رقم الورقة	
رقم المغلف	

حاضر ☐

غائب ☐

سلطنة عمان
وزارة التربية والتعليم

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٣٥/١٤٣٤ هـ - ٢٠١٣ / ٢٠١٤ م

الدور الثاني - الفصل الدراسي الأول

تنبيه:
- المادة: فيزياء.
- الأسئلة في (١٢) 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 شهادة 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

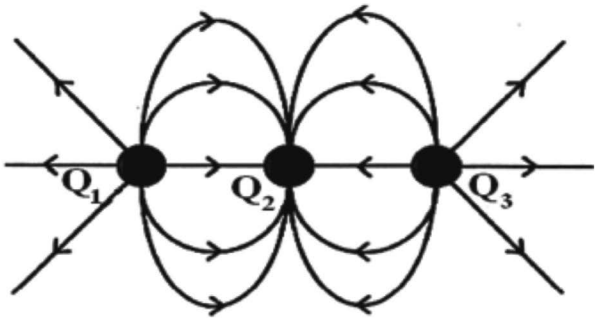
ملاحظة: يتم تظليل الشكل (●) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ● **غير صحيح** ⊖ ◉ ◔ ⊗ ☑

Question 1 (28 marks)

Shade the best correct answer for each of the following questions.

1) The diagram below shows three electric charges labeled (Q_1, Q_2, Q_3) and electric field lines in the region surrounding them. The sign of the charges are:



	Q1	Q2	Q3
☐	positive	negative	positive
☐	positive	positive	positive
☐	negative	positive	negative
☐	negative	negative	negative

2) Two charged particles attract each other with a force of magnitude (F). If the charge of one particle is doubled and the distance between the particles is also doubled, then the magnitude of the force acting on each of the two particles will be:

☐ F/4 ☐ F/2

☐ F ☐ 2F

3) An electron is accelerated from rest through a potential difference of (900 V). The velocity of the electron is:

☐ 1.8×10^7 m/s ☐ 1.2×10^8 m/s

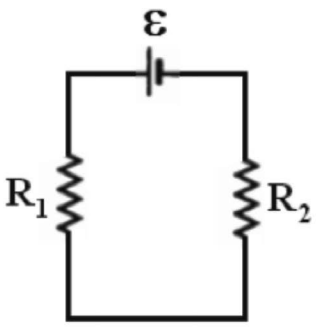
☐ 3.2×10^{14} m/s ☐ 4.4×10^{16} m/s

Do not write in this space

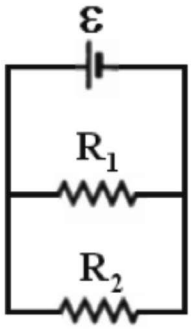
4) An electric current of (5A) is equivalent to:

- ☐ 5 J/C
- ☐ 5 V/C
- ☐ 5 C/sec
- ☐ 5 W/sec

5) In the diagrams below, resistors (R_1) and (R_2) are shown in two different connections with the same source of emf ($\mathcal{E}$).



Series Connection

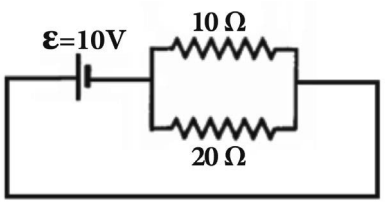


Parallel Connection

Which of the following combinations is correct to describe the voltage (V) and the power dissipated (P) by the resistor (R_1)?

	P_{series} and $P_{parallel}$	V_{series} and $V_{parallel}$
☐	$P_{series}=P_{parallel}$	$V_{series}= V_{parallel}$
☐	$P_{series}>P_{parallel}$	$V_{series}= V_{parallel}$
☐	$P_{series}>P_{parallel}$	$V_{series}< V_{parallel}$
☐	$P_{series}<P_{parallel}$	$V_{series}< V_{parallel}$

6) What is the total power dissipated in the resistors shown in the circuit opposite?



- ☐ 10 W
- ☐ 15 W
- ☐ 33 W
- ☐ 67 W

7) A copper wire has radius of (1.3 mm) and resistivity of ($1.7 \times 10^{-8} \Omega.m$). What is the voltage drop in the length of (40 m) of this wire if it carries a current of (10 A)?

