سلطنة عمان
وزارة التربية والتعليم

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)
للعام الدراسي ١٤٣٨/١٤٣٩ هـ - ٢٠١٧ / ٢٠١٨ م
الدور الأول - الفصل الدراسي الأول

تنبيه:
- المادة: الفيزياء.
- الأسئلة في (١٢) 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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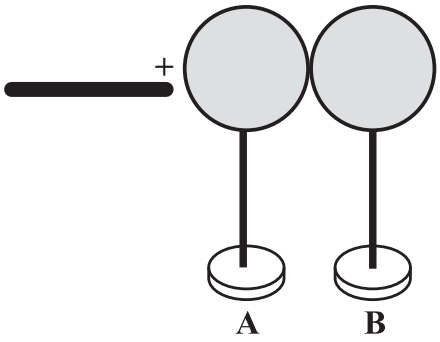
Question 1: Multiple Choice Items (28 marks)

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) Two uncharged, conducting spheres, (A) and (B) are held on insulating stands and are in contact. A positively charged rod is brought near sphere (A) as shown in the figure opposite. While the rod is in place, the two spheres are separated.
What will be the charge on each sphere?



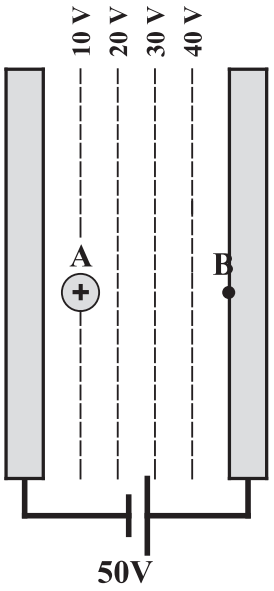
	Sphere (A)	Sphere (B)
⬭	positive	positive
⬭	positive	negative
⬭	negative	positive
⬭	negative	negative

2) Two charges, each of magnitude (6.0 μC). At what separation between them will each charge exert a force of (1.4 N) on the other?

⬭ 0.23 m ⬭ 0.48 m

⬭ 2.0 m ⬭ 40.0 m

3) The figure opposite shows a proton moved in an electric field between two parallel plates. How much work was done on the proton when it is moved from point (A) to (B)?



⬭ 1.6×10^{-18}J

⬭ 4.8×10^{-18}J

⬭ 6.4×10^{-18}J

⬭ 8.0×10^{-18}J

Question 1 continued

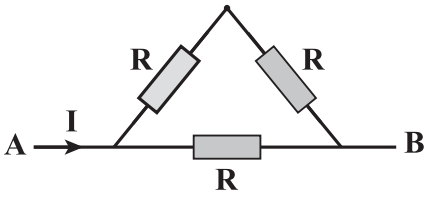
4) What is the unit of resistivity?

- ☐ Ω
- ☐ Ω/m
- ☐ Ω.m
- ☐ Ω/m^2

5) Which of the following instruments is used to control the current in an electrical circuit?

- ☐ Capacitor
- ☐ Ammeter
- ☐ Rheostat
- ☐ Potentiometer

6) The figure opposite shows three identical resistors. If the potential difference between points (A) and (B) is (V), what is the value of the current (I)?

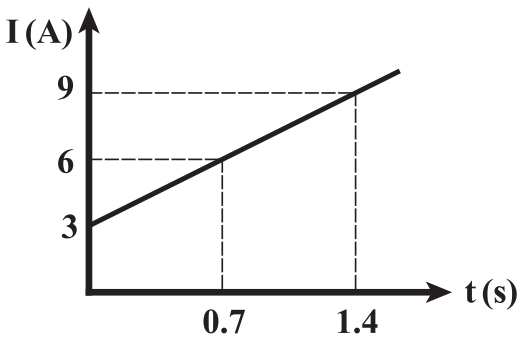


- ☐ $\frac{V}{3R}$
- ☐ $\frac{2V}{3R}$
- ☐ $\frac{3V}{2R}$
- ☐ $\frac{3VR}{2}$

7) Three resistors of (10 Ω), (10 Ω) and (20 Ω) are connected in parallel. What is the value of the resistance that should be connected in series with the combination to give a total resistance of (7 Ω)?

