## الاجــــــــــــابات
## Part A: Electromagnetism
## $Q_1$ - <u>Choose the right answer:</u>          [24 Marks]

**1**- The electric field at a distance of 10 cm from an isolated point particle with a charge of $2\times10^{-9}$ is ($\varepsilon_o = 8.85 \times 10^{-12}$ C$^2$/N.m$^2$):

A.  1.8N/C          B.  180N/C          C.  18N/C          **D.   1800N/C**

**2**- Two charged particles $q_1 = 2C$ and $q_2 = -4C$ are arranged as shown. A third charge Q= +1 C, is located exactly at the middle between the two charges $q_1$ and $q_2$. What is the correct from the following:
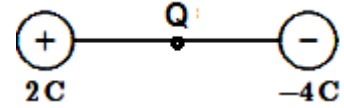
A.   The electric force $F_1$ between $q_1$ and Q is higher than that $F_2$ between $q_2$ and Q
**B.    The electric force $F_1$ between $q_1$ and Q is lower than that $F_2$ between $q_2$ and Q**
C.    Both forces $F_1$ and $F_2$ are equal
D.    None of these answers

**3**- The electric field between sheets with equal charges in magnitude and different in signs is

A. $E = \dfrac{Q}{A\varepsilon_0}$          B.  $E = \dfrac{Q\varepsilon_0}{A}$          C. $E = \dfrac{Q}{A}$          D.   $E = 0$

**4**-    Calculate the electric flux due to a charge q = 5 C inside a Gauss's surface of area 7.5 cm$^2$ .     ($\varepsilon_o = 8.85 \times 10^{-12}$ C$^2$/N.m$^2$)

A.  $7.53 \times 10^{14}$ Nm$^2$/C          B.  $4.24 \times 10^8$ Nm$^2$/C
C.  $4.43 \times 10^{-11}$ Nm$^2$/C          **D.  $5.65 \times 10^{11}$ Nm$^2$/C**

**5**-The potential difference ΔV equals to:

A.  **ΔV = q/4πε$_o$r**          B.  $\Delta V = q/4\pi\varepsilon_o r^2$          C.  $\Delta V = qE$          D.  $\Delta V = q/\varepsilon_o$

**6**- For the electric field given by   E = ϕ / A cosα  , which of the following is correct?

A.   "ϕ" is the electric potential          B.   "α" is the angle between  E  and  A
C.   "A" is the Gauss's surface          **D.    None of these answers**.

**7**-    The potential difference between two points is 100V. If a particle with a charge of 2C is transported from one of these points to the other, the magnitude of the work done is:

A.  2 J          B.  50 J          C.  100 J          **D.  200 J**

**8**- The ratio of the magnitude of the  electrical potential energy to the charge is defined as:

**A. Electric Potential**      B. Electric Field      C. Electric capacity      D. Work

**9**-The capacitance of a parallel plate capacitor that has plates of dimensions 4 cm by 3cm separated by 1 mm thickness of paper (k=3.7 , $\varepsilon_0 = 8.85 \times 10^{-12}$ C$^2$ /N.m$^2$ ) is .

A. 20 pF          B. 30 pF          **C.  40 pF**          D.  40 µF

**10**- The centripetal force F equals to:

A.  F = v/r          **B.  F = v$^2$/r**          C.  v/r$^2$          D.  v$^2$/r$^2$

**11**- A parallel-plate capacitor with air between the plates has an area A $= 2 \times 10^{-4}$ m$^2$ and a plate separation d = 1 mm. What is the capacitance? ($\varepsilon_o = 8.85 \times 10^{-12}$ C$^2$/N.m$^2$)

A.  44.3 10$^{-12}$ F          B.  44.3 µF          **C. 1.77 $\times$ 10$^{-12}$ F**  D.  1.77 µF

**12**-Four wires meet at a junction. The first $i_1$carries 4A into the junction, the second $i_2$carries 5Aout of the junction, and the third $i_3$carries 2A out of the junction. The fourth $i_4$carries:

A.   7A into the junction          B.   1A into the junction
C.   3A out of the junction          **D.   3 A into the junction**
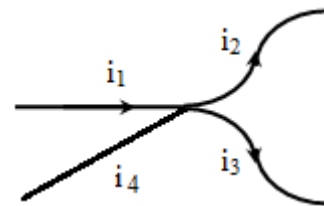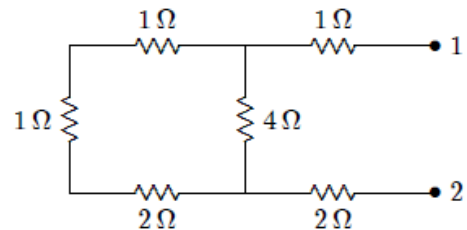
**13**- The unit of resistivity is:

A.  Ω          **B.  Ω.m**          C.  Ω/m          D.  Ω/m$^2$

**14**- The total number of electric field lines for point charge depends on

A.   Distance from the source          **B.  Charge**          C. enclosed surface          D. dimensions

**15**- The equivalent resistance between points 1 and 2 of the circuit shown is:

A. 3 Ω          B. 4 Ω

**C. 5 Ω**          D. 6 Ω

**16**- The magnetic field B is measured in units of:

A.  N/A          **B.  T**          C.  N/C          D.  T/C

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**Q$_2$ - Answer the two questions (16 Marks)**

**A**) Consider an electron travels with initial velocity $v_i$ to the right between two flat metal plates of length L and separation d as shown in figure. Derive a formula to calculate the axial velocity '$v_y$' and the axial displacement 'y'.
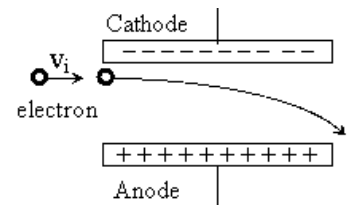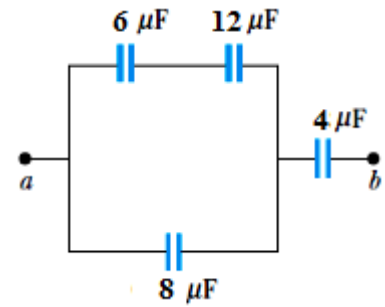
ANS:
E=V/d
F= ma=eE=eV/d
V=eVt/md

2

**Y=Vt= evt$^2$/md**

**B**) Four capacitors are connected as shown in Figure.
1- Find the equivalent capacitance between points a and b.
2-If we applied a potential difference $\Delta V_{ab}$ =15 V,calculate the charge on the capacitor of 4 µF.



**ANS;**
**In series**
**1/C$_{eq}$= 1/6+1/12= 3/12= ¼**
**Then C= 4 uf**
**The**
**4 uf capacitors is parallel with 8 uf**
**C= 4+8= 12**
**Then the total capacitance = 1/c= 1/12 +1/4 = 4/12**
**equivalent capacitance  = 3 µF**
**total charge = total capacitance x volt**
**          3 x15 =45 uC**
**Q at 4 uf = 22.5 uC**

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Constants:     $e = 1.6 \times 10^{-19}$ C        $\varepsilon_o = 8.85 \times 10^{-12}$ C$^2$/N.m$^2$