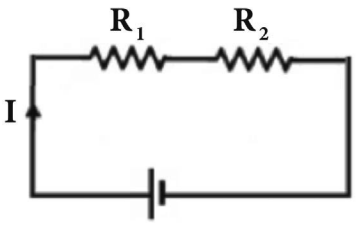
- ☐ 0.50 V
- ☐ 0.77 V
- ☐ 1.3 V
- ☐ 4.0 V

8) What is the potential difference across a (2 Ω) resistor that draws (2) coulombs of charge per second?

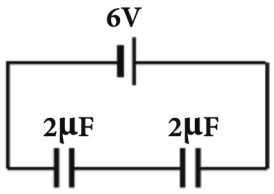
- ☐ 1 V
- ☐ 2 V
- ☐ 3 V
- ☐ 4 V

9) In the figure opposite, if a third resistor (R) is added in parallel with resistor (R_1), the effect of that on the current value and the potential difference is:

	The current	The potential difference
☐	Increases	Increases
☐	Increases	Decreases
☐	Decreases	Increases
☐	Remains constant	Remains constant



10) Which of the following circuits can store the largest quantity of energy?

☐


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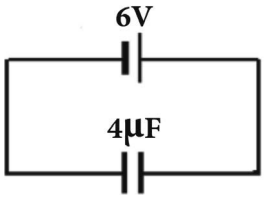

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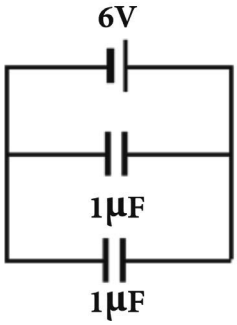

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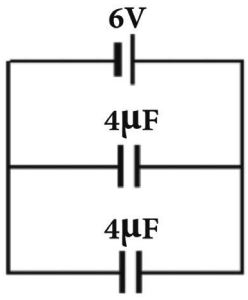
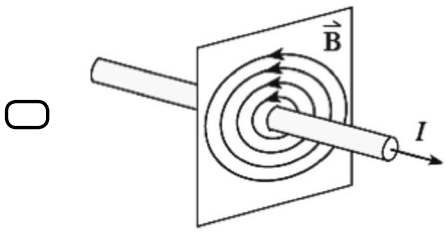
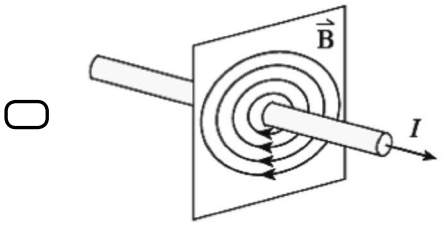
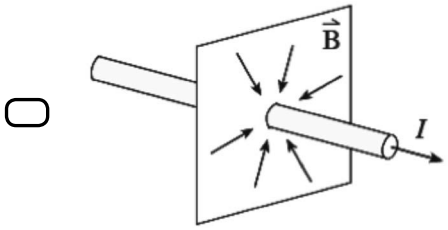
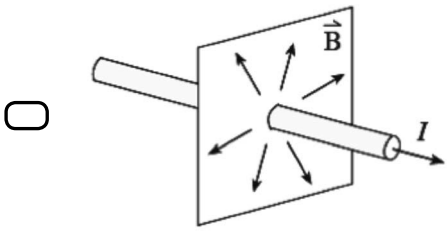


11) Which of the following diagrams shows the magnetic field due to a long straight wire?

