سلطنة عمان
وزارة التربية والتعليم

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٣٨/١٤٣٧ هـ - ٢٠١٦ / ٢٠١٧ م

الدور الثاني - الفصل الدراسي الأول

تنبيه:
- المادة: الفيزياء.
- الأسئلة في (١٣) 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)

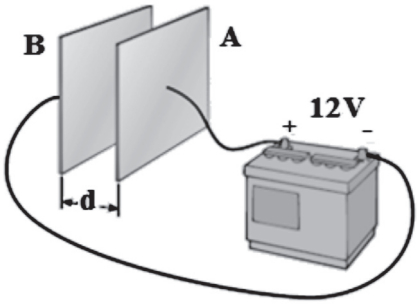
There are 14 multiple-choice items worth two marks each.
Shade in the bubble (⬭) next to the **correct** answer for each of the following items.

1) Which of the following units is equivalent to the volt?

⬭ $J\,A^{-1}$ ⬭ $J\,C^{-1}$

⬭ $W\,C^{-1}$ ⬭ $W\,s^{-1}$

2) A battery is connected to two parallel plates (A) and (B) as shown in the figure below. It produces (3×10^3 V/m) electric field between the plates. What is the separation (d) between them?



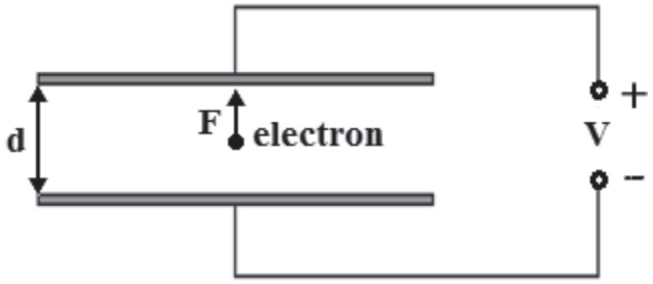
⬭ 4×10^{-3} m

⬭ 8×10^{-3} m

⬭ 0.25×10^{3} m

⬭ 36×10^{3} m

3) An electron of charge (e) is introduced between two metal plates which are a distance (d) apart .A potential difference (V) is applied to the plates as shown in the figure below.



Which expression gives the electric force (F) on the electron?

⬭ $\frac{eV}{d}$ ⬭ eVd

⬭ $\frac{V}{ed}$ ⬭ $\frac{dV}{e}$

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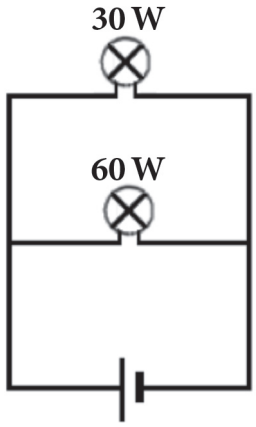
Question 1 continued

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

	Kirchhoff's first law	Kirchhoff's second law
☐	charge	current
☐	charge	energy
☐	current	mass
☐	energy	current

5) Two light bulbs with different power are connected as shown in the circuit below.

Which of the following is **true**?



	The bulb having greater current	The bulb having higher resistance
☐	30 W bulb	30 W bulb
☐	30 W bulb	60 W bulb
☐	60 W bulb	30 W bulb
☐	60 W bulb	60 W bulb

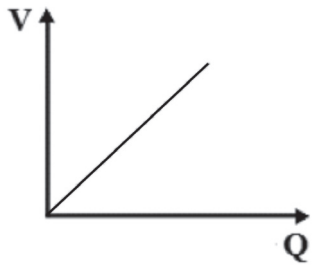
6) The graph below shows the relation between the charge (Q) on a capacitor and the corresponding voltage across it (V). What does the area under the graph present?

☐ Power

☐ Energy

☐ Current

☐ Capacitance



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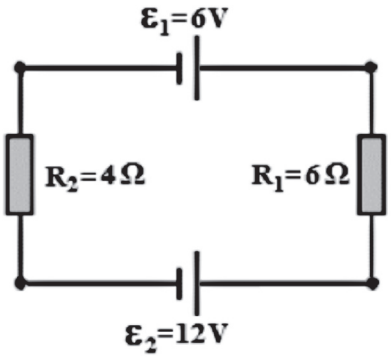
Question 1 continued

7) During a thunderstorm, the potential difference between thunderclouds and the ground is (1.5×10^6 V). In each stroke of lightning, (30 C) of charge passes between the thunderclouds and the ground. Lightning strokes to the ground occur on average every two minutes. Which of the following is **correct**?