- ☐ 3 Ω
- ☐ 5 Ω
- ☐ 7 Ω
- ☐ 33 Ω

8) In the figure opposite (I) is a current flowing through a circuit. What is the charge that flows through the circuit for the first (0.7 seconds)?



- ☐ 1.05 C
- ☐ 2.10 C
- ☐ 3.15 C
- ☐ 4.20 C

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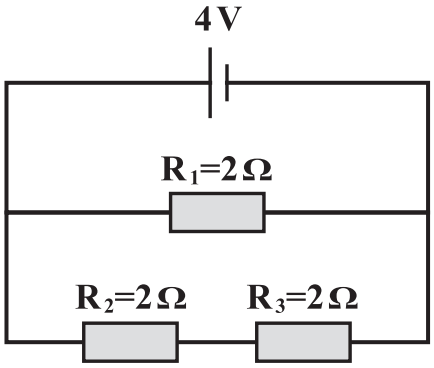
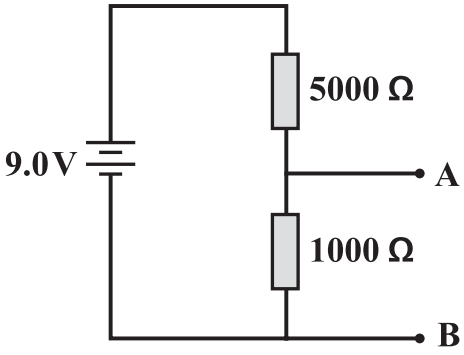
Question 1 continued

9) Three identical resistors are connected as shown in the circuit opposite. If the power dissipated in (R_1) is (P), what is the power dissipated in (R_2)?



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

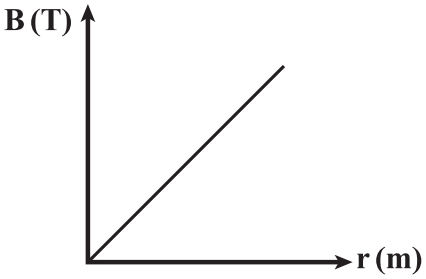
10) Find the final potential difference between (A) and (B) when another resistor of (1000 Ω) is connected in parallel with the (1000 Ω).



- ☐ 0.82 V
- ☐ 1.50 V
- ☐ 2.60 V
- ☐ 7.50 V

11) For a wire carrying current, which of the following graphs represents a relation between the flux density (B) around the wire versus the distance (r)?

☐



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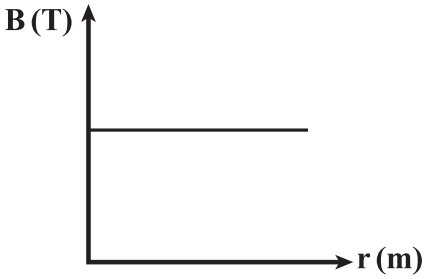

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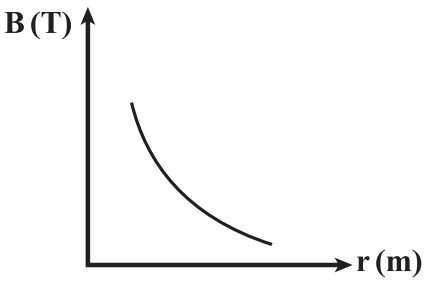

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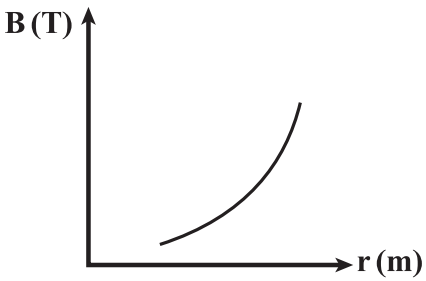