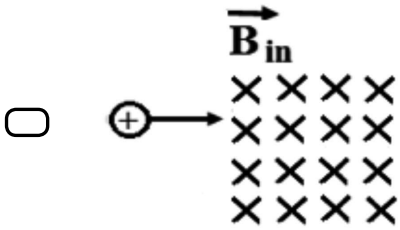


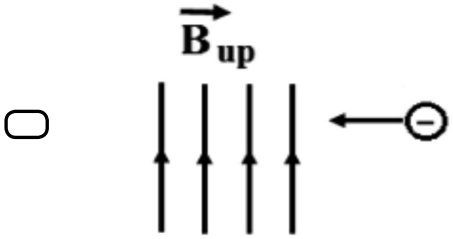


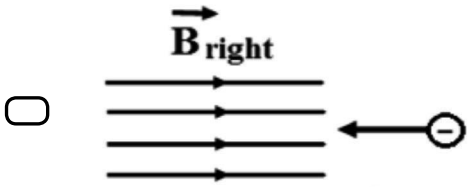


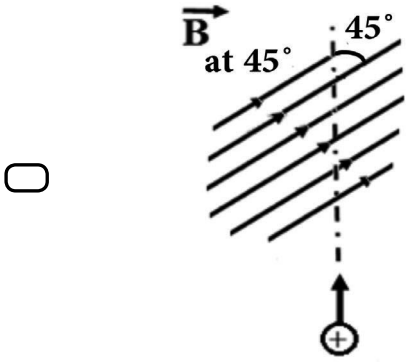


12) The diagrams below show different charged particles entering different magnetic fields. Which particle will move out of the page?









13) A copper ring is placed as shown in figure (1) and figure (2). The magnet's long axis lies along the x- axis in both figures. An induced current flows through the rings as shown.

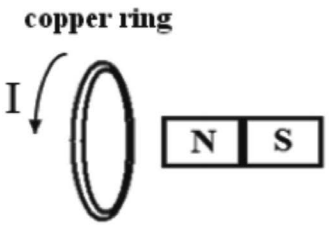


Figure (1)

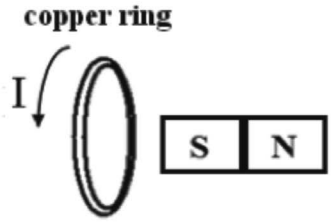
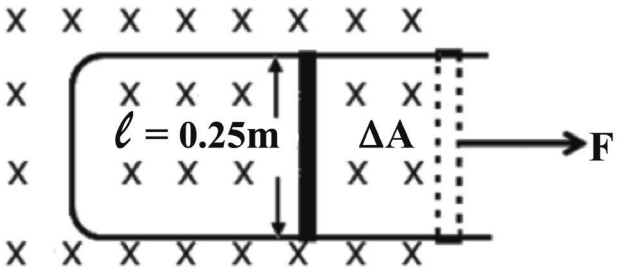


Figure (2)

Which of the following combinations best describe the magnet's movement?

	Magnet in figure (1)	Magnet in figure (2)
☐	moving away from the ring	moving away from the ring
☐	moving toward the ring	moving toward the ring
☐	remaining stationary	remaining stationary
☐	moving toward the ring	moving away from the ring

14) A conducting rod is placed on a U-shaped metal wire which is located in a magnetic field of strength (0.4 T) as shown in the figure below. An applied force moves the rod to the right and makes a change in the area(ΔA) equal to (1.5 m^2) in (1 s). What is the magnitude of the induced emf in the wire?



☐ 0.13 V

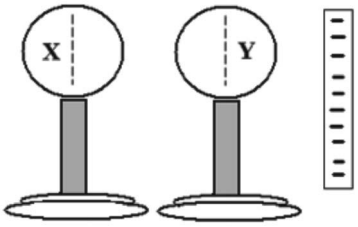
☐ 0.15 V

☐ 0.60 V

☐ 2.40 V

Question Two: (14 marks)

15) There are two spheres with a negative strip close to one of them.



A. Define the potential difference between two points. (1 mark)

_____

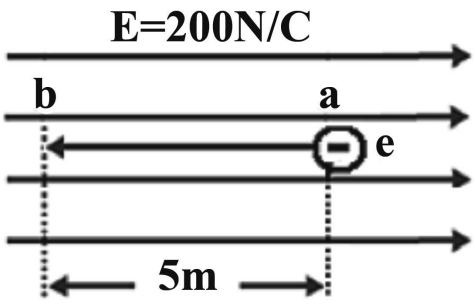
_____

B. Determine the type of charge in regions (X) and (Y). (2 marks)

Region (X): _____

Region (Y): _____

16) An electron moves in the electrical field shown in the diagram opposite. Calculate the change in the electron's electric potential energy when moved from (a) to (b) (2 marks).



