



PHYSICS

BOOKS - MBD -HARYANA BOARD

ELECTROSTATICS

Very Short Answer Type Questions

1. Write the vector form of force acting between two charges q_1 and q_2 having

\vec{r}_1 and \vec{r}_2 as their position vectors respectively.



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2. What is the Importance of expressing coulomb's law in vector form ?



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3. Derive an expression for the torque acting on an electric dipole placed in a uniform

electric field.



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4. Vehicles carrying inflammable material usually have metallic ropes touching the ground during motion, why?



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5. Calculate the distance between two protons such that the electrical repulsive force

between them is equal to the weight of either.



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6. State the principle of conservation of electric charge



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7. State the factor on which the capacitance of a parallel plate capacitor depends.



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8. Distinguish between electric potential and electric potential energy and state the relation between them.



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9. Why can one ignore quantization of electric charge, when dealing with macroscopic charges i.e. large scale charges?



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10. Establish relation between electric field and potential gradient.

Or

Derive relationship between Electric field intensity and potential gradient at a point in the electric field.



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11. Why no two electric lines of force can intersect each other ?



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12. Assertion: Electric field is always directed perpendicular to an equipotential surface.

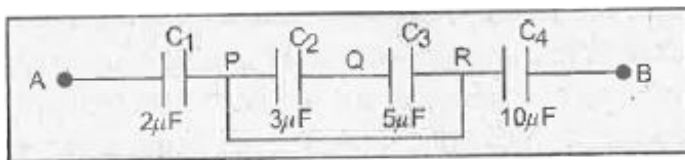
Reason: Equipotential surface is a surface on which at each point potential is same.



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13. Calculate the equivalent capacitance between two points A and B in the following

figure:



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14. What is meant by equipotential surface?

Show that the amount of work done in moving

a test positive charge along the equipotential

surface is zero.

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15. Draw a labelled diagram of vande Graaff generator.



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16. (a) An electrostatic field line is a continuous curve. That is a field line cannot have sudden breaks. Why not ?

(b) explain why two field lines never cross each other at any point.



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17. (a) Define the SI unit of capacitance.



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18. The dimensions of electric potential are



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19. Electric Flux



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20. Are we safer inside a house than under a tree during lightening?



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21. Symbol of variable capacitor is ___



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22. There are about _____ electrons in a charge of -1 coulomb.



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23. The quantization of charge reveals that



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24. Write the expression for energy stored in a capacitor in terms of capacitance and potential difference between the plates.



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25. Write the expression for energy density of electric field E in free space.



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26. SHARING OF CHARGE



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Short Answer Type Questions

1. Why are certain compounds called hydrocarbons? Write the general formula for homologous series of alkenes and alkynes and also draw the structure of the first member of each series. Write the name of the reaction that converts alkenes into alkanes and also write a chemical equation to show the necessary conditions for the reaction to occur.



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2. Derive an expression for electric field intensity at a point due to point charge.



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3. Explain what is meant by quantization of electric charge and conservation of electric charge.



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4. Give four properties of electric lines of force.

Or.

Give important properties of electric lines of forces.



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5. Apply Gauss's theorem to find an expression for the electric field intensity at a point due to a point charge.



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6. Derive an expression for electric field intensity E due to an infinite plane sheet of charge.



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7. Derive the expression for the electric potential at any point along the axial line of an electric dipole.



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8. Derive an expression for the potential energy of an electric dipole placed in a uniform electric field.



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9. Show that the capacitance of an insulated spherical conductor is directly proportional to the radius of the conductor.



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10. What amount of charge will be in 1600 electrons?



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11. Three capacitors of capacitance 2pF , 3pF and 4pF are connected in parallel. Determine the charge on each capacitor, if the combination is connected to a 100 V supply?



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Long Answer Type Questions

1. State Coulomb's law of force in electrostatics. Express it in vector form.



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2. What is an electric dipole? Derive expression of electric field intensity at a point on its axial line.



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3. Derive a relation for electric field of an electric dipole at a point on its equatorial line.



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4. State and prove Gauss's law in electrostatics.



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5. A charge is distributed uniformly over a ring of radius 'a'. Obtain an expression for the electric intensity E at a point on the axis of the ring. Hence show that for points at large distances from the ring, it behaves like a point charge.



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6. Define capacitance of a parallel plate capacitor, Derive an expression for the

capacitance of a parallel plate capacitor with dielectric of thickness "t," where "(t



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7. Derive expression for capacitance of a parallel plate capacitor and explain the combination of capacitors in series.