Question 1 continued

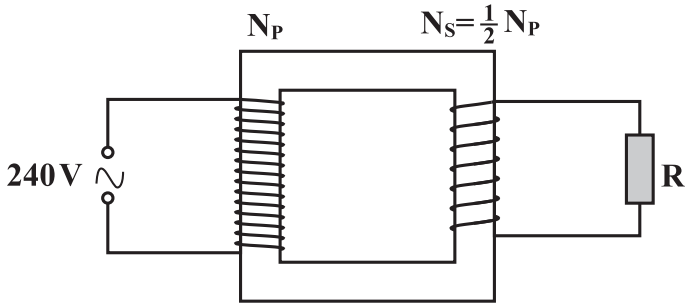
12) A (40 cm) long copper wire carries a current of (6.0 A) and weighs (0.35 N). A certain magnetic field is strong enough to balance the force of gravity on the wire. What is the strength of the magnetic field?

- ☐ 0.10 T
- ☐ 0.15 T
- ☐ 0.69 T
- ☐ 1.50 T

13) A coil wire of (60) turns and a radius of (3 cm) is placed between the poles of an electromagnet. The field increases from (0) to (0.5 T) at a constant rate in a time interval of (22 s). What is the magnitude of (e.m.f) in the coil if the field is perpendicular to the plan of the coil?

- ☐ 0.06×10^{-3} V
- ☐ 0.41×10^{-3} V
- ☐ 1.29×10^{-3} V
- ☐ 3.86×10^{-3} V

14) A current of (2 A) flows in the resistor (R) which is connected to an ideal transformer as shown in the below figure.



How much power is supplied to the secondary coil?

- ☐ 60 W
- ☐ 120 W
- ☐ 240 W
- ☐ 360 W

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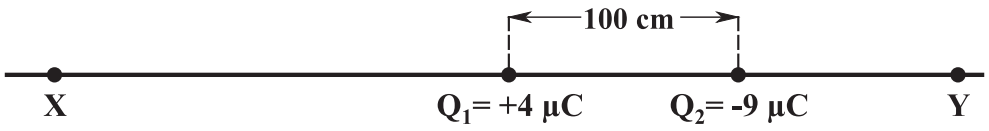
Question 2: Extended Questions (42 marks)

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) Two point charges (Q_1 = +4 μC) and (Q_2 = -9 μC) are placed on the x-axis as shown in the figure below.



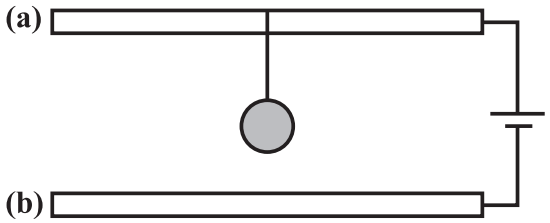
a. If the resultant electric field strenght (E) is equal to zero at point (X) , find the distance between (X) and (Q_1) (3 marks)

b. What is the direction of the resultant electric field strength (E) at point (Y)? (1 mark)

☐ To the left ☐ To the right (Shade the correct answer)

Question 2 continued

16) In the figure below, a tiny ball with a mass of (6×10^{-4} kg) carries a charge of (8 μC), it is suspended by a thread in an electric field of (E = 300 N/C).



a. On the above figure draw the lines of the electric field between the two plates. (1 mark)

b. How can you make the electric field between plates (a) and (b) stronger? (2 marks)

1- _____

2- _____

c. What is the tension of the thread if the charge of the ball is positive? (2 marks)

_____

_____

_____

_____

_____

d. What will happen to the tension strength of the thread, if we reverse the battery's poles? (1 mark)

_____

Question 2 continued

17) Figure (1) below shows a circuit with three capacitors (C_1), (C_2) and (C_3). The relation between the charges stored in each capacitor and the p.d (V) is shown in figure (2).