_____

_____

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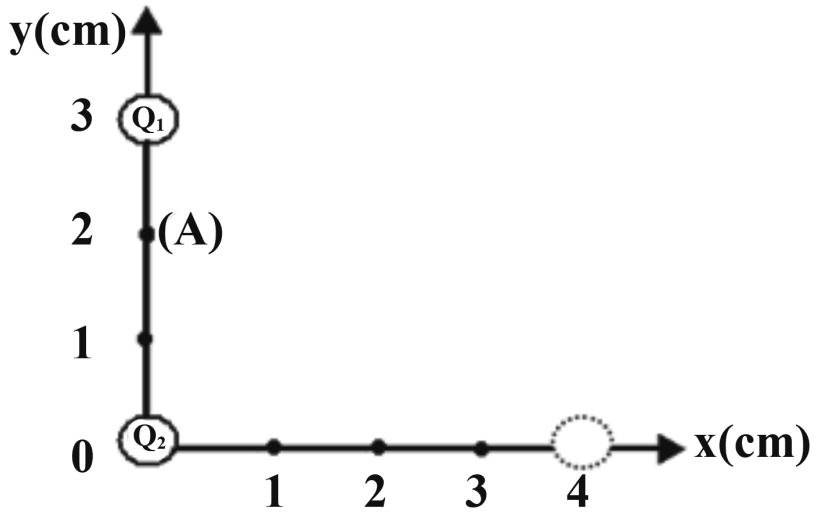
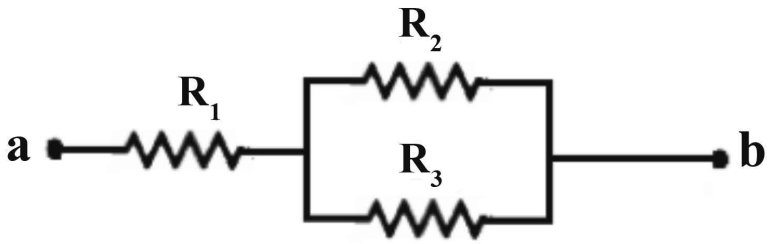
17) Two charges are located as shown in the diagram below, where ($Q_1 = +9 \times 10^{-9}$ C) and (Q_2) is unknown. The resultant electric field due to both charges is equal to zero at point (A).



A. Determine the type of (Q_2). (2 mark)

B. If Q_1 moves a distance of (4 cm) towards the (+ x-axis), calculate the distance at which the resultant field strength equals zero. (3 marks)

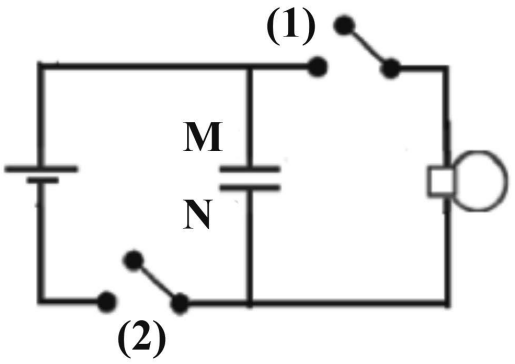
18) Three equivalent resistors of value (100 Ω) are connected as shown in the figure below. The maximum power that can be delivered to (R_1) is (25 W). What is the maximum voltage that can be applied to terminals (a) and (b)? (2 marks)



19) A very fine aluminum wire is (10 μm) in diameter and has a resistor of (1000 Ω) and a resistivity of (2.8×10^{-8} Ω.m). Calculate the length of the wire. (2 marks)

Question Three : (14 marks)

20) A student builds an electric circuit as shown in the diagram opposite.