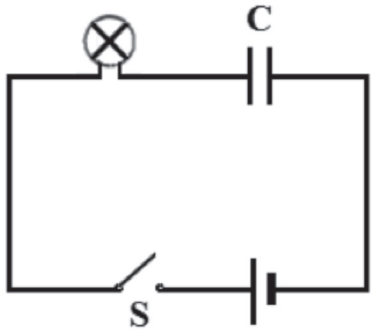
	Average current flowing to the ground	Energy transferred in each stroke of lightning
☐	0.25 A	45×10^6 J
☐	15 A	45×10^6 J
☐	0.25 A	50×10^3 J
☐	15 A	50×10^3 J

8) A circuit contains two resistors and two batteries as shown in the figure below. What is the current in the circuit?



- ☐ 0.6 A
- ☐ 1.2 A
- ☐ 1.8 A
- ☐ 3.0 A

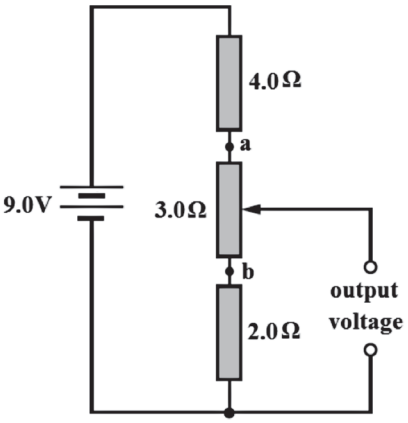
9) In the circuit below the capacitor (C) is initially uncharged. When the switch (S) is closed, what will happen to the brightness of the bulb after a while?



- ☐ Increase.
- ☐ Decrease.
- ☐ Remain constant.
- ☐ Decrease and then increase.

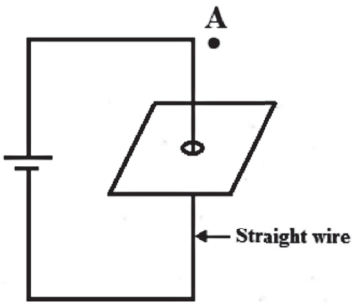
Question 1 continued

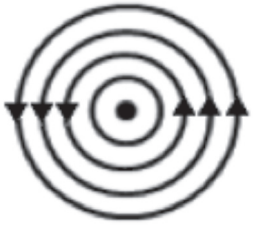
10) A circuit consists of two fixed resistors of resistance (2.0 Ω) and (4.0 Ω), connected in series with a (3.0 Ω) resistor. The (3.0 Ω) resistor is connected with a potential divider which can be moved between the points (a) and (b) as shown in the figure opposite. What are the maximum and the minimum output voltages of this potential divider circuit?

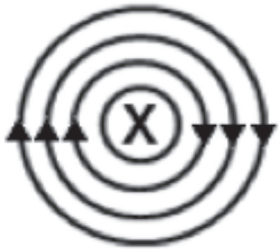


	Maximum voltage (V)	Minimum voltage (V)
☐	5.0	0
☐	5.0	2.0
☐	9.0	0
☐	9.0	2.0

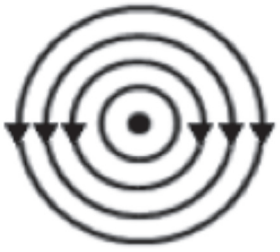
11) Which of the following figures show the magnetic field formed around the straight wire shown in the circuit opposite as viewed from position (A)?



☐ 

☐ 

☐ 

☐ 

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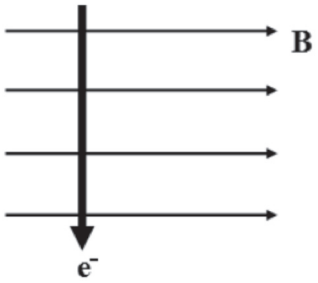
Question 1 continued

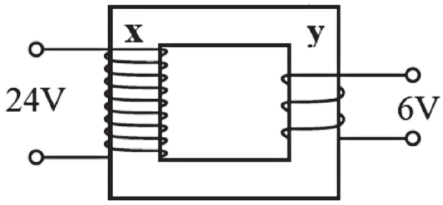
12) An electron crosses perpendicularly a magnetic field as shown in the figure below. In which direction will the magnetic force act on the electron?



