○ حاضر
○ غائب

سلطنة عمان
وزارة التربية والتعليم

امتحان شهادة دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)
للعام الدراسي ١٤٣٤/١٤٣٥هـ - ٢٠١٣/٢٠١٤م
الدور الأول - الفصل الدراسي الأول

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

تعليمات وضوابط التقدم للامتحان:

- الحضور إلى اللجنة قبل عشر دقائق من بدء الامتحان للأهمية.
- إبراز البطاقة الشخصية لمراقب اللجنة.
- 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 لايجوز 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 – عاصمة سلطنة عمان هي:

○ القاهرة. ○ الدوحة.
● مسقط. ○ أبو ظبي.

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

صحيح ● غير صحيح ⊘ ⊗ ◒ ◉ ○

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مُسَوَّدة، لا يتم تصحيحها

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QUESTION ONE

There are 14 multiple choice items worth two marks each.
Shade in the bubble next to the best answer for each item.

1. Kirchhoff's loop rule is an example of conservation of:

- ◯ mass.
- ◯ charge.
- ◯ energy.
- ◯ momentum.

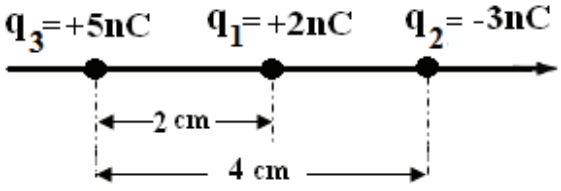
2. When different resistors are connected in parallel, we can be certain that:

- ◯ the same current flows in each one.
- ◯ the power dissipated in each is the same.
- ◯ the potential difference across each is the same.
- ◯ their equivalent resistance is greater than the resistance of each individually.

3. The constant (k) in Coulomb's law depends on the:

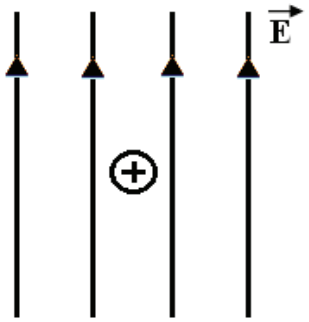
- ◯ force
- ◯ charges
- ◯ distance
- ◯ material

4. What is the total force exerted by the charges **(q_1)** and **(q_2)** on the charge **(q_3)** in the diagram below ?



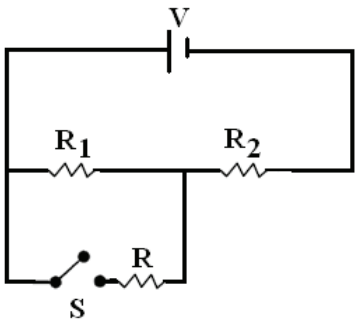
- ◯ 1.41 x 10^{-4} N
- ◯ 2.82 x 10^{-4} N
- ◯ 3.09 x 10^{-4} N
- ◯ 3.94 x 10^{-4} N

5. In an experiment, a positively charged oil drop weighing **(6.5×10^{-15} N)** is held stationary by a vertical electric field as shown in the diagram opposite. If the charge on the oil droplet is **(1.2×10^{-18} C)**, then the electric field strength equals:



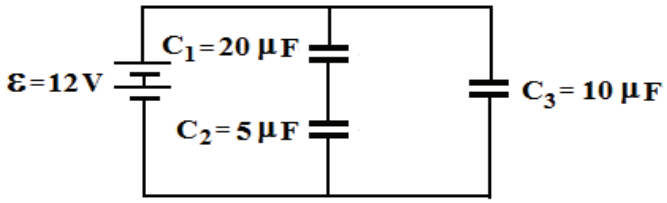
- ○ 7.8×10^{-33} N/C
- ○ 1.8×10^{-4} N/C
- ○ 5.4×10^{3} N/C
- ○ 7×10^{6} N/C

6. In the circuit opposite, switch **(S)** is originally open.How does the current through resistors **(R_1)** and **(R_2)** change when switch **(S)** is closed?