A. Determine the type of charges on plates (M) and (N) when switch (1) is opened and switch (2) is closed.

Plate (M): _____ (1 mark)

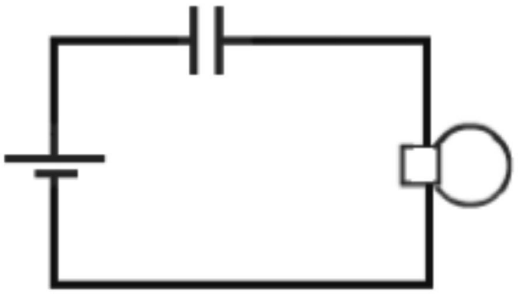
Plate (N): _____ (1 mark)

B. Describe what will happen to the bulb and the capacitor when switch (1) is closed and switch (2) is opened. (2 marks)

For the bulb: _____

For the capacitor: _____

C. If the student rebuilds the circuit as shown in the diagram opposite, describe what will happen to the light. (2 marks)



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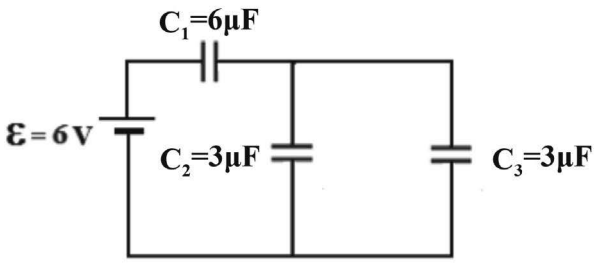
Do not write in this space

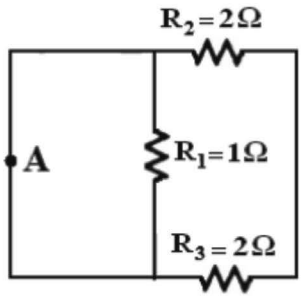
21) A (20 μF) capacitor is charged to (3.0 kV) by a power source. Then it is removed and connected with an uncharged (50 μF) capacitor.

Calculate the total charge. (3 mark)

22) Two circuits (1) and (2) are shown below. Circuit (1) consists of three capacitors connected to a battery of (6V). If capacitor (C_2) is removed from circuit (1) and connected to circuit (2) at point (A), calculate the current through resistor (R_3) in circuit (2). (5 marks)



Circuit (1)



Circuit (2)

Question Four: (14 marks)

23) The diagram opposite shows a coil with (25) turns, a length of (0.25 m) and a width of (0.15 m). It is suspended by a thread inside a magnetic field of (0.065 T). When current flows through the coil from a power source, the tension in the thread will be reduced by (4×10^{-2} N).

A. Define magnetic flux density. (1 mark)

B. Determine the direction of the current. (Clockwise or counter clockwise). (1 mark)

C. Calculate the magnitude of the current for each turn. (2 marks)

24) A proton with a speed of (6×10^{9} m/s) in a magnetic field is affected by a force of (7×10^{-14} N) towards the west when it moves vertically upward. However the force is zero when it moves horizontally towards the north. What are the magnitude and the direction of the magnetic field in this region? (3 marks)

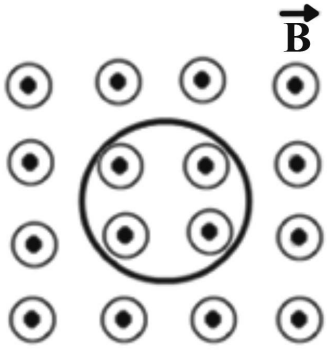
25) A transformer for a transistor radio changes voltage from (120 V) ac to (9 V) ac. The secondary coil contains (30) turns and the radio draws (400 mA).

A. What is the type of this transformer? (1 mark)

B. What is the number of turns in the primary coil? (2 marks)

26) State Lenz's Law. (2 marks)

27) The opposite diagram shows a loop of wire placed in a perpendicular magnetic field. Suddenly, the magnitude of the magnetic field begins to increase. Describe the effect of the magnetic field on the loop? (2 marks)



[End of the Examination]