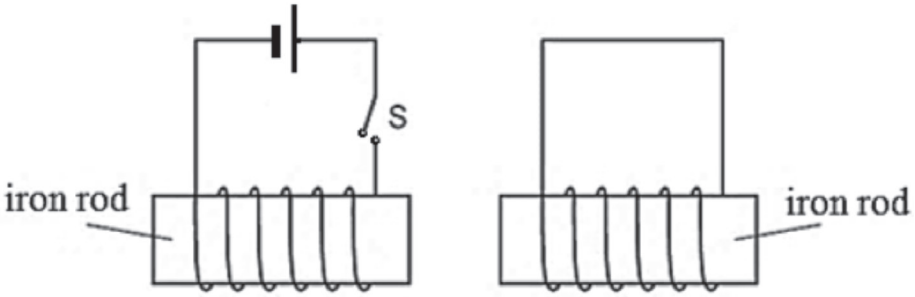
- ☐ To the right.
- ☐ To the left.
- ☐ Out of the page.
- ☐ Into the page.

13) The transformer shown in the figure below is used to produce a (6 V) output from a (24 V) input. What are the suitable number of turns for coil (X) and for coil (Y)?

	Number of turns on coil (X)	Number of turns on coil (Y)
☐	240	30
☐	480	120
☐	960	20
☐	1000	50



14) Two circuits are set up as shown in the figure below. The iron rods are placed close to each other, and are free to move.



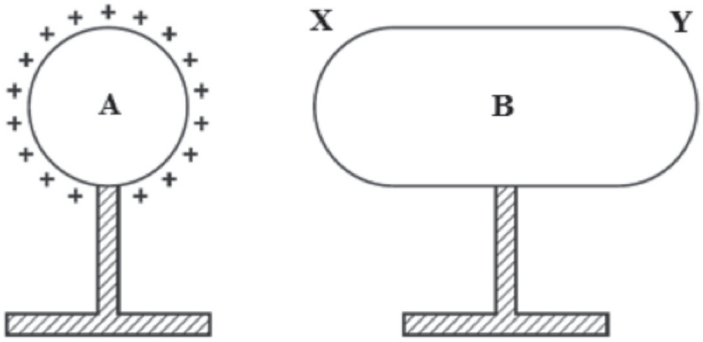
What happens to the gap between the two iron rods when switch (S) is just closed?

- ☐ Decreases.
- ☐ Increases.
- ☐ Does not change.
- ☐ Decreases then increases.

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) (A) and (B) are two conductors placed on insulating stands. (A) is positively charged while (B) is initially uncharged as shown in the figure below.

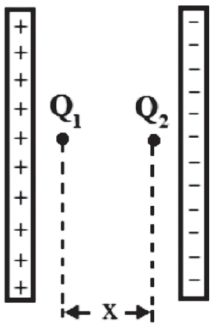


a. On the figure above show the signs of the charges induced at the sides (X) and (Y) of conductor (B). (1 mark)

b. If side (Y) is now connected to the earth by a wire and then conductor (A) is removed, what will be the charge at (Y)? (1 mark)

16) Two point charges ($Q_1 = -6.7 \times 10^{-6}\,C$) and ($Q_2 = +1.8 \times 10^{-6}\,C$) are separated by a distance ($x = 0.34\,m$) and located between two parallel charged plates as shown in the figure opposite.

Assuming that the electric field between the plates is ($E = 73000$ N/C), calculate the net electric force on (Q_1). (3 marks)



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Question 2 continued

17) A stationary charge (Q) of (6×10^{-4} C) creates an electric field. A test charge (q) of (2×10^{-6} C) is affected by a force of (0.3 N) at a distance (r) due to the charge (Q).

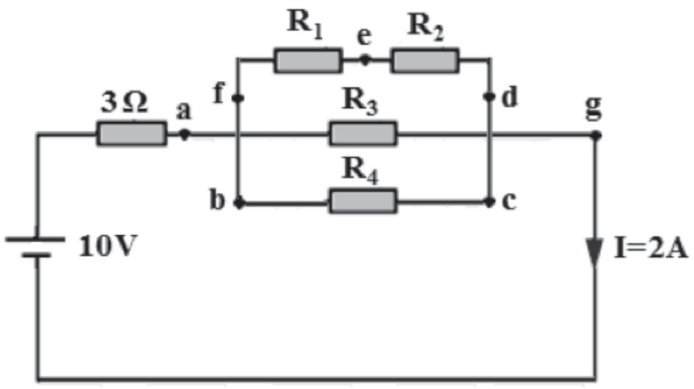
a. State Coulomb's law. (2 marks)

b. Find the electric field strength at the distance (r). (1 mark)

c. If test charge (q) is replaced by another test charge (2q) at a distance (2r), find the force experienced by this test charge. (2 marks)

