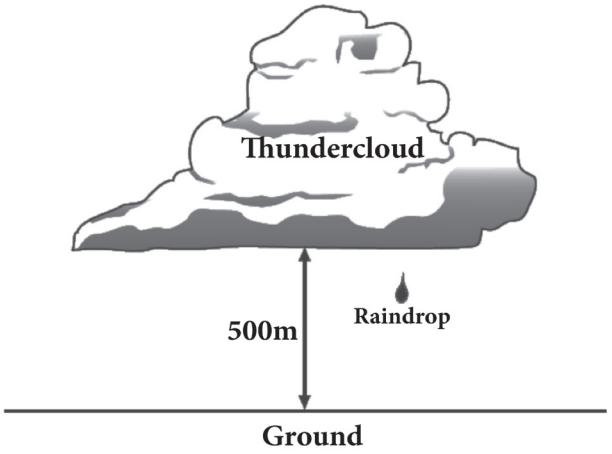
There are 14 multiple-choice items worth two marks each.
Shade in the bubble (⬭) next to the **correct** answer for each of the following items.

1) Which point has the lowest electric field strength in the electric field of a unit charge shown below?



⬭ 1
⬭ 2
⬭ 3
⬭ 4

2) The figure opposite shows a thunder cloud which is (500 m) above the ground. The potential difference between the base of the cloud and the ground is (200×10^6 V). A raindrop with a charge of (4×10^{-12} C) is in the region between the cloud and the ground. What is the electrical force on the rain drop?



⬭ 1×10^{-17} N
⬭ 1.6×10^{-6} N
⬭ 5×10^{19} N
⬭ 2.5×10^{22} N

3) The electron and proton of a hydrogen atom are separated by a distance of approximately (5.3×10^{-11}m). What is the magnitude of the electric force between these two particles?

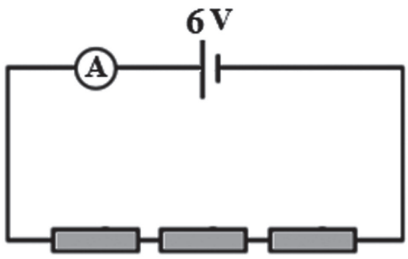
⬭ 4.3×10^{-18} N
⬭ 8.2×10^{-8} N
⬭ 0.27×10^{2} N
⬭ 5.1×10^{11} N

Question 1 continued

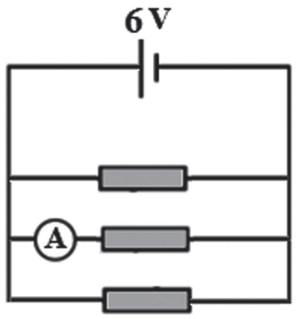
4) A capacitor of capacitance (C) stores charge (Q) at a potential difference (V). If the applied voltage is doubled, what will be the capacitance?

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

5) The figure below shows two circuits (1) and (2) each of them has three identical resistors.



Circuit (1)



Circuit (2)

Which circuit has the higher combined resistance and the lower ammeter reading?

	Circuit with higher combined resistance	Circuit with lower ammeter reading
☐	(1)	(2)
☐	(1)	(1)
☐	(2)	(1)
☐	(2)	(2)

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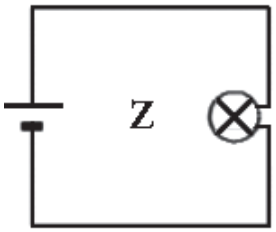
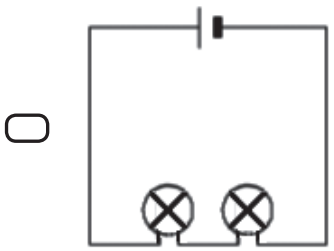
Do not write in this space

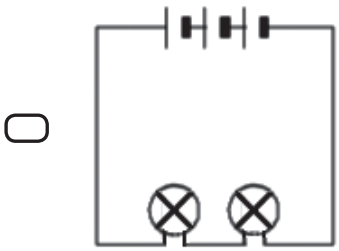
Question 1 continued

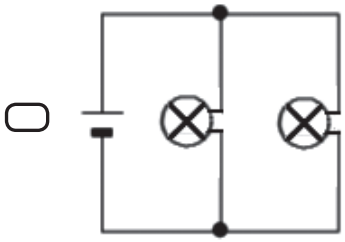
6) A bulb is connected in a circuit (Z) as shown in the figure below.