FORMULA AND CONSTANTS

Forces and charge

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

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

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

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

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

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

$$W = q\Delta V$$

Magnetic forces and fields

$$F = BIL\sin\theta$$

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

$$F = Bqv$$

Constants

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

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

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

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

$$m_{electron} = 9.1\times10^{-31}kg$$

Electricity

$$I = nAev = \frac{\Delta Q}{\Delta t}$$

$$V = IR$$

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

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

$$W = VIt$$

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

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

$$V = \varepsilon - Ir$$

$$R = R_1 + R_2$$

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

$$C = C_1 + C_2$$

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

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

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

Electromagnetic induction

$$\Phi = NAB$$

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

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

مُسَوَّدَة

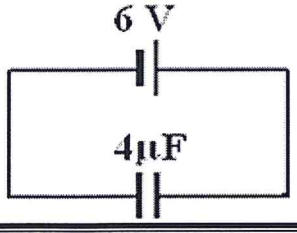
مُسَوَّدَة

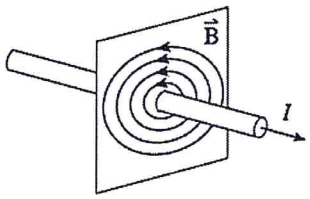
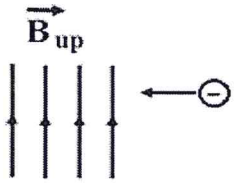
Physics 2013/2014 Bilingual Exams

1st semester, 2nd session

Marking Guide

Answers for Question One:(28 marks)

Item	Answer	Answer	Mark	C.L	OB
1	A	Q_1 positive; Q_2 negative; Q_3 positive	2	K	1.6
2	B	F/2	2	A	1.4
3	A	1.8×10^7 m/s	2	A	1.5 1.10
4	C	5C/sec	2	K	2.13
5	C	P_{series} and $P_{parallel}$: $P_{series} > P_{parallel}$; V_{series} and $V_{parallel}$: $V_{series} < V_{parallel}$	2	K	2.8 2.13
6	B	15W	2	A	2.13
7	C	1.3V	2	A	2.11
8	D	4V	2	A	2.3 2.8
9	D	The current: Remains constant; The potential difference: Remains constant	2	R	2.18
10	B		2	R	2.6

<table>
<tr><td>11</td><td>A</td><td> 
</td><td>2</td><td>K</td><td>3.3</td></tr>
<tr><td>12</td><td>B</td><td> 
</td><td>2</td><td>A</td><td>6.3</td></tr>
<tr><td>13</td><td>D</td><td><table><tr><td>Magnet in figure (1)</td><td>Magnet in figure (2)</td></tr><tr><td>moving toward the ring</td><td>moving away from the ring</td></tr></table></td><td>2</td><td>A</td><td>1.4</td></tr>
<tr><td>14</td><td>C</td><td>0.60 V</td><td>2</td><td>R</td><td>4.4</td></tr>
</table>

Answers for Question Two:(14 marks)

Item	Answer	Mark	C.L	OB
15-a	The energy transferred when one coulomb of charge passes from one point to the other point.	1	K	1.12
15-b	Region (X): negative. Region (Y): positive	1 1	K	1.2
16	W= V Q= EQd $= 200x1.6x10^{-19}x\ 5$ $= 1.6x10^{-16}J$	 $1\frac{1}{2}$ $\frac{1}{2}$	A	1.13
17-a	positive charge	2	A	1.13
17-b	$E_1 = E_2$ $K\frac{9x10^{-9}}{(0.02)^2} = K\frac{Q_2}{(0.01)^2}$ $Q_2 = 2.25x10^{-9}C$ After Q_1 moved (4 cm) $E_1 = E_2$ $K\frac{9x10^{-9}}{(5-x)^2} = K\frac{2.25x10^{-9}}{(x)^2}$ $\frac{3}{5-x} = \frac{1.5}{x}$ **or** $\frac{3}{x} = \frac{1.5}{5-x}$ $3x = 7.5 - 1.5x$ **or** $1.5\ x = 1.5x - 3x$ $\therefore X = 1.67$ cm **or** $\therefore X = 3.33$ cm	 $\frac{1}{2}$ $\frac{1}{2}$ 1 $\frac{1}{2}$ $\frac{1}{2}$	R	1.9

Answers for Question Two: (14 marks)