	Current through (R_1)	Current through (R_2)
○	increases	increases
○	increases	decreases
○	decreases	decreases
○	decreases	increases

7. Three capacitors are connected to a **(12 V)** battery as shown in the circuit below. The capacitors are fully charged. The total energy stored by the capacitors is:

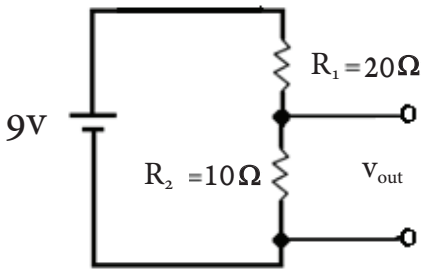


- ○ 2.06×10^{-4} J
- ○ 5.14×10^{-4} J
- ○ 10.1×10^{-4} J
- ○ 25.2×10^{-4} J

8. The table below shows measurements of length ,(ℓ)radius **(r)** , resistivity (ρ) and temperature **(T)** for four conductors. Which of these conductors has the highest resistance?

	ℓ (m)	r (m)	$\rho x10^{-8}$ (Ωm)	T(C°)
○	0.20	0.002	2	40
○	0.40	0.004	4	35
○	0.60	0.006	6	25
○	0.80	0.008	8	20

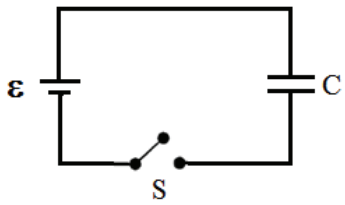
9. The diagram opposite shows a potential divider circuit. What is the power dissipated in resistor **(R_2)** ?

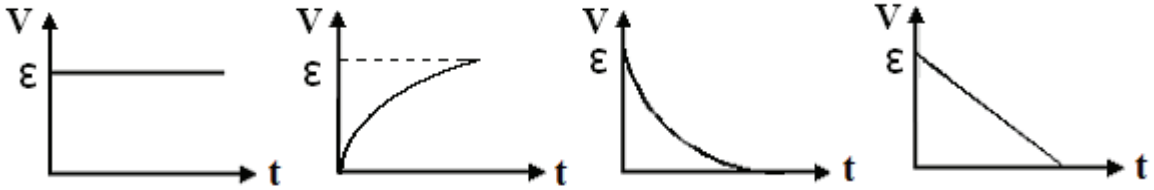


○ 0.9 W ○ 1.8 W

○ 2.7 W ○ 8.1W

10. For the circuit shown in the diagram opposite, when switch **(s)** is closed, which graph represents the voltage across the capacitor with time?





○ ○ ○ ○

11. The equivalent unit to the "Tesla" is:

○ web/m^2 ○ web.m^2

○ web/m ○ m/web

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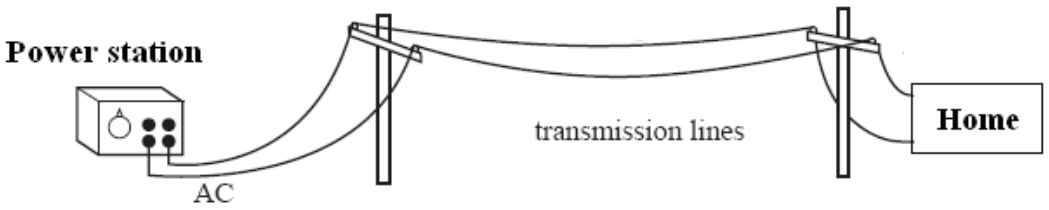
12. The figure below shows a power station. The suitable values for **V (kV)** and I **(A)** to reduce the energy lost by wires from the power station are:



	V (KV)	I (A)
○	10	200
○	20	100
○	40	50
○	80	25

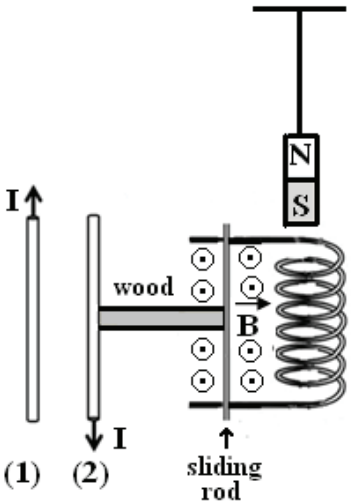
13. The figure opposite shows two identical wires carrying the same current. One of them is connected to a sliding rod. What will happen to the magnet when current passes through wires **(1)** and **(2)**?