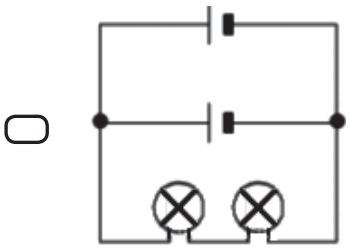


If all the light bulbs shown in the circuits below are identical to the bulb in circuit (Z) and the p.d across each battery is identical as well, in which of the circuits do the bulbs glow with the same brightness as in circuit (Z)?

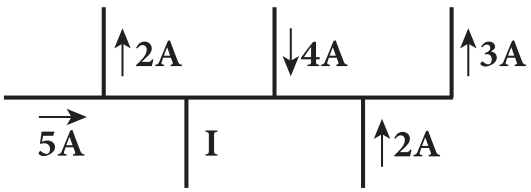








7) A part of a circuit is shown opposite with the values and directions of the currents for some branches. What is the value and direction of current (I)?



	Value of current (I)	Direction of current (I)
☐	6A	↓
☐	6A	↑
☐	4A	↓
☐	4A	↑

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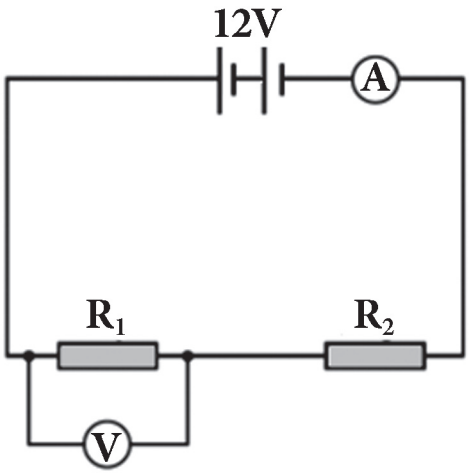
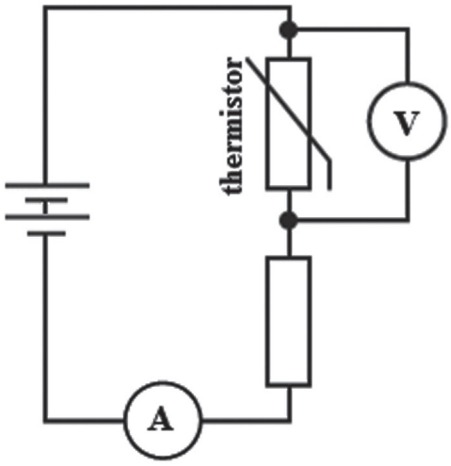
Question 1 continued

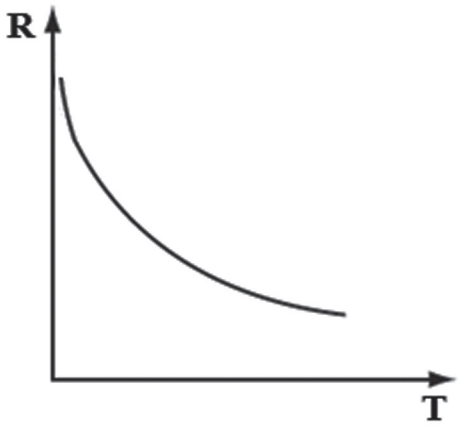
8) A circuit is set up as shown in the figure opposite. The reading of the ammeter is (3.0 A), and the reading of the voltmeter across (R_1) is (4 V). What are the values of both current (I) and the voltage (V) across resistor (R_2)?



	I (A)	V (V)
☐	1.5	8
☐	3.0	4
☐	3.0	8
☐	1.5	4

9) The circuit below shows a thermistor in a potential divider. The graph shows how the resistance (R) of the thermistor changes with temperature (T).



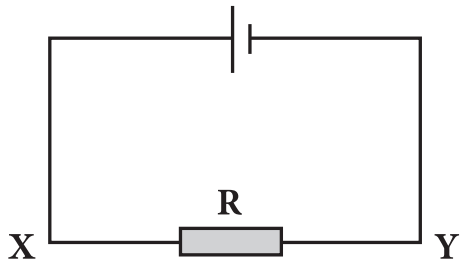


As the thermistor becomes warmer, what happens to the reading of the ammeter and the voltmeter?

	Reading of the ammeter	Reading of the voltmeter
☐	Decreases	Increases
☐	Decreases	Decreases
☐	Increases	Increases
☐	Increases	Decreases

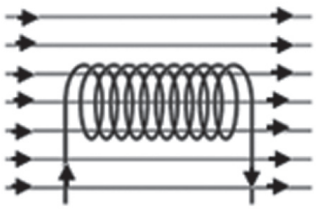
Question 1 continued

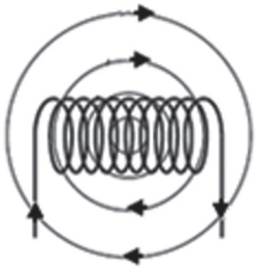
10) The current in the circuit opposite is (6.4 A). What is the number of electron flow per second and its direction through the resistor (R)?