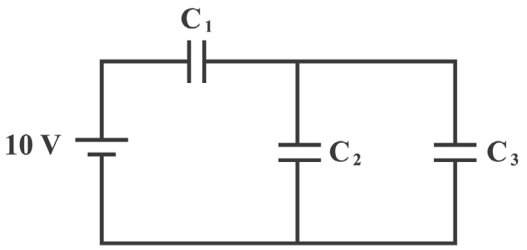


Figure (1)

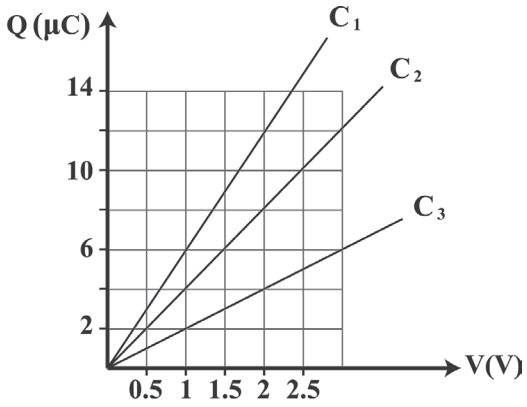


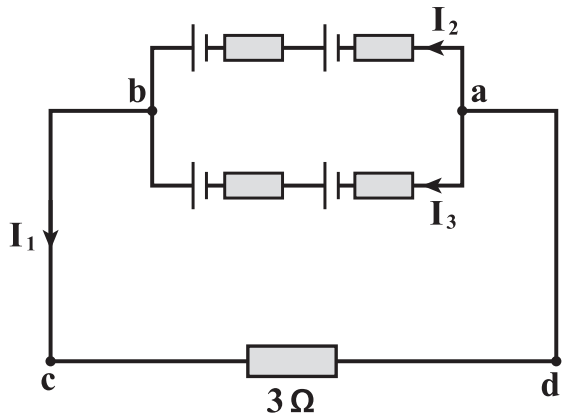
Figure (2)

a. What is meant by "The capacitance of a capacitor equal to (14 μF)"? (2 marks)

b. Calculate the charge stored in capacitor (C_2). (3 marks)

Question 2 continued

18) In the circuit below, the e.m.f of each of the batteries is (1.5 V) and the resistance of each resistor between points (a) and (b) has a value of (1 Ω).



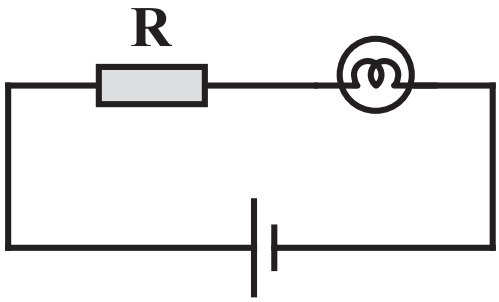
a. Write two factors that affect the resistance of the wire. (2 marks)

b. Calculate the value of (I_1). (3 marks)

c. What is the potential difference (p.d) between points (c) and (d)? (1 mark)

Question 2 continued

19) A flashlight bulb rated at (2.0 W) and (3.0 V), is operated by a (9.0 V) battery. To light the bulb at its rated voltage and power, a resistor (R) is connected in series as shown in the figure below.



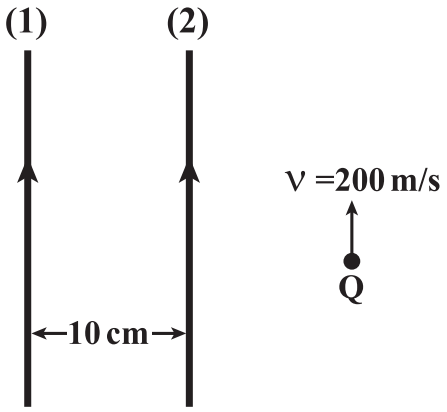
a. What is meant by "The power of the flashlight bulb is (2.0 W)"? (2 marks)

b. Find the current flowing through the bulb. (2 marks)

c. Find (R) of the resister. (3 marks)

Question 2 continued

20) Two long parallel wires each carry the same current (I). A charge (Q) of (0.2 μC) is placed as shown in the figure below.



a. What is the type of force between wires (1) and (2)?

