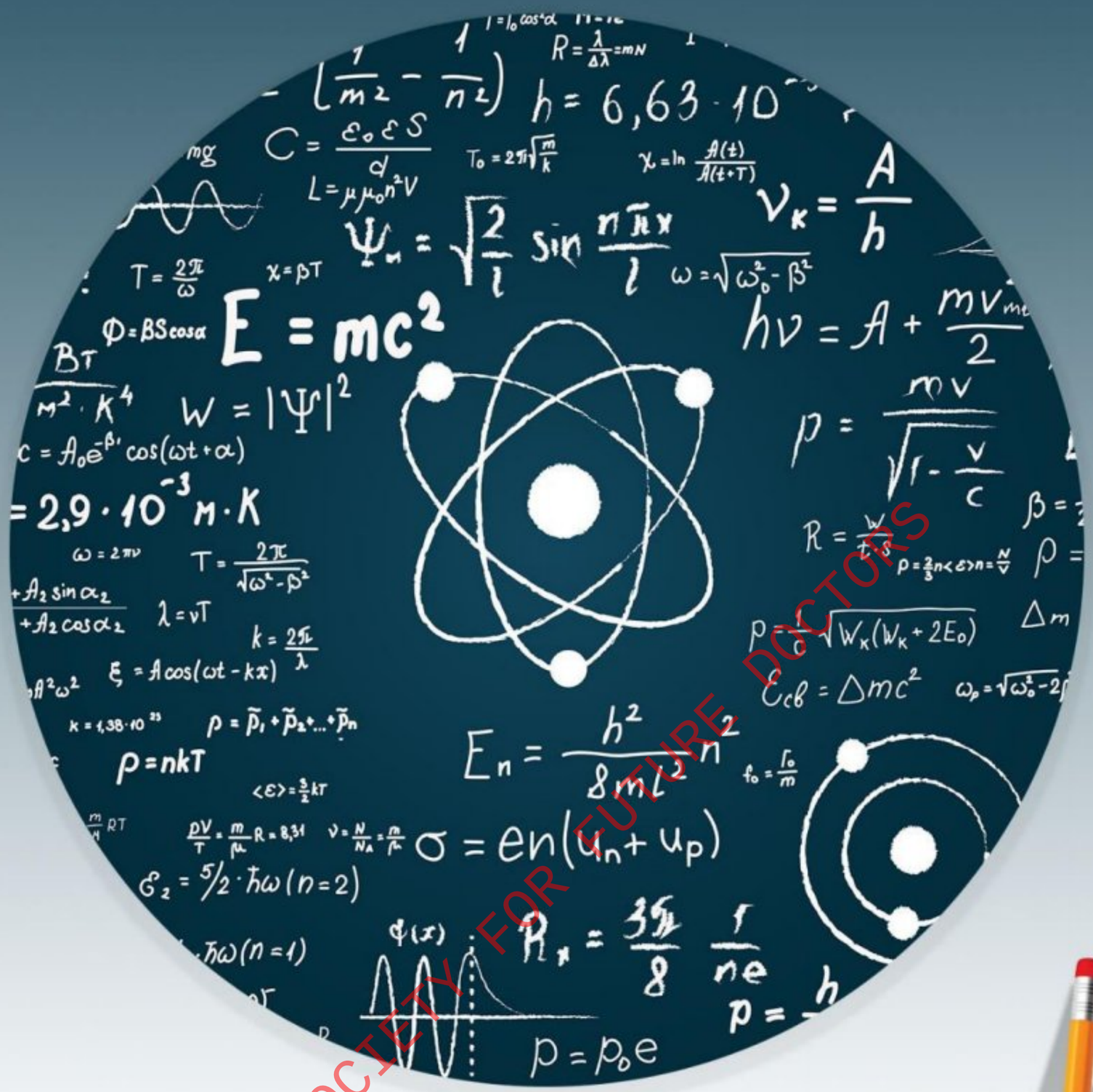
PHYSICS



WORKSHEET-1

STEP

A PROJECT BY PUNJAB GROUP

Worksheet-01

Topics:- Coulomb's Law, Electric Field Strength, Electric Potential & Potential Gradient, Electric field due to an infinite sheet of charge and between two oppositely charged parallel plates

USE THIS SPACE FOR SCRATCH WORK

Q.1 **The Coulomb's law is:**

$$\vec{F} = \frac{1}{4\pi\varepsilon_\circ}\frac{q_1 q_2}{r^2}\hat{r}$$

The units of "$\varepsilon_\circ$" are:

A) $N\ m^{-2}\ C^{-2}$
C) $N^{-1}\ m^{-2}\ C^{2}$
B) $N\ m^{-2}\ C^{2}$
D) None of these

Q.2 **The study of charges at rest under the action of electric forces is called:**