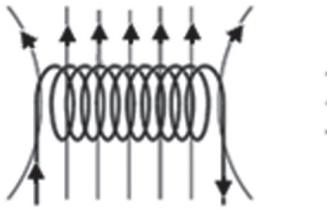


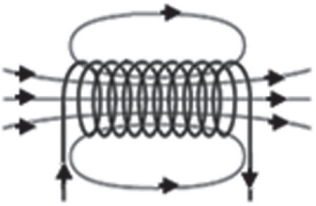
	Number of electron flow /second	direction of electron flow
☐	4×10^{19}	From X to Y
☐	8×10^{19}	From X to Y
☐	4×10^{19}	From Y to X
☐	8×10^{19}	From Y to X

11) Which figure shows the pattern of the magnetic field produced by a current-carrying solenoid?

☐ 

☐ 

☐ 

☐ 

12) Two long parallel wires are carrying the same current and repelling each other with a force (F) per unit length. If both currents are doubled and the wire separation is tripled, what will be the force per unit length?

☐ $\frac{3F}{4}$

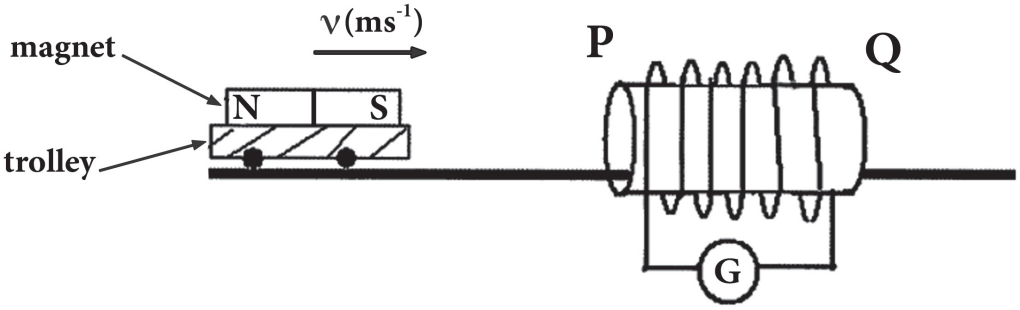
☐ $\frac{4F}{9}$

☐ $\frac{2F}{3}$

☐ $\frac{4F}{3}$

Question 1 continued

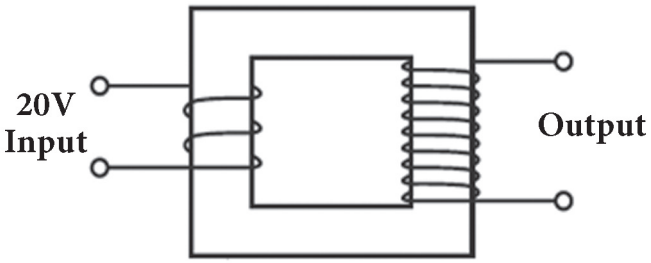
13) A magnetic bar on a light trolley is moving towards a coil (PQ) as shown in the figure below.



Which of the following statements is true?

	Polarity of pole (P) as trolley approaches the coil	Polarity of pole (Q) as trolley leaves the coil
☐	south pole	south pole
☐	north pole	south pole
☐	north pole	north pole
☐	south pole	north pole

14) The figure opposite shows a transformer that has an efficiency of (100%). If it produces an output power of (100 W), what will be the amount of current in the primary coil?



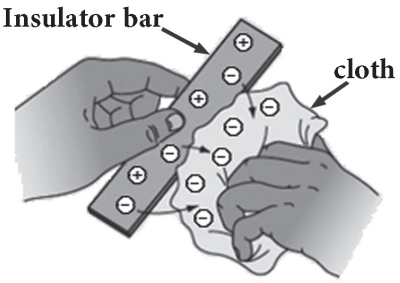
☐ 0.2 A ☐ 5 A

☐ 50 A ☐ 2000 A

Question 2: Extended Questions (42 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) An insulator bar is rubbed with cloth and charges are transferred as shown in the figure opposite.



a. What is the material of the bar? (1 mark)

(Choose the correct answer)