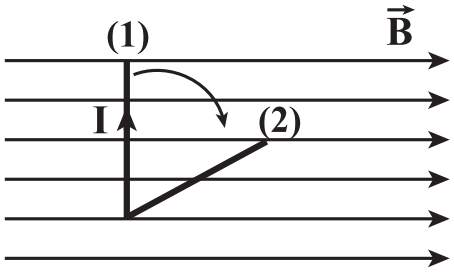
☐ Attraction force ☐ Repulsion force (Shade the correct answer)

b. If the force acting per unit length on wires (1) and (2) is (9.68×10^{-6} N/m), find the current passing in wire (1). (2 marks)

c. When the charge (Q) starts moving upwards, a magnetic force of (1.88×10^{-4} N) acts on it due to the magnetic field (B) of the two wires above, calculate (B). (2 marks)

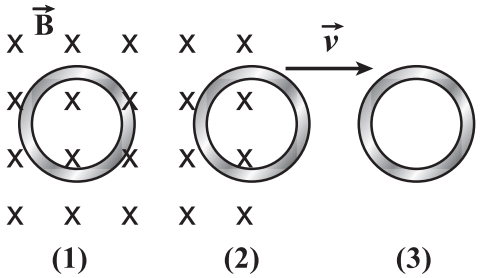
Question 2 continued

21) A wire of (0.5 m) carries a current of (4.0 A) in a uniform magnetic field of (0.30 T) as shown in position (1) in the figure opposite. If the force that affects on the wire in position (2) is (0.25N), calculate the angle of rotation from (1) to (2). (2 marks)



22) The opposite figure shows a ring travelling with a constant speed to the right in a region of a uniform magnetic field (B).

In which step of the ring movement, the induced current will be maximum. (1 mark)



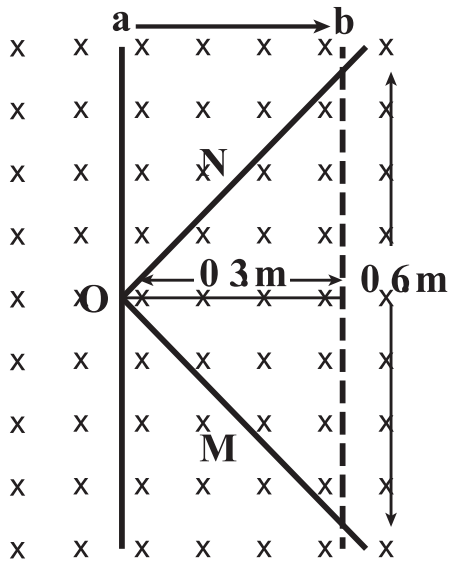
- ☐ (1)
- ☐ (2)
- ☐ (3)

(Shade correct answer)

Explain your answer. (2 marks)

Question 2 continued

23) Two conducting rods (M) and (N) are connected perpendicularly and lie in a uniform magnetic field of (0.35 T). A third conducting rod (O) slides on them from point (a) to point (b) at (3 s) with a constant velocity as shown in the figure opposite.



a. Calculate the magnetic flux (ϕ). (3 marks)

b. Find the induced (e.m.f) after (3 seconds). (1 mark)

[End of Examination]

FORMULA AND CONSTANTS

Forces and charge

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

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

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

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

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

$$V = \frac{KQ}{r}$$

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

$$W = q\Delta V$$

$$F = mg$$

Magnetic forces and fields

$$F = BIL\sin\theta$$

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

$$F = Bqv$$

$$B = \frac{\mu_\circ I}{2\pi r}$$

Constants

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

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

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

$$m_{proton} = 1.67\times10^{-27}kg$$

$$g = 9.8m/s^2$$

Electricity

$$I = nAev$$

$$Q = It$$

$$Q = ne$$

$$V = IR$$

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

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

$$W = VIt$$

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

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

$$V = \varepsilon - Ir$$

$$R = R_1 + R_2$$

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

$$C = C_1 + C_2$$

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

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

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

Electromagnetic induction

$$\phi = NAB$$

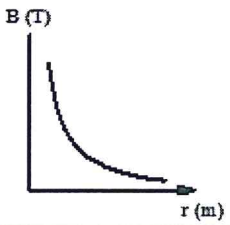
$$\varepsilon = -N\frac{\Delta\phi}{\Delta t} = IR$$