○ move up.

○ move down.

○ stay stationary.

○ rotate clockwise.



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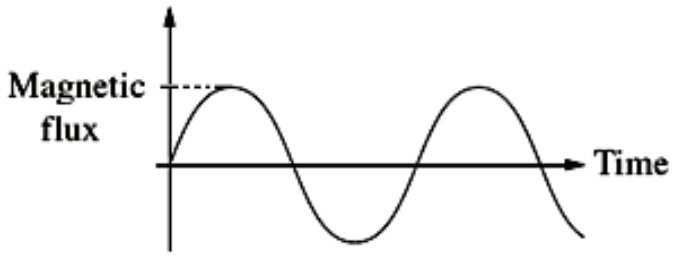
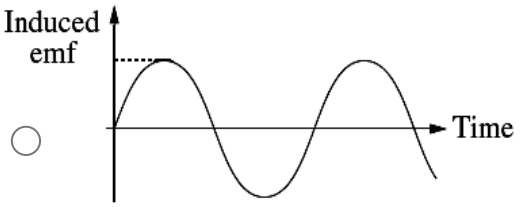
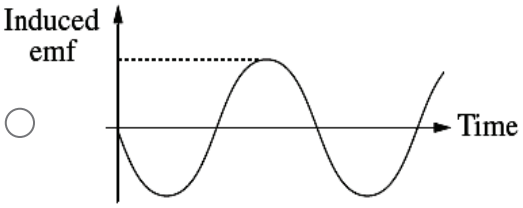
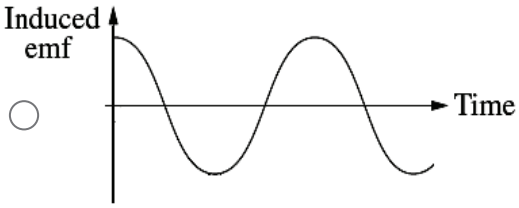
14. The graph in the figure below represents the variation in magnetic flux with time for a coil rotating vertically in a magnetic field.

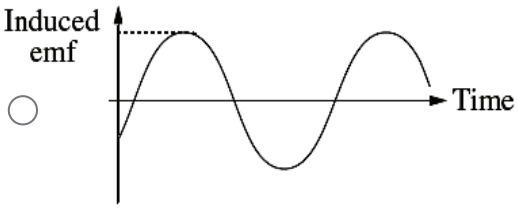


Which graph represents the corresponding induced emf in the coil?







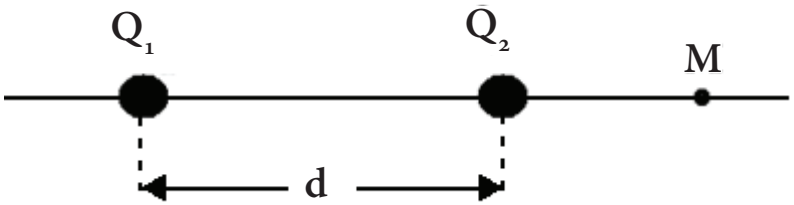


Write your answer for each of the following questions in the space provided.

Be sure to show all your work, including the correct units where applicable.

QUESTION TWO: 14 marks

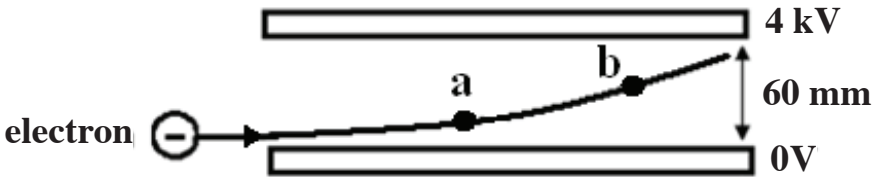
15. The diagram below shows two charges **(Q_1)** and **(Q_2)** which are distance **(d)** apart. If the electric field is zero at point **(M)**, which is at distance **(3/2d)** from Q_1 and **(d/2)** from Q_2, answer the following questions.