- ☐ Polythene
- ☐ Perspex

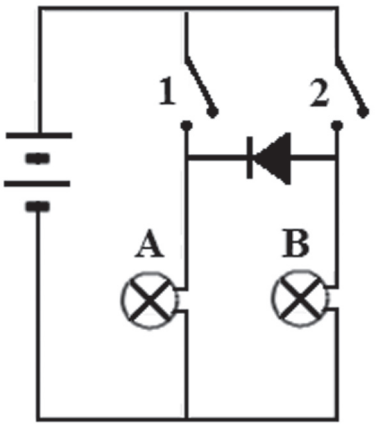
b. Explain why we cannot charge a metal bar using the same method shown in the figure above? (1 mark)

_____

_____

_____

16) Two bulbs (A) and (B), each is labeled with (75 W), and connected as shown in the circuit below.



a. What is meant by that a bulb has a power of (75 W)? (2 marks)

_____

_____

_____

Question 2 continued

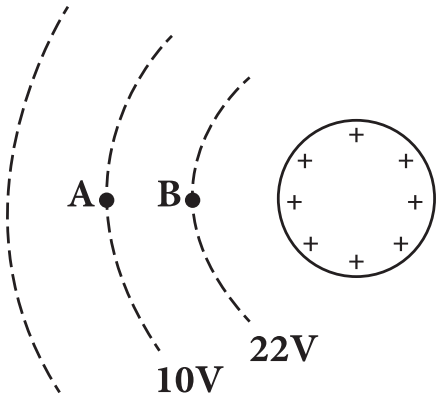
b. Which bulbs in the circuit above will be glowing in the following cases?

(i) Switch (1) is closed and switch (2) is opened. (1 mark)

(ii) Switch (2) is closed and switch (1) is opened. (1 mark)

17) The figure below shows two values of electrical potential at points (A) and (B) within the electric field of a positively charged sphere.

a. Define the electric field strength. (1 mark)

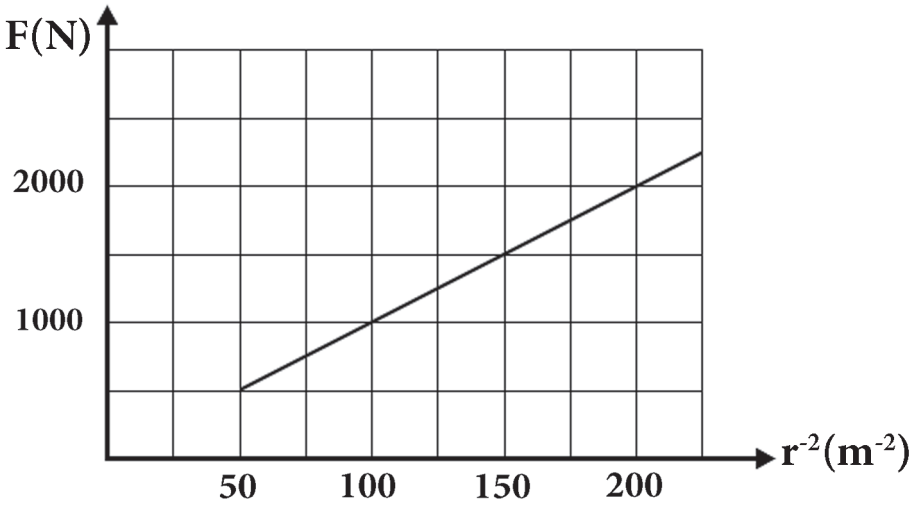


b. Find the magnitude of the charge (Q) that requires (3.0×10^{-2} J) of work to move it from (A) to (B)? (2 marks)

c. On the figure above, draw a point (O) where the charge (Q) gains kinetic energy greater than (3.0×10^{-2} J) when it moves from point (O) to point (A). (1 mark)

Question 2 continued

18) Two point charges (Q_1) and (Q_2) are separated by distance (r).The charge (Q_1) is three times the charge (Q_2).The below graph represents the relation between the electric force (F) and the inverse squared distance between them (r^{-2}).

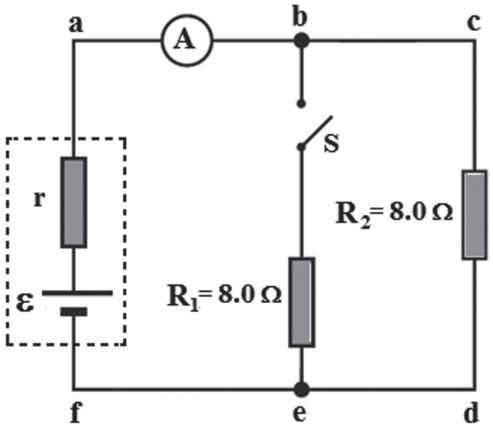


a. Find the charge of the smaller point charge. (2 marks)

b. Calculate the electric field strength of the greater point charge at a distance (0.08 m) from its center. (2 marks)

