ختم المركز

سلطنة عمان
وزارة التربية والتعليم

حاضر ☐
غائب ☐

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)
للعام الدراسي ١٤٣٦/١٤٣٥ هـ - ٢٠١٤ / ٢٠١٥ م
الدور الأول - الفصل الدراسي الأول

تنبيه
- المادة: الفيزياء.
- الأسئلة في (١١) 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** ▭ ◉ ◔ ☒ ☑

مُسَوَّدَة، لا يتم تصحيحها

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Multiple Choice Questions (28 marks)

There are 14 multiple-choice items worth two marks each.
Shade in the **correct** answer for each of the following items .

1) What will happen when a metal rod is rubbed with a piece of wool?

- ☐ Positive charges will be transferred from rod to wool.
- ☐ Negative charges will be transferred from rod to wool.
- ☐ Positive charges will be transferred from wool to rod.
- ☐ Negative charges will be transferred from wool to rod.

2) Two equal point charges are **(3cm)** apart in air and repel each other with a force of **(4×10^{-5} N)**. What is the value of each point charge?

- ☐ 4×10^{-18} C
- ☐ 4×10^{-14} C
- ☐ 2×10^{-9} C
- ☐ 2×10^{-7} C

3) The potential difference (p.d) across a filament lamp is **(230 V)**. A charge of **(31 C)** flows through the lamp at a time interval of **(60 S)**. What is the energy transferred by the lamp?

- ☐ 13.4×10^{-2} J
- ☐ 1.19×10^{2}J
- ☐ 7.13×10^{3}J
- ☐ 4.28×10^{5}J

4) What is the definition of an electric current in an electrical circuit?

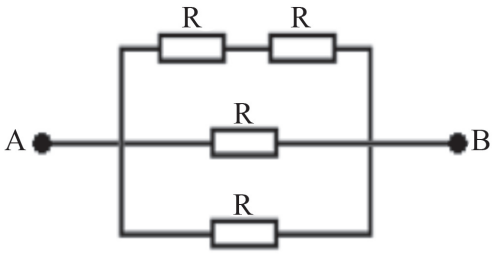
- ☐ The flow rate of positive ions.
- ☐ The flow rate of free electrons.
- ☐ The flow rate of free positive charges.
- ☐ The flow rate of both positive and negative particles.

5) Which of the following is equivalent to the potential difference **(10 V)**?

- ☐ 10 J/C
- ☐ 10 C/S
- ☐ 10 A/Watt
- ☐ 10 F/J

Multiple Choice continued

6) The diagram below shows a number of identical resistors, each of resistance (**R**). What is the total resistance between points (**A**) and (**B**) in terms of (**R**)?

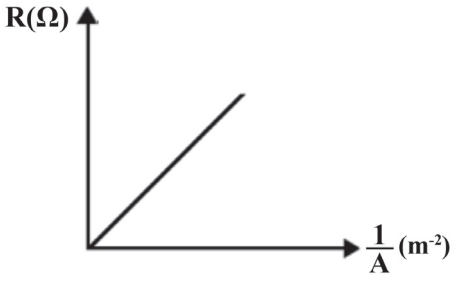


- ☐ $\frac{4}{R}$
- ☐ $\frac{5}{2R}$
- ☐ 4R
- ☐ $\frac{2R}{5}$

7) Two capacitors of **(C_1 = 2μF)** and **(C_2 = 4μF)** are connected in series. A potential difference of **(100 V)** is applied. What is the total energy stored in them?

- ☐ 6.67×10^{-5}J
- ☐ 3.5×10^{-4}J
- ☐ 6.67×10^{-3}J
- ☐ 3.5×10^{-2}J

8) The opposite graph represents the resistance **(R)** of a conductor against the inverse of its cross section area ($\frac{1}{A}$). Which of the following statements explains the graph?



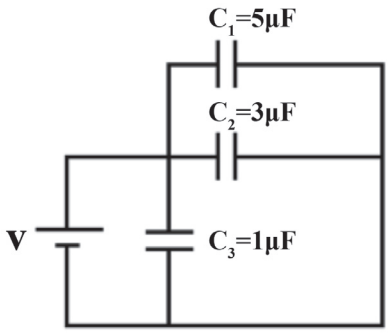
- ☐ A large current is flowing through a thin wire.
- ☐ A large current is flowing through a thick wire.
- ☐ The resistance of a wire is inversely proportional to ($\frac{1}{A}$) .
- ☐ The resistance is directly proportional to the cross section area of a wire.