A) Electromagnetics
C) Electricity
B) Electrostatics
D) None of these

Q.3 **The existence of an object is primarily because of:**

A) Magnetic force
C) Gravitational force
B) Electric force
D) Nuclear force

Q.4 **Which one is sure test for the presence of charge on a body?**

A) Attraction
C) Both A and B
B) Repulsion
D) None of these

Q.5 **Coulomb's force:**

A) Obeys inverse square law
B) Depends on magnitudes of charges
C) Depends on medium between charges
D) All of these

Q.6 **A charge q is divided into two parts 'q_1 and $(q-q_1)$'. What is the ratio $\frac{q}{q_1}$ so that force between the two parts placed at a given distance is maximum?**

A) 1:1
C) 1:2
B) 2:1
D) 1:4

Q.7 **The ratio of the force between two charges in vacuum to that the force between two same charges when a medium is placed between them is:**

A) ε_r:1
C) $\varepsilon_\circ$:1

B) $1:\varepsilon_r$ D) $1:\varepsilon_\circ$

Q.8 The ratio of electric force to electric field strength gives the units of:

A) Current C) Time

B) Charge D) None of these

Q.9 The work done in carrying a unit positive charge from one point to other in electric field keeping the charge in equilibrium is called:

A) Electric potential energy

B) Electric potential difference

C) Electric field strength

D) None of these

Q.10 An ECG records _____ between points on human skin.

A) Current C) Voltage

B) Charge D) Electric field

Q.11 Which statement is true for two oppositely charged metal plates?

A) Electric field is constant between plates

B) Potential difference is constant between plates

C) Electric potential is zero at mid-point of plates

D) All of these

Q.12 If a charge of 5 C is moved against an electric field of 10 N C^{-1} through a distance of 5 m, the P.E gained by charge is:

A) 25 J C) 2 J

B) 200 J D) 250 J

Q.13 Two point charges each of magnitude "q" and opposite sign are separated by distance "2d". Which one of following statement is true?

A) Electric Potential at midpoint of charges is zero

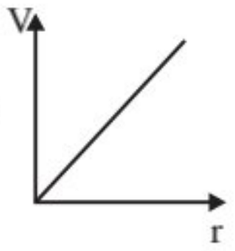
B) Electric field at midpoint of charges is not zero

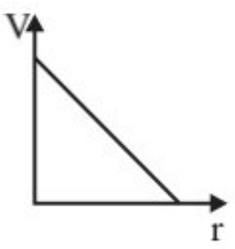
C) Potential difference (due to electric potentials of both charges) at midpoint is not zero

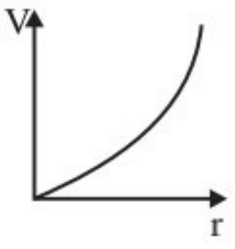
D) All of these

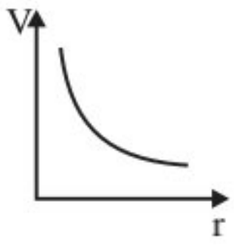
Q.14 The graph which correctly describes the relation between electric potential "V" at a point due to point charge and distance "r" from point charge is:

USE THIS SPACE FOR SCRATCH WORK

A) 

C) 

B) 

D) 

Q.15 **If the magnitude of a point charge is doubled and distance of a point from point charge is halved, then electric potential and electric field at that point becomes:**

A) Two times each

B) Two times & four times

C) Four times & Eight times

D) None of these

Q.16 **A particle carrying a charge of 10e falls through a potential difference of 5 V, the energy gained by it is:**

A) 50 eV

B) 5 eV

C) 3.2×10^{-18} J

D) Both A and C

Q.17 **The coulomb's force between two charges "q_1=2 μC" and "q_2" is 2 N. The distance between them is 3 m, what is the charge q_2?**

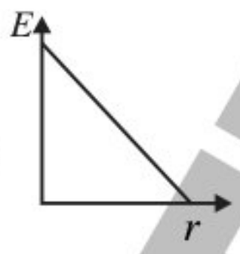
A) 1×10^{0} C

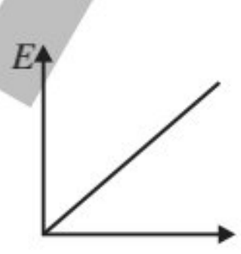
B) 1×10^{-3} C

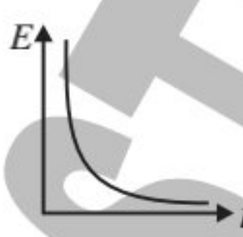
C) 2×10^{2} C

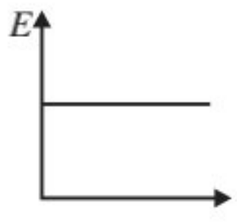
D) 4×10^{-2} C

Q.18 **While moving from positive plate of a charged capacitor towards its negative plate, the electric field "E" varies with distance covered "r" as:**