Question 2 continued

19) In the circuit below when switch (S) is opened the reading of the ammeter is (0.25 A), and when switch (S) is closed the reading of the ammeter is (0.45 A).



a. Define the elecromotive force (emf) of a source. (2 marks)

b. Using Kirchhoff's laws prove that the current passing through resistor (R_1) and (R_2) are equal when switch (S) is closed. (2 marks)

c. Find the emf when switch (S) is closed. (3 marks)

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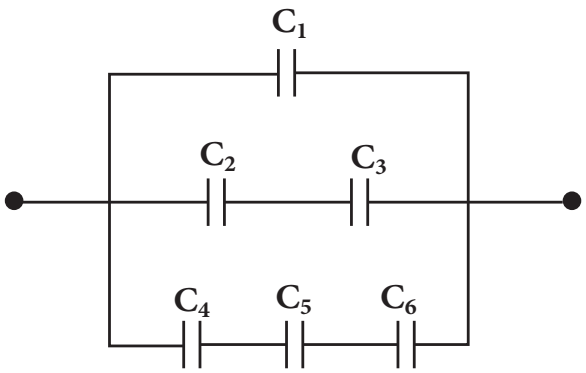
Question 2 continued

20) The configuration in the figure below shows identical capacitors, each has capacitance (C).

a. Define capacitance. (2 marks)

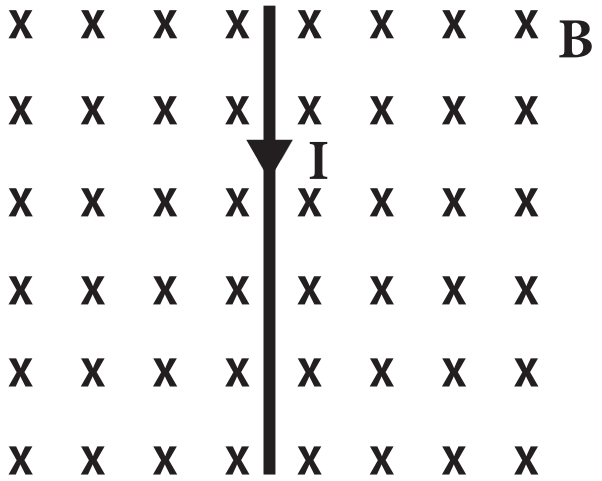


b. Calculate the combined capacitance. (3 marks)

c. Which capacitor stores the largest energy? Explain. (2 marks)

Question 2 continued

21) The figure below shows a current carrying wire of (4.7 cm) length in a magnetic field (B).

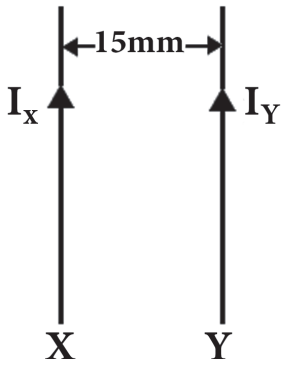


a. In the figure above draw the direction of the magnetic force acting on the wire. (1 mark)

b. If the magnetic flux density is (2.6×10^{-3} T) and the current in the wire is (5.4 A), calculate the maximum magnetic force that will act on the wire. (2 marks)

Question 2 continued

22) Two parallel long wires (X) and (Y) carry currents of (5 A) and (2 A) respectively as shown in the opposite figure.