a- State Coulomb's Law. (3 marks)

b- Calculate the ratio $\left(\frac{Q_1}{Q_2}\right)$. (2 marks)

16. An electron is accelerated from rest to pass between the deflecting plates shown in the figure below.

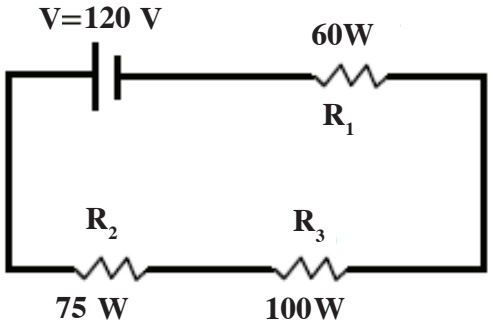


a- At which point, (a) or (b) will the electron gain higher kinetic energy. (1 mark)

b- Calculate the electric force acting on the electron. (2 marks)

c- Calculate the velocity of the electron when it exits the region between the deflecting plates. (2 marks)

17. The diagram below shows a circuit consisting of three resistors which are connected with a power supply of voltage **(120 V)**.

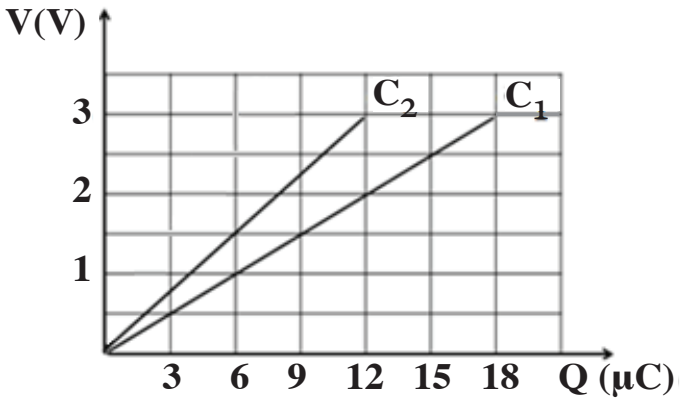


a- Define the electrical power. (2 marks)

b- Which resistor has the lowest resistance? Explain. (2 marks)

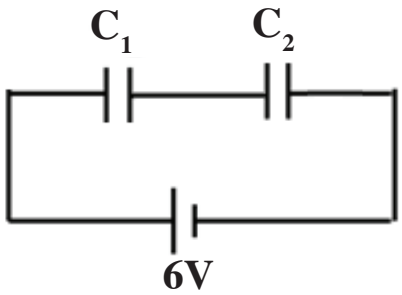
QUESTION THREE: 14 marks

18. The diagram below shows a graph of the voltage **(V)** against the charge **(Q)** for two capacitors.



a- Define the capacitance. (2 marks)

b- If the capacitors were connected as shown in the circuit below, calculate thier equivalent capacitance. (3 marks)



19. Figures **(1)** and **(2)** below show two electric irons. The first one has a wire length of **(0.2 m)** and a radius of **(0.002m)**, while the second has a wire with length of **(0.1m)** and a radius of **(0.001m)**.

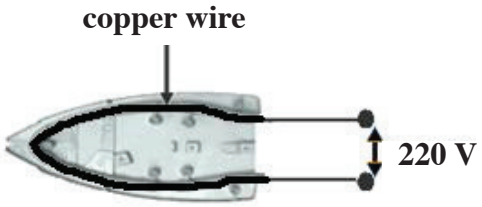


Figure (1)

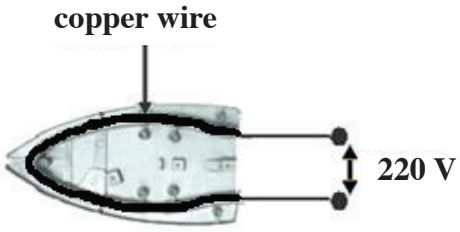


Figure (2)

a- Define resistance? (2 marks)

b- Determine the ratio of power between the two electric irons $\left(\frac{P_1}{P_2}\right)$. (2 marks)

c- If the resistivity for the wire of the electric iron is **($2 \times 10^{-6}\ \Omega m$)**, how many coulombs of charge pass through the first electric iron during **(2 hours)**? (2 marks)