Multiple Choice continued

9) A wire of radius **(0.15 mm)** has a resistance of **(6.23 Ω)** and a length of **(20 cm)**. What is the resistivity of the wire when its length is doubled?

- ☐ 2.2×10^{-6} Ω.m.
- ☐ 1.1×10^{-6} Ω.m.
- ☐ 0.146 Ω.m.
- ☐ 0.073 Ω.m.

10) What is the total capacitance for the three capacitors shown in the diagram opposite?



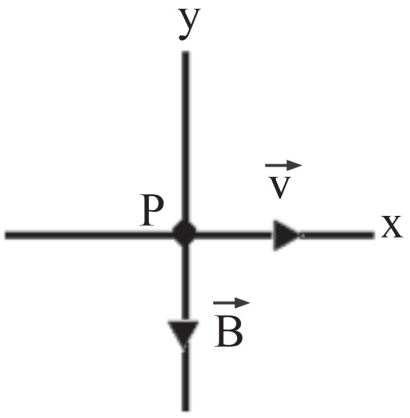
- ☐ 9 μF
- ☐ $\frac{1}{9}$ μF
- ☐ $\frac{15}{23}$ μF
- ☐ $\frac{23}{15}$ μF

11) Which of the following actions will not increase the force on a conductor in a magnetic field?

- ☐ Increasing the current (I).
- ☐ Increasing the cross section area (r).
- ☐ Increasing the magnetic flux density (B).
- ☐ Increasing the length of the conductor in the field (ℓ).

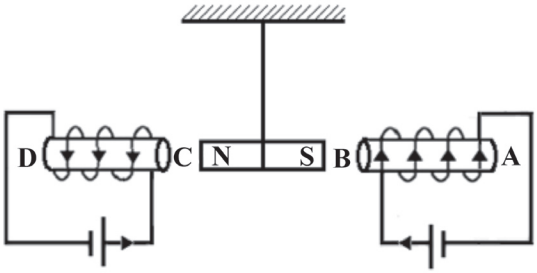
12) The diagram below shows a proton moving in the positive (***x***) direction, through a uniform magnetic field in the negative (***Y***) direction. What is the direction of the electric force on the proton?

- ☐ Into the page.
- ☐ Out of the page.
- ☐ In the positive (y) direction.
- ☐ In the negative (y) direction.



Multiple Choice continued

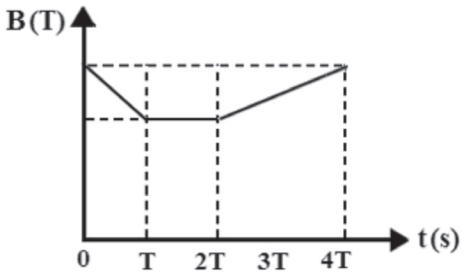
13) If a bar magnet is hanging between two identical coils as shown in the figure below.



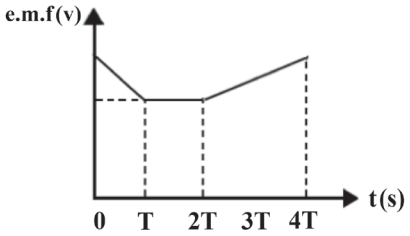
What would happen to the bar magnet?

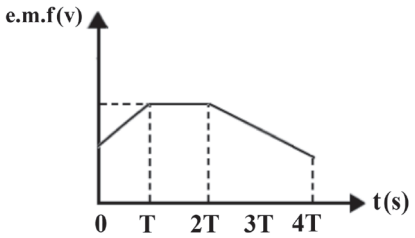
- ○ Stay at rest.
- ○ Move towards B.
- ○ Move towards C.
- ○ Oscillate between B and C.

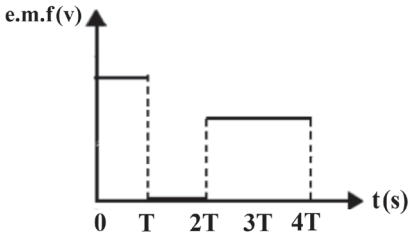
14) The graph below shows the magnetic flux density **(B)** versus time **(t)** for a coil with fixed area and placed perpendicular to a magnetic field.

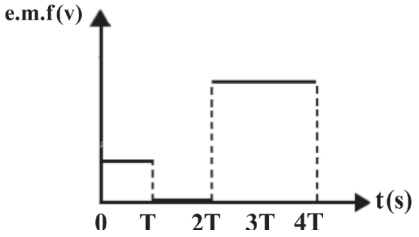


Which of the following graphs represents the variation with time of the magnitude of the induced e.m.f. in the coil?