A) 

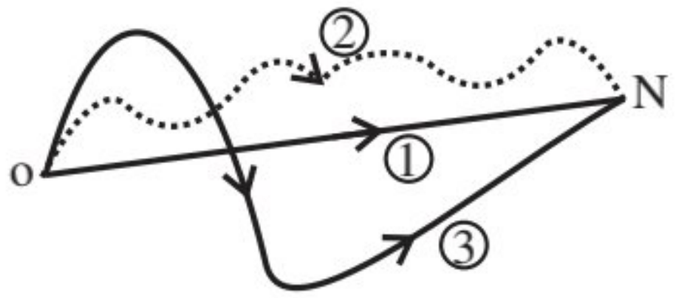
C) 

B) 

D) 

USE THIS SPACE FOR SCRATCH WORK

Q.19 **In the region of an electric field a charge is moved from "O" to "N" via three different paths W_1, W_2 and W_2 denote the work done along three paths. Then:**

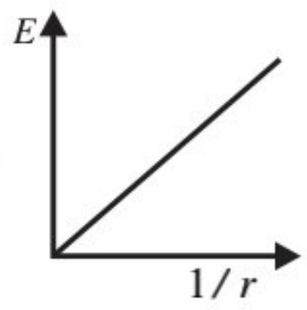


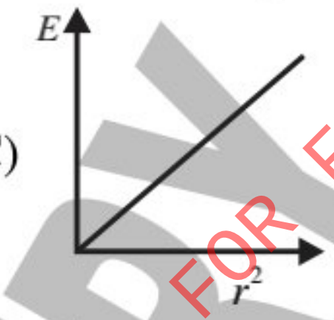
A) $W_1<W_2<W_3$
C) $W_1=W_2>W_3$
B) $W_1>W_2>W_3$
D) $W_1=W_2=W_3$

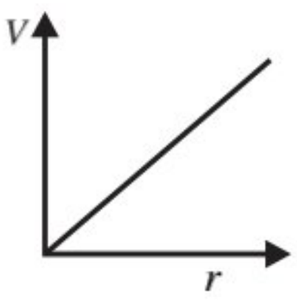
Q.20 **The electric field strength between two oppositely charged parallel plates is E. If the distance between the plates is halved and potential difference is doubled, then the electric field strength becomes:**

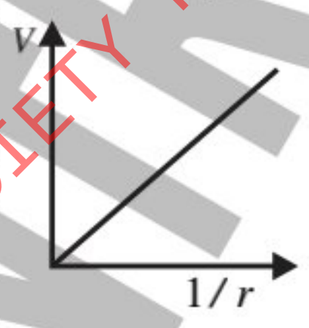
A) E
C) 4E
B) 2E
D) 8E

Q.21 **Which of the following is correct graph for a point charge?**

A)


C)


B)


D)


Q.22 **Two positive charges $q_1 = 16\ \mu C$ and $q_2 = 4\ \mu C$ are separated by a distance of 3 m. The distance of zero field spot from smaller charge is:**

A) 1 m
B) 2 m
C) 3 m
D) 4 m

Q.23 **The zero field spot in case of two unequal and opposite charges exist:**

A) Between the charges at mid-point
B) Between the charges but closer to smaller charge
C) Both A and B
D) None of these

Q.24 **If E_1 is the electric field near an infinite charged sheet and E_2 is the electric field between two oppositely**

USE THIS SPACE FOR SCRATCH WORK

charged plates then which statement is correct?

A) $E_1 = E_2$

C) $E_1 = 2E_2$

B) $E_1 = \frac{1}{2}E_2$

D) $E_1 = \frac{1}{4}E_2$

Q.25 **Electric field strength between two similar and equally charged Parallel plates is:**

A) $\frac{\sigma}{2\varepsilon_\circ}$

C) $\frac{2\sigma}{\varepsilon_\circ}$

B) $\frac{\sigma}{\varepsilon_\circ}$

D) Zero

USE THIS SPACE FOR SCRATCH WORK

ANSWER KEY (Worksheet-01)					
1	C	11	D	21	D
2	B	12	D	22	A
3	B	13	D	23	D
4	B	14	D	24	B
5	D	15	C	25	D
6	B	16	A		
7	A	17	B		
8	B	18	D		
9	B	19	D		
10	C	20	C		

SOLUTIONS

Unit – 6 (WS-01)

Q.1 Answer is "C"

Solution:- The units of "$\varepsilon_\circ$" are reciprocal of the units of "k".

Q.2 Answer is "B"

Solution:- "The study of charges at rest under the action of the electric force is named as electrostatics".

Q.3 Answer is "B"

Solution:- Matter is composed of atoms and existence of atom is primarily due to electric forces present in it.