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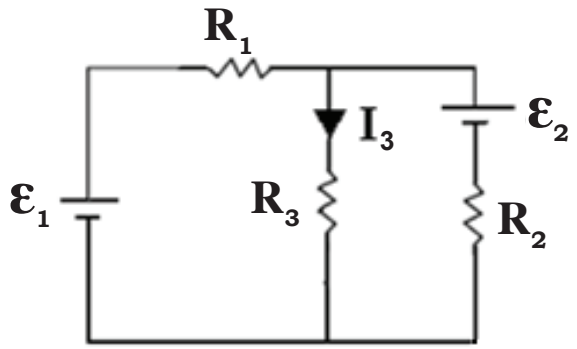
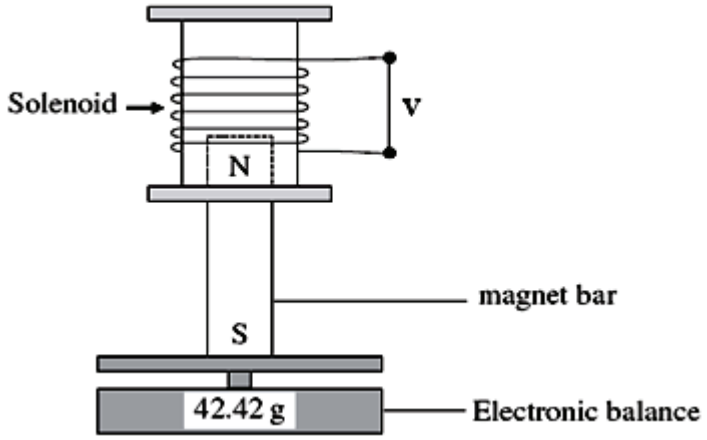
20. The circuit below consists of three equivalent resistors $\mathbf{R_1}$,$\mathbf{R_2}$ and $\mathbf{R_3}$, each of value **(100 Ω)**, and two dry cells with **($\mathcal{E}_1$= 12V, $\mathcal{E}_2$= 6V)**.



Determine the current **($\mathbf{I_3}$)** through resistor $\mathbf{R_3}$. (3 marks)

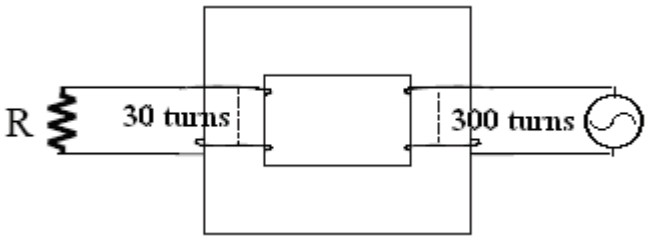
QUESTION FOUR: 14 marks

21. A magnet bar is placed on a sensitive electronic balance as shown in the diagram below. A hollow solenoid is held stationary, so that the magnet is partly within the solenoid.

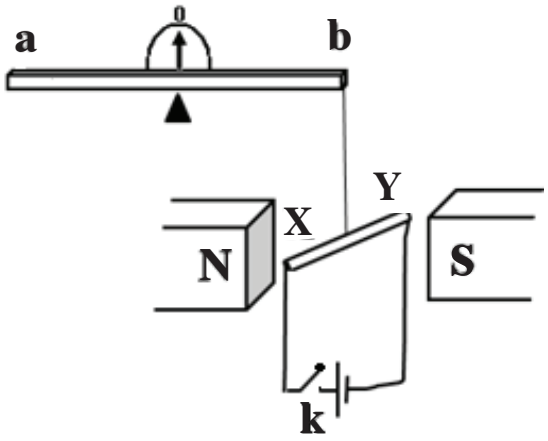


a- Does the reading of the electronic balance decrease or increase after the solenoid is lifted straight up? Explain. (2 marks)

b- Determine from the diagram below the type of the transformer. (1 mark)



22. The figure below shows a rod **(X ,Y)** with length **(0.16 m)** suspended by a scale **(a,b)**. The rod is connected with a battery and put inside a perpendicular magnetic field of **(0.4 T)**. The scale **(a,b)** is at equilibrium when switch **(k)** is open.