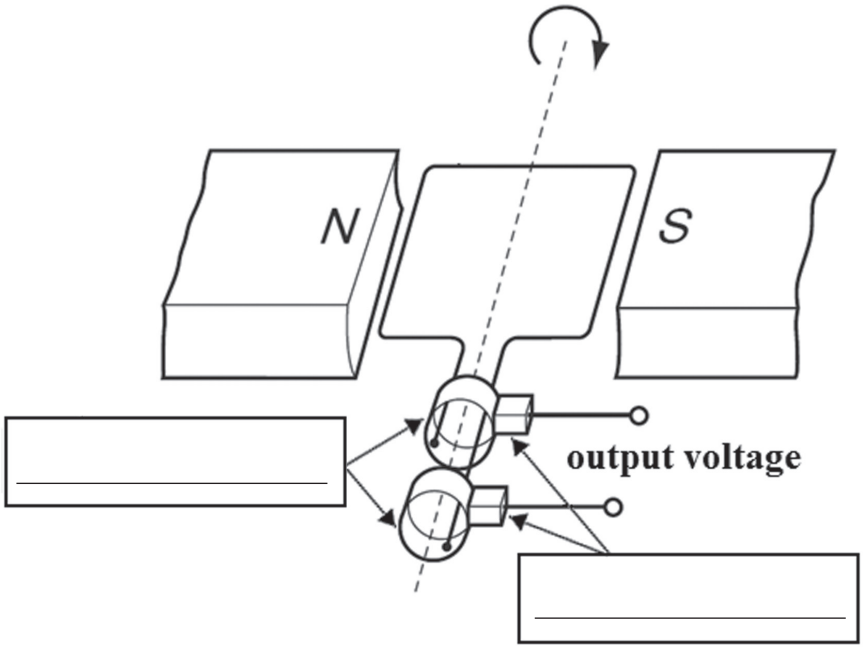


a. Calculate the force per unit length acting on wire (Y). (2 marks)

b. If a third wire (Z) with current (3 A) directed upwards is placed (5 mm) to the right of wire (X). Find the resultant force per unit length (F/l) acting on wire (Z) due to the current in wires (X) and (Y). (2 marks)

Question 2 continued

23) The figure below shows a simple a.c. generator. The coil of the generator has (1 turn) and is (25 cm) wide and (30 cm) long. It is located in a magnetic field of (1.4 T).

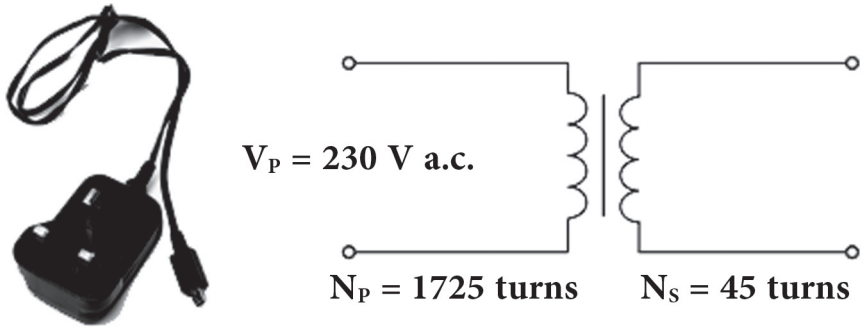


a. On the above figure write in each of the boxes the name of the parts. (1 mark)

b. State two ways which could be done to increase the rate of change of flux linkage of the generator coil. (2 marks)

Question 2 continued

24) A mobile phone charger contains a transformer. Part of the circuit is shown below.



a. Calculate the voltage across the secondary coil. (2 marks)

b. When the charger is connected to a mobile phone the output current is (0.80 A). Calculate the current in the primary coil. (2 marks)

[End of Examination]

List of Formulae

$$F = K\frac{Q_1 Q_2}{r^2}$$

$$E = K\frac{Q}{r^2}$$

$$E = \frac{V}{d} = \frac{F}{Q}$$

$$v \text{ or } \varepsilon = \frac{W}{Q}$$

$$KE = \frac{1}{2}mv^2$$

$$\frac{1}{2}mv^2 = eV$$

$$W = q\Delta V$$

$$\mathrm{F = mg}$$

Magnetic forces and fields

$$F = BIL\sin\theta$$

$$\frac{F}{L} = \frac{\mu_o I_1 I_2}{2\pi r}$$

$$F = Bqv$$

Constants

$$e = 1.6\times10^{-19}C$$

$$K = 9\times10^{9}N.m^2/C^2$$

$$\mu_\circ = 4\pi\times10^{-7}T.m/A$$

$$m_{proton} = 1.673\times10^{-27}kg$$

$$I = nAev$$

$$Q = It$$

$$Q = ne$$

$$V = IR$$

$$R = \rho\frac{L}{A}$$

$$P = VI = I^2R = \frac{V^2}{R}$$

$$W = VIt$$

$$W = \frac{1}{2}QV = \frac{1}{2}CV^2$$

$$\Sigma\varepsilon = \Sigma IR$$

$$V = \varepsilon - Ir$$

$$R = R_1 + R_2$$

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$C = C_1 + C_2$$

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$C = \frac{Q}{V}$$

$$V_{out} = V_{in}\frac{R_1}{R_1 + R_2}$$

Electromagnetic induction

$$\Phi = AB$$

$$\varepsilon = -N\frac{\Delta\varphi}{\Delta t}$$

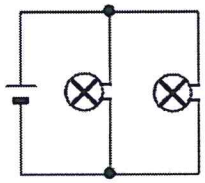
$$\frac{Vs}{Vp} = \frac{Ns}{Np} = \frac{Ip}{Is}$$