○ 

○ 

○ 

○ 

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) When two parallel metal plates are connected in an electric circuit, a uniform electric field is produced between them. Write down two ways to make the electric field between the plates stronger. [2 marks]

16) A particle with a charge of **(+8 nC)** is placed in a uniform electric field **(E)** which is directed to the left. The charge is released from rest and moves in the same direction as **(E)**. After it has moved **(3 cm)**, its kinetic energy is found to be **(5×10^{-6} J)**.

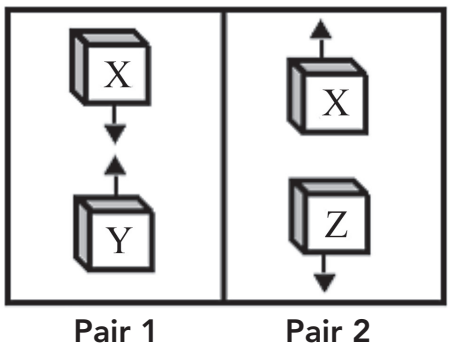
a. How much work was done by the charge? [1 mark]

b. What is the potential difference at distance (3 cm)? [1½ marks]

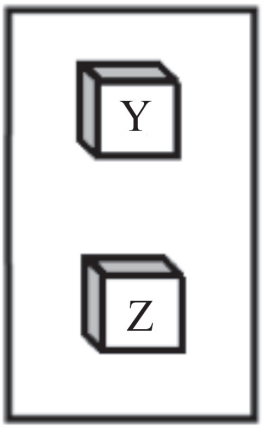
c. Find the magnitude of the electric field. [1½ marks]

Extended Questions continued

17) The diagram below shows two pairs of charged plastic cubes. The arrows represent the direction of the electric force.



Determine the direction of the electric force by adding arrows between the cubes **(Y)** and **(Z)** in the diagram below. [1 mark]



18) What is the energy required to carry a charge of **(10 C)** from a **(5.0 V)** equipotential surface to a **(6.0 V)** equipotential surface and back again to the **(5.0 V)** surface? [1 mark]

Explain your answer. [2 marks]

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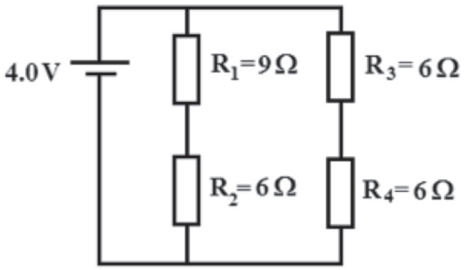
Extended Questions continued

19) Four resistances are connected to a battery with neglected internal resistance as shown in the circuit below.

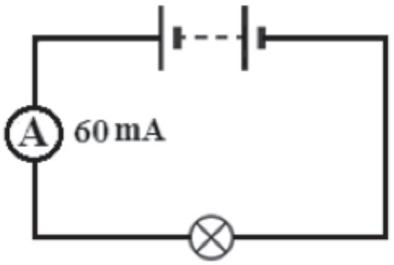


a. State Ohm's law. [2 marks]

b. Calculate the potential difference across R_1 and R_4. [3 marks]

Extended Questions continued

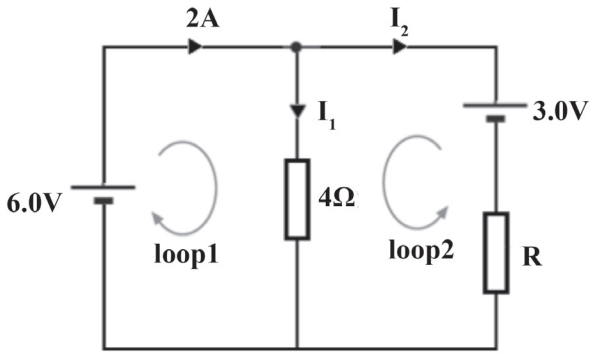
20) The diagram opposite shows an electrical circuit.



a. Indicate with an arrow on the circuit the direction of flow of electrons. [1 mark]

b. Calculate the charge flow through the filament lamp over a time period of **(300 s)**. [2 marks]

21) Use Kirchhoff's law to calculate the following from the circuit shown below:



a. The current (I_1) and (I_2). [1½ marks]

b. The resistance (R). [1½ marks]