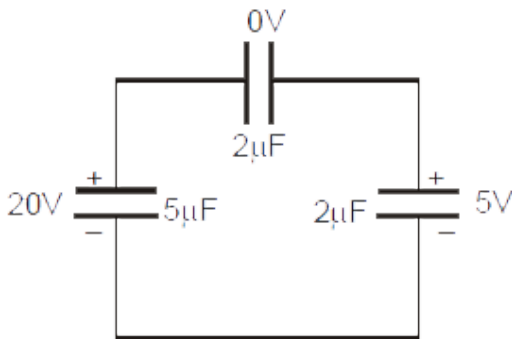
Or.

Write expression for three capacitors in series and parallel combinations.



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8. Find the final charge on each capacitor if they are connected as shown in the figure.



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9. Derive an expression for the capacitance of a parallel plate capacitor. Explain the effect of

dielectrics on capacitance of this capacitor.

Or.

Derive expression for capacitance of a parallel plate capacitor. Explain the effect of dielectrics on its capacitance.



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10. Write different expression for the energy stored in a capacitor.



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11. Determine electric field intensity near an infinitely long straight uniformly charge wire.

Or.

Using Gauss' law expression for electric field intensity at a point situated at a distance 'r' from an infinitely long, uniformly charged straight wire.



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12. Derive an expression for electric intensity E due to a uniformly charged thin spherical shell

at a point outside the shell.



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13. Electric field intensity at a point due to an infinite sheet of charge having surface charge density σ is E . If sheet were conducting electric intensity would be



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14. Two identical resistors, each of resistance $15\ \Omega$ are connected in (i) series and (ii) parallel, in turn to battery of 6V. Calculate the ratio of the power consumed in the combination of resistors in each case.



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Objective Type Questions

1. SI unit of ϵ_0 (permittivity of free space) is:

A. $C^{-2}N^1m^{-2}$

B. $C^2N^{-1}m^{-2}$

C. $N^1C^2m^{-2}$

D. $N^{-1}C^2m^2$

Answer: C



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2. The charge on an electron was calculated by

A. $-2.6 \times 10^{-19}C$

B. *zero*

C. 1C

D. $-1.6 \times 10^{-19} C$.

Answer: A



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3. In bringing an electron towards another electron, the electrostatic potential energy of the system

A. decreases

B. increases

C. remains same

D. becomes zero

Answer: B



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4. There are two charges $+1 \mu C$ and $+5 \mu C$, separated by a distance of 0.2 m in air, the ratio of forces acting in them will be:

A. 1 : 5

B. 5 : 1

C. 1 : 1

D. 1 : 25

Answer: C



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5. An electric dipole when placed in a uniform electric field E will have minimum potential

energy, if the positive direction of dipole moment makes the following angle with E

A. zero

B. π

C. $\frac{\pi}{2}$

D. $\frac{3\pi}{2}$

Answer: A



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6. The work done in carrying a charge of $5\mu\text{C}$ from a point A to a point B in an electric field is 10mJ . The potential difference ($V_B - V_A$) is then

A. -2kV

B. 2kV

C. 200V

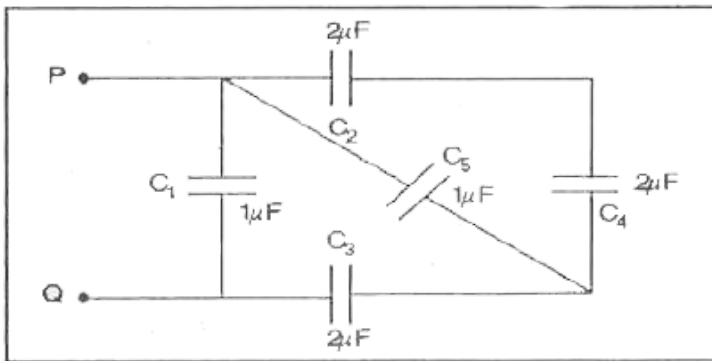
D. -200V

Answer: B



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7. Find the equivalent capacitance between P and Q in the circuit shown in the figure:



A. $2\mu F$

B. $4\mu F$

C. $6\mu F$

D. $3\mu F$

Answer: A



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8. When a capacitor is connected to a battery:

A. an alternating current flows in the circuit

B. current keeps on increasing and reaches maximum after some time

C. no current flows at all

D. a current flows for some times and finally it decreases to zero

Answer: D



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9. When the distance between two charged particles is doubled, the force between them becomes:

A. one-fourth

B. half

C. double

D. four times

Answer: D



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10. If E_a be the electric field strength of a short dipole at a point on its axial line and E_e

that on the equatorial line at the same distance, then

A. $E_e = 2E_a$

B. $E_a = 2E_e$

C. $E_a = E_e$

D. none of these

Answer: B



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11. Two point charges placed at a certain distance r in air exert a force F on each other. Then the distance r at which these charges will exert the same force in a medium of dielectric constant K is given by

A. r

B. $\frac{r}{k}$

C. $\frac{r}{\sqrt{k}}$

D. $r\sqrt{k}$

Answer: C



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12. SI unit of electric charge is

A. ampere

B. coulomb

C. volt

D. none of these

Answer: B



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13. A parallel plate capacitor is first charged and then isolated, and a dielectric slab is introduced between the plates. The quantity that remains unchanged is.

A. charge q

B. potential V

C. capacity C

D. energy U

Answer: A



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14. For capacitors in series combination, total capacitance C is given by

A. $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \dots$

B. $C = C_1 + C_2 + \dots$

C. $C = C_1C_2 + C_2C_3 + \dots$

D. $C + \frac{1}{C_1 + C_2 + \dots}$

Answer: A



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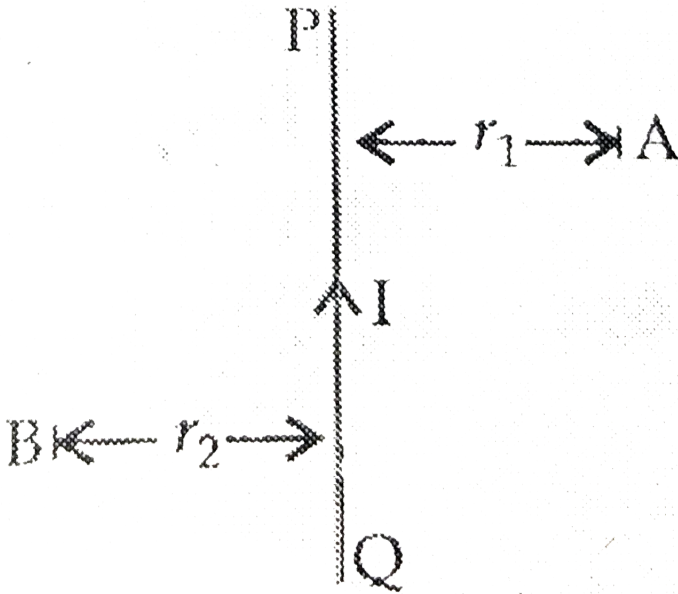
15. (i) State Maxwell's right-hand thumb rule.

(ii) PQ is a current carrying conductor in the plane of the paper as shown in the figure.

Mention the direction of magnetic fields produced by it at points A and B. Given

$r_1 < r_2$, where will the strength of the magnetic field be larger?

Justify your answer in each case.



A. PE

B. $PE \sin \theta$

C. $PE \cos \theta$

D. 0

Answer: B



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16. SI unit of electric capacitance is :

- A. a coulomb (1C)
- B. a volt (1V)
- C. a farad (1F)
- D. a volt-metre (1V-m)

Answer: C



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17. What is the charge on a metal when 5 electrons are removed from it?

A. $8.0 \times 10^{-19} C$

B. $16 \times 10^{-19} C$

C. $1.6 \times 10^{-19} C$

D. 0

Answer: A



18. Write the expression for energy density of electric field E in free space.

A. $1 / 2\epsilon_0 E^2$

B. $\epsilon_0 E^2$

C. $2\epsilon_0 E^2$

D. $\epsilon_0 E$

Answer: A



19. Mention the between a current carrying conductor and magnetic field for which the force experienced by this current conductor placed field is largest ?

A. 0°

B. 90°

C. 45°

D. 270°

Answer: A



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20. What is the value of mass and charge on the proton ?

A. $+ 1.6 \times 10^{-19}$

B. $- 1.6 \times 10^{-19} C$

C. $+ 1C$

D. zero

Answer: A



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21. The dimensions of capacitance are _____



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22. SI unit of electrostatic potential is

A. ohm

B. coulomb

C. volt

D. ampere

Answer: C



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23. On increasing temperature, the conductivity of pure semiconductors

A. decrease

B. increase

C. may increase or decrease

D. does not change

Answer: A



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