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

مُسَوَّدَة

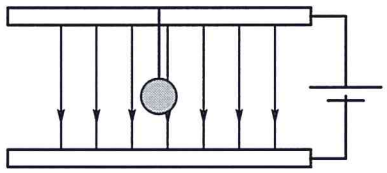
Physics 2017/2018 Bilingual Exam - 1st Semester, 1st Session

Marking Guide

ANSWERS TO MULTIPLE CHOICE QUESTIONS: (28 marks)				
Item	**Answer**	**Answer**	**Mark**	**OB**
1	c	negative | positive	2	1.1
2	b	0.48 m	2	1.4
3	c	6.4×10^{-18} J	2	1.8
4	c	Ω.m	2	2.11
5	c	Rheostat	2	2.19
6	c	$\frac{3V}{2R}$	2	2.10
7	a	3 Ω	2	2.18
8	c	3.15 C	2	2.3
9	a	$\frac{P}{4}$	2	2.13
10	a	0.82 V	2	2.8
11	c		2	3.3

Item	Answer	Answer	Mark	OB
12	b	0.15 T	2	3.7
13	d	3.86×10^{-3} V	2	4.4
14	c	240 W	2	4.8

ANSWER OF EXTENDED RESPONSES: (42 marks)

Item	Part	Answer	Mark		OB
15	a	$E_{net} = k\left(\frac{Q_1}{x^2}\right) - k\left(\frac{Q_2}{(100+x)^2}\right) = 0$	1	3	1.8 1.9
		$k\left(\frac{4\mu C}{(x)^2}\right) = k\left(\frac{9\mu C}{(100+x)^2}\right)$			
		$\frac{2}{x} = \frac{3}{100+x}$ (find the square root)	$\frac{1}{2}$		
		$2(x+100) = 3x$	$\frac{1}{2}$		
		$X = 200\ cm = 2\ m$	1		
	b	To the left	1	1	1.9
16	a		1	1	1.7
	b	1- Increase the p.d across the plates.	1	2	1.6
		2- Move the plates closer together.	1		
	c	$T = w + F_E$	1	2	1.5 1.6
		$T = mg + E.q$			
		$= (6\times10^{-4})\times(9.8) + (300)\times(8\times10^{-6})$	$\frac{1}{2}$		
		$= 8.3\times10^{-3}N$	$\frac{1}{2}$		
	d	Decrease	1	1	1.5

Item	Part	Answer	Mark		OB
17	a	It means that (14μC) of charge is stored in each plate of the capacitor when the potential difference is (1V).	1 1	2	2.23
	b	$C_1 = \frac{12}{2} = 6\,\mu C$ $C_2 = \frac{8}{2} = 4\,\mu C$ $C_3 = \frac{4}{2} = 2\,\mu C$ $C_{2,3} = 2 + 4 = 6\,\mu C$ $\frac{1}{C_{1,2,3}} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3} \therefore C_{1,2,3} = 3\mu\,C$ $Q = CV = 3 \times 10 = 30\mu C$ $V_{2,3} = \frac{Q}{C_{2,3}} = \frac{30}{6} = 5 \times 10^{-6} V$ $Q_2 = C_2 V = 4x\,5 = 20\,\mu C$	½ ½ ½ ½ ½ ½ ½	3	2.24
18	a	Length, Cross-sectional area, temperature and Material form (resistivity). (mark for 2 effects only)	1 1	2	2.11
	b	$I_2 = I_3 \;\therefore\; I_2 = \frac{1}{2} I_1$ *from loop abcd* $-I_2 + 1.5 - I_2 + 1.5 - 3I_1 = 0$ $-2I_2 + 3 - 3I_1 = 0$ $-2\frac{I_1}{2} + 3 - 3I_1 = 0$ $\therefore\; -4I_1 = -3$ $I_1 = \frac{3}{4} = 7.5\,A$	½ ½ ½ ½ ½ ½	3	2.15 2.16 2.17