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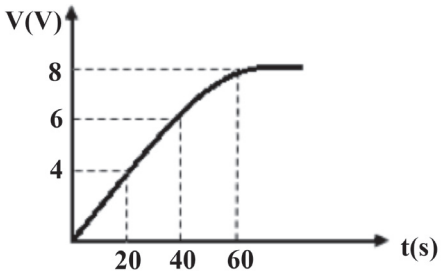
Extended Questions continued

22) **a.** Define electromotive force (e.m.f). [1 mark]

b. Explain why the conductivity of a metal decreases when the temperature of a wire increases. [2 marks]

23) The opposite graph shows the voltage **(V)** across a capacitor which is connected to a battery with negllected internal resistance against time **(t)**. Based on the graph answer the following:



a. State whether the capacitor is charging or discharging. [1 mark]

b. What is the electromotive force $(\mathcal{E})$ of the battery? [1 mark]

c. If the charge on the capacitor is **(2400 μC)**, calculate the capacitance. [2 marks]

Extended Questions continued

24) Two long parallel wires carrying identical current **(I)** in the same direction are separated by a distance **(d)** as shown in the figure below.

a. Define magnetic flux density. [1 mark]

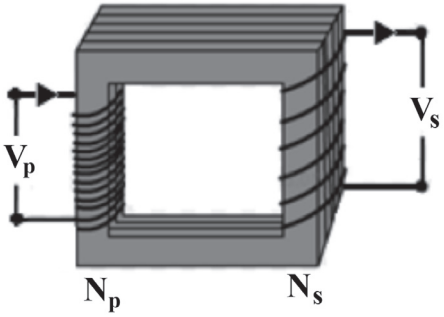
b. Draw the direction of the magnetic force acting on both wires in the figure above. [1 mark]

c. If both wires carry a current of **(4 A)** and are separated by a distance of **(7 m)**, calculate the magnetic force per unit length acting on each wire. [3 marks]

25) A charge of **(1C)** is passing with velocity **(v)** perpendicularly through a magnetic field **(B)**. When the velocity increased three times more, compare between the forces per unit charge using equations in both cases. [2 marks]

Extended Questions continued

26) The figure below shows an ideal transformer with a primary coil of **(400)** turns and a secondary coil of **(200)** turns.



a. What is the function of a transformer in general? [2 mark]

b. What is the type of the transformer shown in the diagram opposite? [1 mark]

c. What do we mean by an ideal transformer? [1 mark]

d. If the primary coil is connected to **(250 V)**, calculate the voltage of the secondary coil. [1½ marks]

e. If the current passing through the secondary coil is **(5 A)**, what is the current in the primary coil? [1½ marks]

[End of Examination]

FORMULA AND CONSTANTS

Forces and charge

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

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

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

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

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

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

$$W = q\Delta V$$

Magnetic forces and fields

$$F = BIL\sin\theta$$

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

$$F = Bqv$$

Electricity

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

$$V = IR$$

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

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

$$W = VIt$$

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

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

$$V = \varepsilon - Ir$$

$$R = R_1 + R_2$$

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

$$C = C_1 + C_2$$

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

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

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

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

$$\Phi = NAB$$

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

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

مُسَوَّدَة

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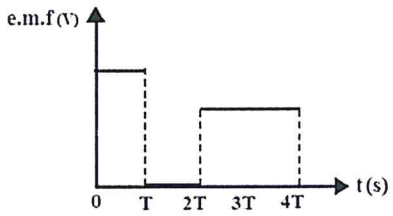
Physics 2014/2015 Bilingual Exams

1st Semester, 1stSession

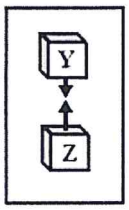
Marking Guide

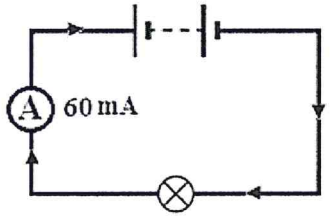
ANSWERS TO MULTIPLE CHOICE QUESTIONS:(28 marks)

Item	Answer	Answer	Mark	C.L	OB
1	d	Negative charges will be transferred from wool to rod.	2	K	1.1
2	c	2×10^{-9} C	2	A	1.4
3	c	7.13×10^{3} J	2	A	1.13
4	b	The flow rate of free electrons.	2	K	2.1
5	a	10 J/C	2	K	2.5
6	d	$\frac{2R}{5}$	2	A	2.18
7	c	6.67×10^{-3} J	2	A	2.26 2.27
8	b	A large current is flowing through a thick wire.	2	A	2.10 2.11
9	b	1.1×10^{-6} Ω.m.	2	R	2.11
10	a	9 μF	2	R	2.27
11	b	Increasing the cross section area (r).	2	K	3.2