Q.4 Answer is "B"

Solution:- If a test charge is brought near an object (about which we are going to find whether it is charged or not) and test charge is attracted towards it, this leads to two possibilities:

i. That object is oppositely charged

ii. That object is neutral but because of Electrostatic Induction it shows attraction for test charge.

Hence, attraction is not a sure test to find whether an object is charged or not.

Q.5 Answer is "D"

Solution:- Coulomb's law is given as

$$F = \frac{1}{4\pi\varepsilon_\circ\varepsilon_r}\frac{q_1q_2}{r_2}$$

$$F \propto q_1q_2 \ , \ F \propto \frac{1}{r^2} \ , \ F \propto \frac{1}{\varepsilon_r}$$

Q.6 Answer is "B"

Solution:- If the charge q is divided into equal parts, the product of these parts and electric force between them will be maximum. i.e $\Rightarrow q_1 = q - q_1$

Q.7 Answer is "A"

Solution:- The Coulomb's force in case of vacuum and medium is given as:

$$F_{vac} = \frac{1}{4\pi\varepsilon_\circ}\frac{q_1q_2}{r^2}; F_{med} = \frac{1}{4\pi\varepsilon_\circ\varepsilon_r}\frac{q_1q_2}{r^2}$$

Taking ratio

$$\frac{F_{vac}}{F_{med}} = \varepsilon_r$$

Q.8 Answer is "B"

Solution:- Electric field strength is defined as:

$$E = \frac{F}{q} \Rightarrow \frac{F}{E} = q = \text{coulomb}$$

Q.9 Answer is "B"

Solution:- Electric potential difference is defined as:

$$\Delta V = \frac{W_{AB}}{q_\circ}$$

Q.10 Answer is "C"

Solution:- ECG records electric voltage and display it on graph.

Q.11 Answer is "D"

Solution:- Between two oppositely charged metal plates:

i. $E = -\frac{\Delta V}{\Delta r} = \text{constant}$

ii. $\Delta V = -E\Delta r = \text{constant}$

iii. $V_{mid} = V_+ + V_- = \frac{kq}{r} - \frac{kq}{r} = 0$

Q.12 Answer is "D"

Solution:- $\Delta V = \frac{\Delta U}{q}$ …… (i)

Also $\Delta V = E\Delta r$ …… (ii)

Compare (i) and (ii) and solve for P.E.

Q.13 Answer is "D"

Solution:-

i. $V_{mid} = V_+ + V_- = \left(\frac{kq}{d}\right) + \left(\frac{k(-q)}{d}\right) = 0$

ii. $\vec{E}_{mid} = \vec{E}_+ + \vec{E}_- \neq 0$

iii. $\Delta V = V_+ - V_- = \left(\frac{kq}{d}\right) - \left(\frac{k(-q)}{d}\right) \neq 0$

Q.14 Answer is "D"

Solution:- $V \propto \frac{1}{r}$

Q.15 Answer is "C"

Solution:- $E = \frac{kq}{r^2}, V = \frac{kq}{r}$

Q.16 Answer is "A"

Solution:- $K.E = Q\Delta V$

Q.17 Answer is "B"

Solution:- Use Coulomb's law;

$$F = k\frac{q_1 q_2}{r_2} \Rightarrow q_2 = \frac{Fr^2}{kq_1}$$

Put the values and solve for q_2.

Q.18 Answer is "D"

Solution:- Electric field between capacitor plates is constant at every point. So, graph of electric field strength will be a horizontal straight line whether it is plotted against "r" or "1/r".

Q.19 Answer is "D"

Solution:- Electric field just like gravitational field is conservative so, work done is independent of path followed.

Q.20 Answer is "C"

Solution:- Electric field strength is given as

$$E = \frac{\Delta V}{\Delta r}$$

If $\Delta V' = 2\Delta V$ and $\Delta r' = \frac{1}{2}\Delta r$ then

$$E' = \frac{2\Delta V}{\frac{1}{2}\Delta r} = 4\frac{\Delta V}{\Delta r}$$

$$E' = 4E$$

Q.21 Answer is "D"

Solution:- $V = \frac{kq}{r} \Rightarrow V \propto \frac{1}{r}$

Q.22 Answer is "A"

Solution:- $E_1 = E_2 \Rightarrow k\frac{q_1}{(3-d)^2} = k\frac{q_2}{d^2}$

Q.23 Answer is "D"

Solution:- In this case zero field location cannot be present between the two charges as $\vec{E}$ starts from +ve and ends up at –ve, it must be on other side of smaller charge.

Q.24 Answer is "B"

Solution:- $E_1 = \frac{\sigma}{2\varepsilon_\circ}; E_2 = \frac{\sigma}{\varepsilon_\circ}$

Q.25 Answer is "D"