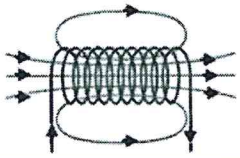
مُسَوَّدَة

Physics 2016/2017 Bilingual Exam - 1st Semester, 1st Session

Marking Guide

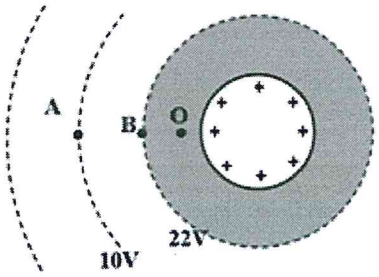
ANSWERS TO MULTIPLE CHOICE QUESTIONS:(28 marks)

Item	Answer	Answer	Mark	OB	C.L
1	c	3	2	1.7	K
2	b	1.6×10^{-6} N	2	1.6 1.8	A
3	b	8.2×10^{-8} N	2	1.4	A
4	b	C	2	2.24	K
5	b	(1) | (1)	2	2.18	K
6	c		2	2.8 2.18	A
7	a	6A | ↓	2	2.15	R
8	c	3.0 | 8	2	2.18	A
9	d	Increases | Decreases	2	2.9 2.19	R

Item	Answer	Answer	Mark	OB	C.L
10	c	4×10^{19} | From Y to X	2	2.1 2.3	A
11	d		2	3.3	K
12	d	4F/3	2	3.10	A
13	a	south pole | south pole	2	4.4	R
14	b	5A	2	4.8	A

ANSWER OF EXTENDED RESPONSES: (42 marks)

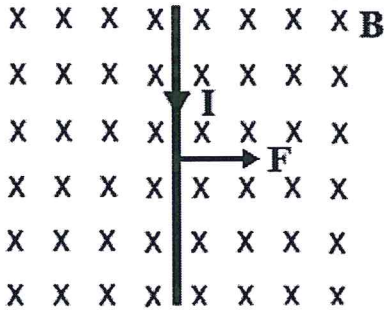
Item	Part	Answer	Mark	OB	C.L
15	a	Perspex	1	1.1	K
	b	Because each charge transferred to the metal rod will flow along the rod then through the hand/body to earth. **OR** Hand/body and earth are poor insulators (or good conductors) of electricity.	1	1.2 1.3	K
16	a	The bulb transfers (75 J) of energy in each second.	2	2.13	K
	b-i	A	1	2.9	A
	b-ii	A , B	1	2.9	A
17	a	Force per unit positive charge acting on a stationary point charge.	1	1.6	K
	b	$V = 22 - 10 = 12V$ $Q = \frac{w}{V} = \frac{3.0 \times 10^{-2}}{12}$ $= 2.5 \times 10^{-3} C$	$\frac{1}{2}$ 1 $\frac{1}{2}$	1.13	A

Item	Part	Answer	Mark	OB	C.L
17	c	 **NOTE:** Point (O) could be anywhere in the shaded area.	1	1.14	R
18	a	$slope = \frac{\Delta F}{\Delta r^{-2}} = \frac{(2000-1000)}{(200-100)} = 10\ N.m^2$ $slope = kQ_1Q_2$ $10 = (9 \times 10^9) \times 3Q_2 \times Q_2$ $Q_2 = 1.9 \times 10^{-5} C$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	1.4	R
	b	$Q_1 = 3Q_2$ $E = \frac{kQ_1}{r^2}$ $E = \frac{(9\times10^9)\times3\times(1.9\times10^{-5})}{(0.08)^2}$ $= 80.2 \times 10^6\ V.m^{-1}$	$\frac{1}{2}$ 1 $\frac{1}{2}$	1.9	A

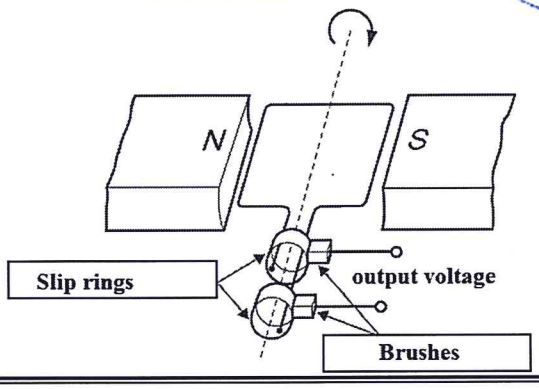
Item	Part	Answer	Mark	OB	C.L
19	a	The electrical potential energy transferred from other forms per coulomb of charge that passes through the source.	2	2.14	K
	b	Taking the loop (bedcb): $-I_1R_1 + I_2R_2 = 0$ $-8I_1 + 8I_2 = 0$ $8I_2 = 8I_1$ $\therefore I_2 = I_1$ **Note:** Students can take other loops to prove that give $I_2 = I_1$	1 $\frac{1}{2}$ $\frac{1}{2}$	2.16 2.17	A