Question 2 continued

18) Study the circuit below then answer the following questions:



a. State Kirchhoff's First Law. (2 marks)

b. Calculate the potential difference (V_{ag}) between the points (a) and (g). (1 mark)

c. What are the **three** points at which an ammeter reads the same value? (1 mark)

Question 2 continued

19) The table below shows the voltage applied on some wires of different materials and their resistivities. The wires have the same dimensions (l = 10 cm , A = 2 × 10^{-4} m^2):

Material	Resistivity (Ω.m)	Voltage applied (V)
Silver	1.59 × 10^{-8}	10
Gold	2.44 × 10^{-8}	8
Carbon	3.5 × 10^{-5}	6
Germanium	0.46	4

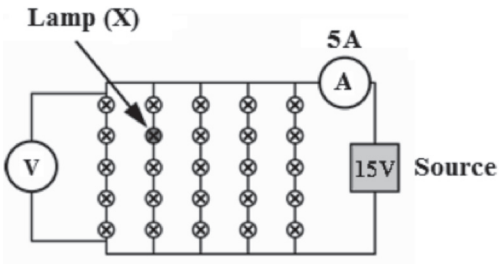
a. Write two factors that affect the resistance of a wire. (2 marks)

b. Which material has the highest resistance? Explain. (2 marks)

c. Find the current flow in the gold wire. (2 marks)

Question 2 continued

20) Ali connects National Day lamps as shown in the circuit opposite. It has (25) identical lamps. When all the lamps are glowing, a current of (5A) flows through the main wire.



a. State Ohm's law. (2 marks)

b. Calculate the power output. (2 marks)

c. If Ali found that lamp (X) lost connection:

(i) What will happen to the reading of the voltmeter? (1 mark)

(Choose the correct answer)

☐ Increase ☐ Decrease ☐ No change

(ii) What will happen to the reading of the ammeter? (1 mark)

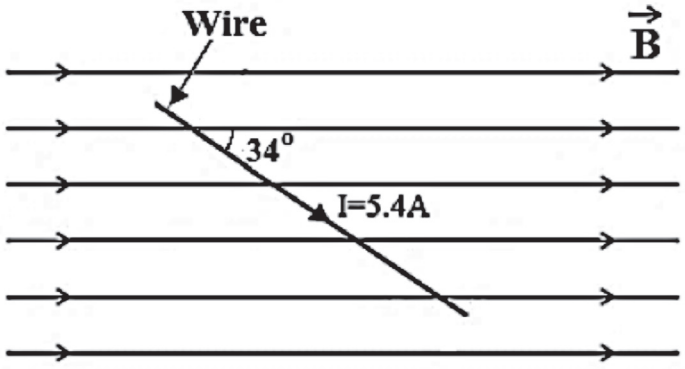
(Choose the correct answer)

☐ Increase ☐ Decrease ☐ No change

Question 2 continued

(iii) Find the combined resistance after lamp (X) lost connection. (2 marks)

21) A straight copper wire with a length of (4.7 cm) is held in a uniform magnetic field of flux density (2.6×10^{-3} T), as shown in the figure below.



a. On the above wire draw the direction of the magnetic force. (1 mark)

b. Calculate the magnetic force on the wire. (2 marks)

c. Write two modifications that could be done to increase the magnitude of the magnetic force acting on the wire. (2 marks)

Question 2 continued

d. Find the magnetic force on the wire if it is rotated by (30°) anticlockwise. (2 marks)

22) Figures (1) and (2) below show an experiment on Faraday's law of electromagnetic induction.

figure (1)

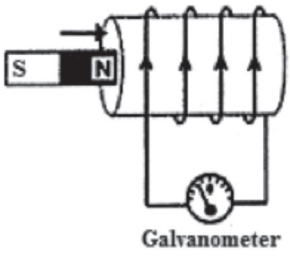
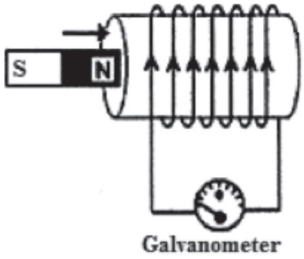


figure (2)



Two identical magnetic bars are pushed into the solenoids in figure (1) and figure (2) with the same velocity.