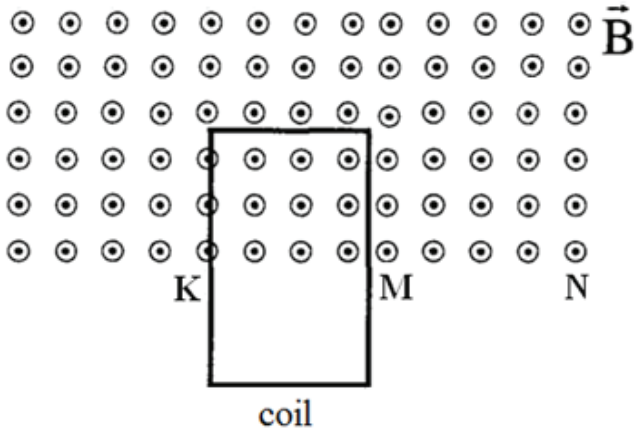


After switch **(k)** is closed, a current of **(8.5A)** flows through the rod **(X , Y)**.

a- At which point, **(a)** or **(b)** does a mass **(m)** have to be added in order to make the scale at equilibrium? (2 marks)

b- Calculate the magnitude of the mass **(m)**. (2 marks)

23. The rectangular coil in the figure below has **80** turns, and is **(25cm)** wide and **(30 cm)** long. Half of its area is located in a magnetic field of value **(1.4 T)** which is directed out of the page as shown.
The resistance of the coil is **(24 Ω)**.

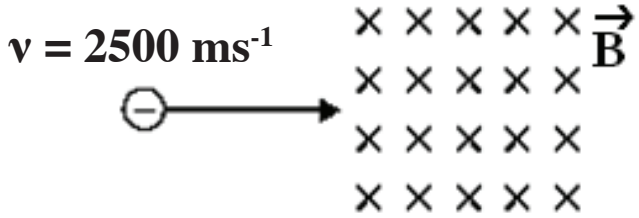


a- If this is an a.c generator's coil, how can you increase the e.m.f **($\mathcal{E}_o$)** of this generator? (State only two ways) (2 marks)

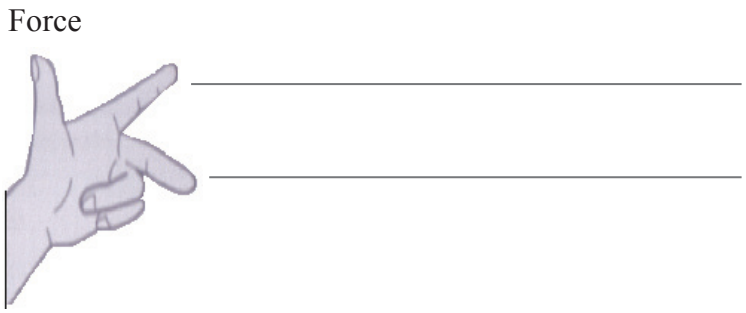
b- Find the magnitude of the induced current if the coile is moved with speed of **(2m/s)** downwards to the end of the magnetic field.

(2 marks)

24. An electron moves from a linear region into a magnetic field of **(0.50T)** as shown in the figure below.



a- Complete the following figure, which represents Flemings left hand rule. (1 mark)



b- Calculate the magnitude of the force acting on the electron. (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

$$\Phi = NAB$$

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

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

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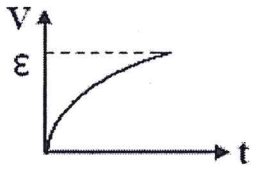
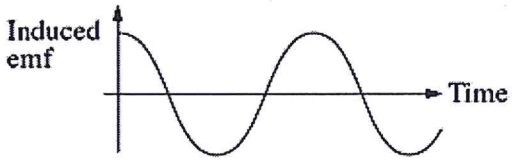
Physics 2013/2014 Bilingual Exams