Item	Part	Answer	Mark		OB
18	b	Another solution. $-I_2 + 1.5 - I_2 + 1.5 - 3I_1 = 0$ $-2I_2 + 3 - 3I_1 = 0 \rightarrow (1)$ $\frac{1}{2}$ $-I_3 + 1.5 - I_3 + 1.5 - 3I_1 = 0$ $-2I_3 + 3 - 3I_1 = 0$ $\frac{1}{2}$ $I_1 = I_2 + I_3 \quad \therefore I_3 = I_1 - I_2$ $\frac{1}{2}$ $-2(I_1 - I_2) + 3 - 3I_1 = 0$ $-2I_1 + 2I_2 + 3 - 3I_1 = 0$ $2I_2 + 3 - 5I_1 = 0 \rightarrow (2)$ $\frac{1}{2}$ *by solve* (1)*and* (2) $-8I_1 = -6$ $\frac{1}{2}$ $\therefore I_1 = \frac{6}{8} = 0.75\ A$ $\frac{1}{2}$		3	2.15 2.16 2.17
	c	$V = IR = 0.75 \times 3$ $= 2.25\ V$	$\frac{1}{2}$ $\frac{1}{2}$	1	2.8
19	a	The number of Jules which is lost in a form of heat and other types of energy in the flash light bulb is equal to 2 J one second.	1 1	2	2.13
	b	$I_{bulb} = \frac{P}{V} = \frac{2}{3}$ $= 0.67A$	1 1	2	2.13

Item	Part	Answer	Mark		OB
19	c	$V_R = 9-3=6v$ $R_R = \frac{6}{0.67} = 9\ \Omega$ **Another solution:** $R_{bulb} = \frac{V^2}{P} = \frac{3^2}{2} = \frac{9}{2}$ $\frac{1}{2}+\frac{1}{2}$ $I_{TOT} = I_R = I_{BULB} = \frac{2}{3}$ $\frac{1}{2}$ $R_T = \frac{V}{I_T} = \frac{9}{1}\times\frac{3}{2} = \frac{27}{2}$ $\frac{1}{2}$ $R_T = R_1 + R_{BULB}$ $R = \frac{27}{2} - \frac{9}{2} = \frac{18}{2}$ $\frac{1}{2}$ $= 9\ \Omega$ $\frac{1}{2}$	1 2	3 3	2.8
20	a	Attraction force	1	1	3.9
	b	$= \frac{F}{l}\frac{\mu_o I_1 I_2}{2\pi r}$ $9.68\times10^{-6} = \frac{4\pi\times10^{-7} I_1 I_2}{2\pi\times0.1}$ $I_1 I_2 = 4.84$ $\therefore I_1 = \sqrt{4.84} = 2.2\ A$	1 $\frac{1}{2}$ $\frac{1}{2}$	2	3.10
	c	$F = Bvq$ $B = \frac{F}{vq} = \frac{1.88\times10^{-4}}{200\times0.2\times10^{-6}}$ $= 4.7\ T$	1 1	2	3.8

Item	Part	Answer	Mark		OB
21		$F = BIlsin\theta$ $0.25 = 0.3\times4\times0.5\ sin\theta$ $0.25 = 0.6\ sin\theta$ $sin\theta = \frac{0.25}{0.6} = 0.42$ $sin\theta^{-1}0.42 = 25°$ $\therefore$ *the wire rotates with* $(90 - 25 = 65°)$	1 $\frac{1}{2}$ $\frac{1}{2}$	2	3.7
22		(2) Because the change in flux is maximum.	1 2	3	4.1
23	a	$A = \frac{1}{2}\times0.6\times0.3 = 0.09m^2$ $\Phi = AB = 0.09\times0.35$ $\Phi = 0.0315Web$	1 1 1	3	4.3
	b	$\varepsilon = \frac{0.0315}{3}$ $= 0.0105V$	$\frac{1}{2}$ $\frac{1}{2}$	1	4.5

End of Marking Guide