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

b. Explain why the deflection of the galvanometer in figure (2) is more than in figure (1). (1 mark)

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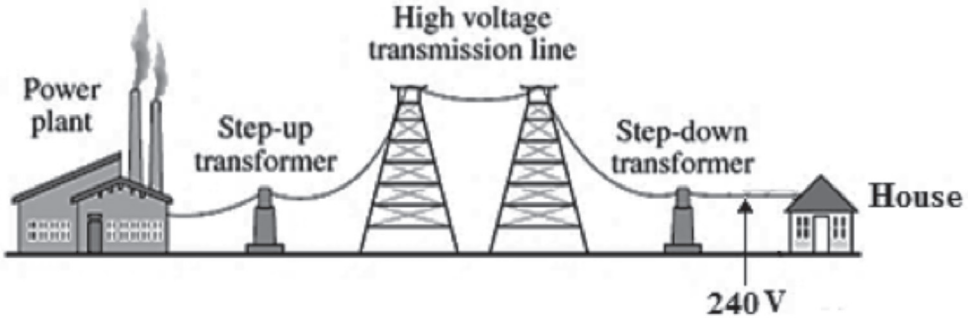
Question 2 continued

23) The figure below shows a system to supply electricity to a house.



a. The step-down transformer has a turns ratio of $\left(\frac{30}{1}\right)$. What is the voltage carried by the high voltage transmission line? (2 marks)

b. If the power delivered by the generator to the house is (2×10^6 W), calculate the current that reaches the house. (2 marks)

[End of Examination]

Formulae and Constants

Forces and charges

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

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

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

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

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

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

$$W = q\Delta V$$

$$F = mg$$

Magnetic forces and fields

$$F = BIL\sin\theta$$

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

$$F = Bqv$$

Electricity

$$I = nAev$$

$$Q = It$$

$$Q = ne$$

$$V = IR$$

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

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

$$W = VIt$$

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

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

$$V = \varepsilon - Ir$$

$$R = R_1 + R_2$$

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

$$C = C_1 + C_2$$

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

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

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

Constants

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

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

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

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

Electromagnetic induction

$$\Phi = AB$$

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

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

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مُسَوَّدَة

Physics 2016/2017 Bilingual Exam – 1st Semester, 2nd Session

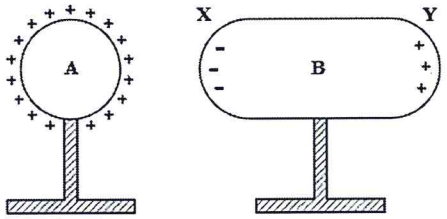
Marking Guide

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(28 marks)

Item	Answer	Answer	Mark	OB	C.L
1	b	$J\,C^{-1}$	2	1.13	K
2	a	4×10^{-3} m	2	1.8	A
3	a	$\frac{eV}{d}$	2	1.8 1.6	A
4	b	charge | energy	2	2.15 2.16	K
5	c	60W bulb | 30W bulb	2	2.8 2.13	R
6	b	Energy	2	2.25	K
7	a	0.25A | 45×10^{6}J	2	2.3 2.6	A
8	a	0.6 A	2	2.16 2.18	A
9	b	Decrease.	2	2.22	A
10	b	5.0 | 2.0	2	2.19	R

Item	Answer	Answer	Mark	OB	C.L
11	b		2	3.3	K
12	d	Into the page.	2	3.6	A
13	b	480 | 120	2	4.8	A
14	b	Increases.	2	4.4	R

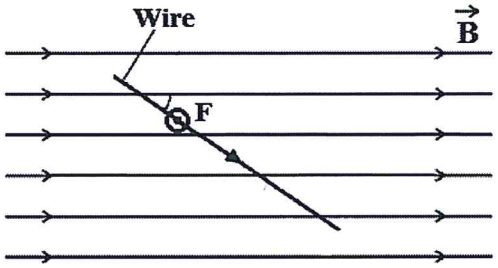
ANSWER OF EXTENDED RESPONSES :(42 marks)

Item	Part	Answer	Mark	OB	C.L
15	a		1	1.2	K
	b	Neutral **OR** no charge.	1	1.2	A
16		$F_{12} = \frac{kQ_1Q_2}{r^2} = \frac{(9\times10^9)\times(6.7\times10^{-6})\times(1.8\times10^{-6})}{(0.34)^2}$ $= 0.94N$ $F_{1plates} = EQ_1$ $= (73000)\times(6.7\times10^{-6})$ $= 0.49N$ $F_{1net} = F_{12} - F_{1plates}$ $= 0.94 - 0.49$ $= 0.45N$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	1.4 1.6 1.10	R