1 st semester, 1st session

Marking Guide

Answers for Question One:(28 marks)

item	answer	answer	mark	C.L	OB
1	C	energy	2	K	2.16
2	C	The potential difference across each is the same.	2	K	2.11
3	D	Material	2	K	1.5
4	A	1.41×10^{-4} N	2	A	1.4
5	C	5.4×10^{3} N/C	2	A	1.8
6	D	Current through (R_1): decreases; Current through (R_2): increases	2	R	2.18
7	C	10.1×10^{-4} J	2	A	2.27
8	A	ℓ (m): 0.20; r (m): 0.002; ρ (Ωm): 2; T (C^o): 40	2	A	2.11
9	A	0.9 W	2	R	2.8
10	B		2	A	2.24

<table>
<tr><td>11</td><td>A</td><td>Web/m^2</td><td>2</td><td>K</td><td>3.4</td></tr>
<tr><td>12</td><td>D</td><td><table><tr><td>V (KV)</td><td>I (A)</td></tr><tr><td>80</td><td>25</td></tr></table></td><td>2</td><td>A</td><td>3.9</td></tr>
<tr><td>13</td><td>B</td><td>move down</td><td>2</td><td>R</td><td>4.9</td></tr>
<tr><td>14</td><td>C</td><td> 
</td><td>2</td><td>A</td><td>4.5</td></tr>
</table>

Answers for Question Two:(14 marks)

item	answer	mark	C.L	OB
(15) -a	The force between two charges is directly proportional to each of them and inversely proportional to the square of their separation.	1.5 1.5	K	1.4
(15) -b	$E_1 = E_2$ $k\frac{Q_1}{(\frac{3d}{2})^2} = k\frac{Q_2}{(\frac{d}{2})^2}$ $\frac{Q_1}{Q_2} = \frac{9}{1}$	 1 1	R	1.4
(16) -a	At point b.	1	R	1.14
(16) -b	$F = e\,E = e\frac{V}{d}$ $F = \frac{1.6x10^{-19}x2\,x10^{3}}{6\,x10^{-3}}$ $= 5.3x10^{-14}\ N$	 1 1	A	1.10
(16) -c	$\frac{1}{2}mv^2 = eV$ $v = \sqrt{\frac{2eV}{m}}$ $v = \sqrt{\frac{2x\ 1.6x10^{-19}x4x10^{3}}{9.1x10^{-31}}}$ $= 3.7 \times 10^{7}$ m/s	 $\frac{1}{2}$ 1 $\frac{1}{2}$	A	1.14

Answers for Question Two:(14 marks)

item	answer	mark	C.L	OB
(17)-a	The rate at which energy is delivered to the resistor.	1+1	K	2.13
(17)-b	R1 In series circuit, the current is the same in all resistors. **or** $P = IV = I^2R$, so, **$P \alpha R$** [1]	1 1	A	2.13

Answers for Question Three: (14 marks)

item	answer	mark	C.L	OB
(18) -a	Capacitance is the ability of a capacitor to store charge on its plates.	2	K	2.23
(18) -b	From the graph we calculate the capacitance for each capacitor. $C_1 = \frac{Q_1}{V_1} = \frac{18 \times 10^{-6}}{3} = 6 \times 10^{-6}\,F$ $C_2 = \frac{Q_2}{V_2} = \frac{12 \times 10^{-6}}{3} = 4 \times 10^{-6}\,F$ Since they are in series, so the capacitance of the three capacitor is : $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{6} + \frac{1}{4} = \frac{5}{12}$ $C = \frac{12}{5}$ $= 2.4 \times 10^{-6} F = 2.4\,\mu F$ Another answer : $W_1 = \frac{1}{2} Q_1 V_1 = \frac{1}{2}\, 18 \times 10^{-6} \times 3 = 27 \times 10^{-6} J$ $W_2 = \frac{1}{2} Q_2 V_2 = \frac{1}{2}\, 12 \times 10^{-6} \times 3 = 18 \times 10^{-6} J$ Then calculate C for each one by using this equation: $W = \frac{1}{2} C V^2$	1 1 $\frac{1}{2}$ $\frac{1}{2}$	A	2.25