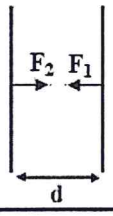
12	a	Into the page.	2	A	3.6
13	b	Move towards B	2	A	4.4
14	c		2	R	4.5

ANSWER OF EXTENDED QUESTIONS :(42 marks)

item	Part	answer	mark	C.L	OB
15		1- Increase the p.d. across the plates.(1mark) 2- Move the plates closer together. (1mark)	2	K	1.8
16	a	KE = W = 5×10^{-6} J	1	A	1.14
	b	$W = qV$ $V = \frac{w}{q} = \frac{5\times 10^{-6}}{8\times 10^{-9}}$ $V = 625V$	1 $\frac{1}{2}$	A	1.13
	c	$E = \frac{V}{d} = \frac{625}{0.03}$ E = 2.08×10^{4} N/C	1 $\frac{1}{2}$	A	1.8
17			1	K	1.6
18		Zero Since it comes back to the initial surface, there is no change in the electrical potential energy.	1 1 1	R	1.12

item	Part	answer	mark	C.L	OB
19	a	Ohm's Law states that the electric current (I) flowing through a conductor is directly proportional to the potential difference (V) across the ends of the conductor, if temperature and other physical conditions remain constant.	1 1	K	2.10
	b	$V = IR$ $I_1 = \frac{V}{R_1 + R_2} = \frac{4}{9+6} = \frac{4}{15}A$ $I_2 = \frac{V}{R_3 + R_4} = \frac{4}{6+6} = \frac{4}{12} = \frac{1}{3}A$ Potential difference across R_1: $V_1 = \frac{4}{15} \times 9 = 2.4V$ Potential difference across R_4: $V_3 = \frac{1}{3} \times 6 = 2V$	$\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	R	2.8
20	a		1	K	2.1
	b	$\Delta Q = I\Delta t$ $\Delta Q = 0.060 \times 300$ $= 18C$	 1 1	A	2.3

item	Part	answer	mark	C.L	OB
21	a	$I_3 = I_1 + I_2$ $\sum e.m.f = \sum p.d.$ $(loop\ 1)$ $6 = 4I_1$ $I_1 = 6/4 = 1.5A$ $I_2 = 2 - 1.5 = 0.5$ A	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	A	2.16 2.17
	b	-3 – (0.5) R+ (4) (1.5) = 0 3 = 0.5R R = 3/0.5 = 6Ω	1 $\frac{1}{2}$	A	2.16 2.17
22	a	e.m.f : energy transferred when a unit charge passes through a source of whole circuit.	1	K	2.14
	b	As the temperature increases, the collisions between free electrons and the metal's molecules increase. This means the electrons will face more resistance to move, therefore the conductivity decrease.	1 1	K	2.9
23	a	Charging	1	A	2.22
	b	$\mathcal{E} = 8$ V	1	A	2.22
	c	$C = \frac{Q}{V} = \frac{2400}{8} \times 10^{-6}$ $= 3 \times 10^{-4}$ F = 300μF	1 1	A	2.24

item	Part	answer	mark	C.L	OB
24	a	Quantity of flux passing through unit area at each point in the field.	1	K	3.4
	b		$\frac{1}{2}+\frac{1}{2}$	A	3.9
	c	$\frac{F}{l}=\frac{2\times10^{-7}\times16}{7}$ $=4.57\times10^{-7}N$	2 1	A	3.10
25		$F=QBv$ $\frac{F_1}{Q}=Bv$ $\frac{F_2}{Q}=B3v$ $\frac{F_2}{Q}=3\frac{F_1}{Q}$	$\frac{1}{2}$ $\frac{1}{2}$ 1	R	3.8
26	a	Changing the value of alternating voltage.	2	A	4.8
	b	Step-down	1	K	4.8
	c	No energy is lost	1	K	4.8
	d	$\frac{N_s}{N_p}=\frac{V_s}{V_p}$ $\frac{200}{400}=\frac{V_s}{250}$ $V_s=\frac{200\times250}{400}=125\,V$	1 $\frac{1}{2}$	A	4.8

item	Part	answer	mark	C.L	OB
	e	$\frac{N_s}{N_p} = \frac{I_p}{I_s}$ $\frac{200}{400} = \frac{I_p}{5}$ $I_p = \frac{200 \times 5}{400} = 2.5\ V$	1 $\frac{1}{2}$	A	4.8

End of Marking Guid