Item	Part	Answer	Mark	OB	C.L
17	a	The force (F) between two charges is directly proportional to each of the charges (Q_1 and Q_2) and inversely proportional to the square of their separation (r).	2	1.4	K
	b	$E = \frac{F}{q}$ $= \frac{0.3}{2\times10^{-6}}$ $E = 1.5\times10^{5} N/C$	$\frac{1}{2}$ $\frac{1}{2}$	1.9	A
	c	$F_1 = 0.3N,\ F_2 = ?,\ q_1 = q,\ q_2 = 2q,\ r_1 = r, r_2 = 2r$ $\frac{F_1}{F_2} = \frac{q_1}{r_1^2} \times \frac{r_2^2}{q_2}$ $\frac{F_1}{F_2} = \frac{q}{r^2} \times \frac{(2r)^2}{2q}$ $\frac{0.3}{F_2} = 2$ $F_2 = 0.15N$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	1.6 1.9	A

Item	Part	Answer	Mark	OB	C.L
18	a	The sum of the currents flowing into a point equals the sum of the currents flowing out of that point.	2	2.15	K
	b	$10 - (3\times2) - V_{ag} = 0$ $V_{ag} = 4V$	$\frac{1}{2}$ $\frac{1}{2}$	2.8 2.17	A
	c	(f,e,d)	1	2.15	R
19	a	- Resistivity **OR** type of material. - Length of the wire. - Cross-sectional area of the wire. **Note:** (Student can write any two of these)	2	2.11	K
	b	- Germanium. The resistance is directly proportional to the resistivity from the relation $\left(R = \frac{\rho l}{A}\right)$ **OR** Germanium has the highest resistivity.	1 1	2.11	A
	c	$R = \frac{\rho l}{A}$ $R = \frac{2.44\times10^{-8}\times10\times10^{-2}}{2\times10^{-4}}$ $R = 0.122\times10^{-4}\Omega$ $V = IR$ $I = \frac{8}{0.122\times10^{-4}}$ $I = 65.6\times10^{4}A$	 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2.11	A

Item	Part	Answer	Mark	OB	C.L
20	a	The current through a metal wire is directly proportional to the p.d. across it.	2	2.10	K
	b	$P = IV$ $P = 15 \times 5$ $P = 75W$	 1 1	2.13	A
	c-i	No change.	1	2.18	A
	c-ii	Decrease.	1	2.18	A
	c-iii	$\frac{1}{R_c} = \frac{1}{5R} + \frac{1}{5R} + \frac{1}{5R} + \frac{1}{5R}$ $\frac{1}{R_c} = \frac{4}{5R}$ $R_c = \frac{5}{4}R$	1 $\frac{1}{2}$ $\frac{1}{2}$	2.18	R

Item	Part	Answer	Mark	OB	C.L
21	a		1	3.6	K
	b	$F = BIl\sin\theta$ $= (2.6 \times 10^{-3}) \times 5.4 \times (4.7 \times 10^{-2}) \sin 34^{\circ}$ $= 3.69 \times 10^{-4} N$	 1 1	3.7	A
	c	- Increse the magnetic flux density(B) - Increase the current (I) - Increase the length of the conductor in the magnetic field (l). - make the angle between the current and the magnetic field ($90^{\circ} \geq \theta > 34^{\circ}$). **Note:** (Student can write any two of these)	2	3.7	A
	d	$\theta = 34^{\circ} - 30^{\circ} = 4^{\circ}$ $F = BIl\sin\theta$ $= (2.6 \times 10^{-3}) \times 5.4 \times (4.7 \times 10^{-2}) \sin 4^{\circ}$ $= 4.6 \times 10^{-5} N$	$\frac{1}{2}$ 1 $\frac{1}{2}$	3.7	R

Item	Part	Answer	Mark	OB	C.L
22	a	The magnitude of the induced e.m.f. is equal to the rate of change of flux linkage.	2	4.4	K
	b	Because the number of turns is more in figure (2) than in figure (1).	1	4.5iii	K
23	a	$\frac{N_p}{N_s} = \frac{V_p}{V_s}$ $\frac{30}{1} = \frac{V_p}{240}$ $V_p = 7200V$	 1 1	4.8	A
	b	$P = I_S V_S$ $2 \times 10^6 = 240 \times I_S$ $I_S = 8.33 \times 10^3 A$	 1 1	4.8	A

End of Marking Guide