Item	Part	Answer	Mark	OB	C.L
19	c	When the switch is open: Take the loop (abcdefa) $\varepsilon - Ir - IR_2 = 0$ $\varepsilon - 0.25r - 0.25 \times 8 = 0$ $\varepsilon - 0.25r - 2 = 0$ (1) When the switch is closed: $I = I_1 + I_2$ $I_1 = I_2$ $I_1 = \frac{I}{2} = \frac{0.45}{2} = 0.225A$ Take the loop (abefa) $\varepsilon - Ir - I_1R_1 = 0$ $\varepsilon - 0.45r - 0.225 \times 8 = 0$ $\varepsilon - 0.45r - 1.8 = 0$ (2) Subtract (2) from (1) $0.2r - 0.2 = 0$ $r = 1\Omega$ Put r in (1) $\varepsilon - 0.25 \times 1 - 2 = 0$ $\varepsilon = 2.25V$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2.15 2.16 2.18	R

Item	Part	Answer	Mark	OB	C.L
20	a	The ability of a capacitor to store charge on plates.	2	2.23	K
	b	$\frac{1}{C_7}=\frac{1}{C_2}+\frac{1}{C_3}=\frac{1}{C}+\frac{1}{C}=\frac{2}{C}$ $C_7=\frac{C}{2}$ $\frac{1}{C_8}=\frac{1}{C_4}+\frac{1}{C_5}+\frac{1}{C_6}=\frac{1}{C}+\frac{1}{C}+\frac{1}{C}=\frac{3}{C}$ $C_8=\frac{C}{3}$ $C_{eq}=C_1+C_7+C_8=C+\frac{C}{2}+\frac{C}{3}=\frac{6C+3C+2C}{6}$ $C_{eq}=\frac{11}{6}C$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2.27	A
	c	Capacitor (1) Because it has the highest p.d (voltage difference) **OR** the energy (w) is directly proportional with p.d as shown in the formula $(W=\frac{1}{2}CV^2)$	1 1	2.26 2.27	A

Item	Part	Answer	Mark	OB	C.L
21	a		1	3.6	K
	b	$F = BIlsin\theta$ $= (2.6 \times 10^{-3}) \times 5.4 \times (4.7 \times 10^{-2})sin90$ $= 6.6 \times 10^{-4}$ N	 1 1	3.7	A
722	a	$\frac{F}{l} = \frac{\mu_o I_X I_Y}{2\pi r}$ $\frac{F}{l} = \frac{(4\pi \times 10^{-7}) \times (5 \times 2)}{2\pi(0.015)}$ $\frac{F}{l} = 1.33 \times 10^{-4}\ N.m^{-1}$	 1 1	3.10	A

Item	Part	Answer	Mark	OB	C.L
22	b	$\frac{F_{ZX}}{l} = \frac{\mu_o I_X I_z}{2\pi r_{ZX}}$ $= \frac{(4\pi\times10^{-7})\times(5\times3)}{2\pi(5\times10^{-3})}$ $= 6\times10^{-4}\ N.m^{-1}$ $\frac{F_{ZY}}{l} = \frac{\mu_o I_z I_Y}{2\pi r_{ZY}}$ $= \frac{(4\pi\times10^{-7})\times(3\times2)}{2\pi(10\times10^{-3})}$ $= 1.2\times10^{-4}N.m^{-1}$ $F_Z = (6\times10^{-4}) - (1.2\times10^{-4})$ $= 4.8\times10^{-4}N.m^{-1}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3.9 3.10	R

Item	Part	Answer	Mark	OB	C.L
23	a		$\frac{1}{2}$ $\frac{1}{2}$	4.6	K
	b	1. Increasing the number of turns. 2.Using a coil with a larg cross section area. 3.Increasing the strength of the magnetic field. 4. Increasing the frequency of rotation of the coil. **Note:** (Student can write any two of these)	1 1	4.6 4.7	K
24	a	$\frac{N_s}{N_p} = \frac{V_s}{V_p}$ $\frac{45}{1725} = \frac{V_s}{230}$ V_s= 6V	$1\frac{1}{2}$ $\frac{1}{2}$	4.8	A
	b	$\frac{N_s}{N_p} = \frac{I_p}{I_s}$ $\frac{45}{1725} = \frac{I_p}{0.8}$ I_p=$20.9 \times 10^{-3} A$	$1\frac{1}{2}$ $\frac{1}{2}$	4.8	A

End Of Marking Guid