Answers for Question Three: (14 marks)

item	answer	mark	C.L	OB
(19)-a	The ratio of potential difference across a conductor to the current in the conductor.	**2**	K	2.7
(19)-b	$\frac{P_1}{P_2} = \frac{I_1 V}{I_2 V} = \frac{\frac{V^2}{R_1}}{\frac{V^2}{R_2}}$ Since both electric iron have same voltage $\therefore \frac{P_1}{P_2} = \frac{R_2}{R_1} = \frac{\rho \frac{L_2}{A_2}}{\rho \frac{L_1}{A_1}} = \frac{L_2 A_1}{L_1 A_2} = \frac{L_2\ \pi r_1^2}{L_1\ \pi r_2^2} = \frac{L_2 r_1^2}{L_1 r_2^2}$ $= \frac{0.1 \times (0.002)^2}{0.2 \times (0.001)^2} = \frac{2}{1}$ $\therefore \frac{P_1}{P_2} = \frac{2}{1}$	**1** **1**	R	2.13
(19) -c	$R = \rho \frac{L_1}{A_1} = 2 \times 10^{-6} \times \frac{0.2}{\pi (0.002)^2}$ $= 3.18 \times 10^{-2} \Omega$ $Q = I t = \frac{V}{R} t = \frac{220}{3.18 \times 10^{-2}} \times (2 \times 60 \times 60)$ $\therefore Q = 4.98 \times 10^7\ C$	**1** $\frac{1}{2}$ $\frac{1}{2}$	A	2.11

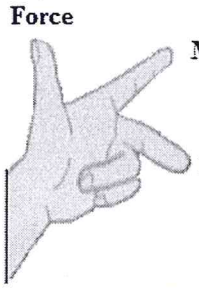
Answers for Question Three: (14 marks)

item	answer	mark	C.L	OB
(20)	$I_3=I_1+I_2 \rightarrow(1)$ From Loop 1: $\varepsilon_1 - I_1R - I_3R=0 \rightarrow (2)$ $\varepsilon_2 - I_3R - I_2R=0 \rightarrow (3)$ $\varepsilon_1 + \varepsilon_2 - R(I_1+ I_2+ 2I_3) = 0$ but $I_3=I_1+I_2$ $\frac{\varepsilon1 + \varepsilon2}{R} = 3I_3$ $I_3= \frac{12+6}{3\ x100}$ $= 0.06$ A $= 60$m A	1 1 1	A	2.8

Answers for Question Four: (14 marks)

item	answer	mark	C.L	OB
(21)- a	Will decrease. Because the coil will create an induced current such that it will try to oppose the change in the flux. So it will have two poles in the coil (S-N) and the S-pole of the coil will be attracted with N-pole of the bar magnet.	1 1	A	4.1
(21)-b	Step – down voltage	1	K	4.8
(22)-a	In point (a) because the direction of force acting on the suspended rode (X,Y) is down.	2	A	3.5
(22) -b	$F_B = m\,g$ $BILsin\theta = m\,g$ $\quad \theta=90^\circ$ $0.4 \times 8.5 \times 0.16 = m \times 9.8$ $m = 0.055\ kg$	 1 1	A	3.6
(23) -a	-Using a coil with more turns (N). -Using a coil with a larger cross- sectional area (A). -Increasing the strength of the magnetic field (B). -Increasing the frequency of rotation of the coil.	2	K	4.5,4.6

Answers for Question Four: (14 marks)

item	answer	mark	C.L	OB
(23)-b	For one loop: $\Phi = B.A = B\,(xy)$ $\varepsilon_1 = \frac{-d\varphi}{dt} = -Bx\frac{dy}{dt}$ $= -\,(1.4\ T) \times (0.25\ m) \times (-2m/s)$ $= 0.7\ V$ So for 80 turns coil: $\varepsilon_{80} = (0.7V) \times (80) = 56\ V$ $\therefore I = \frac{\varepsilon}{R} = \frac{56V}{24\Omega} = 2.3\ A$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	A	4.5
(24) -a	 	$\frac{1}{2}$ $\frac{1}{2}$	K	3.6
(24) -b	$F = Bqv$ $\therefore F = 0.50 \times 1.6 \times 10^{-19} \times 2500$ $= 2.0 \times 10^{-16}$	1 1	A	3.6

End of Marking Guide