Item	Answer	Mark	C.L	OB
18	$V_{ab} = V_{R1} + V_{R2}$		A	2.13
	$I_{ab} = \sqrt{\frac{P}{R}} = \sqrt{\frac{25}{100}}$	$\frac{1}{2}$		
	$= 0.5$ A	$\frac{1}{2}$		
	$V_{ab} = (0.5)(100) + (0.25)(100)$	$\frac{1}{2}$		
	$= 75$V	$\frac{1}{2}$		
19	$R = \frac{\rho l}{A} \rightarrow l = \frac{RA}{\rho} = \frac{R\pi(\frac{d}{2})^2}{\rho}$	$\frac{1}{2}$	A	2.11
	$l = \frac{1000x\ 3.14x(\frac{10x10^{-6}}{2})^2}{2.8 \times 10^{-8}}$	1		
	$= 2.8$ m	$\frac{1}{2}$		

Answer for Question Three: (14 marks)

Item	Answer	Mark	C.L	OB
20.a	Plate A: positive Plate B: negative	1 1	K	2.2
20.b	The light: will not shine. The capacitor: will start storing the energy.	1 1	K	2.2
20.c	**The light will not shine** because the capacitor has the same voltage of the battery.	1 1	K	2.1
21	$C_1 = 20\ \mu F$ $\Delta V_1 = 3.0kV$ $\therefore Q = C_1 \Delta V_1$ $= 20\times10^{-6}\times3\times10^{3}$ $= 0.06C$ $C_2 = 50\ pF \qquad \Sigma\Delta V = 0 \quad \Rightarrow$ $\Delta V_1' = \Delta V_2' \Rightarrow \frac{Q_1}{C_1} = \frac{Q_2}{C_2}$ $Q_2 = \frac{C_2}{C_1}Q_1 \Rightarrow Q_1 + \frac{C_2}{C_1}Q_1 = Q$ $Q_1 = \frac{C_1}{C_1+C_2}Q = \frac{20}{20+50}(0.06) = 1.71\times10^{-2}C$ $Q_2 = \frac{C_2}{C_1+C_2}Q = \frac{50}{20+50}(0.06) = 4.43\times10^{-2}C$ $Q = Q_1 + Q_2$ $\therefore Q = 1.71\times10^{-2} + 4.43\times10^{-2}$ $= 6.14\times10^{-2}C$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	A	2.4

Answers for Question Three: (14 marks)

Item	Answer	Mark	C.L	OB
22	$C_T = 3\mu F$	1	A	2.4
	$Q_T = 18\mu C$	1		2.7
	$V_1 = 3V$	$\frac{1}{2}$		1.8
	$V_2 = 3V$	$\frac{1}{2}$		2.1
	$3-2I-2I = 0$	1	R	
	$I = \frac{3}{4}\ A$	1		

Answer of Question Four:(14 marks)

Item	Answer	Mark	C.L	OB
23-a	The quantity of flux passing through unit are at each point in the field.	1	K	3.4
23-b	counter – clockwise	1	A	3.5
23-c	$F = BLI\ sin\theta \quad and \quad \theta = 90$ $I_{total} = \frac{F}{B\,L} = \frac{4 \times 10^{-2}}{(0.065)(0.15)}$ $= 4.1\ A$ So , the current flow through each turn is: $I = \frac{I_T}{N} = \frac{4.1}{25}$ $= 0.16\ A$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	A	3.7
24	The direction of the magnetic field is to **the north** $B = \frac{F}{qv} = \frac{7x10^{-14}}{1.6x10^{-19}x6x10^{9}}$ $= 7.29 \times 10^{-5}$ T	1 $1\frac{1}{2}$ $\frac{1}{2}$	R A	3.6 3.8
25-a	**Step – down** transformer.	1	K	4.8

25-b	$\frac{N_s}{N_p} = \frac{V_s}{V_p} \Rightarrow N_p = \frac{30 \times 120}{9}$ $\therefore N_p = 400$	$1\frac{1}{2}$ $\frac{1}{2}$	A	4.8
26-a	The direction of the induced e.m.f. is such that it will try to oppose the change in flux that is producing it.	2	K	4.4
26-b	It produces induced current in the loop and its direction in Clockwise	2	A	4.5ii

End of Marking Guide