BOHRA PUBLIC SCHOOL

HOLIDAY ASSIGNMENT

Class 12 – Physics

Electric Charges and Fields

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1. A cylindrical conductor is placed near another positively charged conductor. The net charge acquired by the cylindrical conductor will be
    a. either positive or negative
    b. zero
    c. positive only
    d. negative only
2. Which of the following methods can be used to charge a metal sphere positively without touching it? Select the most appropriate.
    a. Bring a negatively charged rod near the sphere and touch it to ground for a short while.
    b. Rub it with a piece of fur.
    c. Rub it with a piece of silk.
    d. Connect the positive terminal of a battery and float the other end of the battery.
3. The direction of an electric dipole
    a. is from positive to negative charge
    b. is from negative to positive charge
    c. is perpendicular to line from negative to positive charge
    d. is perpendicular to line from positive to negative charge
4. Electric field at a point is defined as
    a. electric force experienced by two charges at that point
    b. electric force experienced by a charge at that point
    c. electric force per unit charge experienced by a unit charge at that point
    d. electric force experienced by a dipole at that point
5. If the amounts of electric flux entering and leaving an enclosed surface respectively are $\phi 1$ and $\phi 2$, the electric charge inside the surface will be :
    a. $(\phi 2+\phi 1)\varepsilon 0$
    b. $(\phi 2-\phi 1)\varepsilon 0$
    c. $(\phi 2+\phi 1)\varepsilon 0$
    d. $(\phi 2-\phi 1)\varepsilon 0$

6. Let E_a be the electric field due to a dipole in its axial plane distant l and let E_q be the field in the equatorial plane distant l. The relation between E_a and E_q is:
    a. $E_a = 2E_q$
    b. $E_a = E_q$
    c. $E_q = 2E_a$
    d. $E_a = 3E_q$
7. Consider a neutral conducting sphere. A positive point charge is placed outside the sphere. Then the net charge on the sphere is -
    a. Negative and distributed uniformly over the surface of the sphere
    b. Negative and distributed non–uniformly over the entire surface of the sphere
    c. Negative and appears only at the point on the sphere closest to the point charge
    d. Zero
8. The frequency of oscillation of an electric dipole moment having dipole moment p and rotational inertia I, oscillating in a uniform electric field E, is given by
    a. 12πIpE
    b. 12πpEI
    c. (2π)IpE
    d. (2π)pEI
9. Gauss's law states that the total electric field flux coming out of
    a. an open surface equals the net charge enclosed within the volume divided by ε0
    b. any surface equals the charge enclosed within the volume divided by ε0
    c. a closed surface in vacuum equals the net charge enclosed within the volume divided by ε0
    d. a closed surface equals the net charge enclosed within the volume
10. According to superposition of electric fields, the electric field of any combination of charges is the
    a. vector sum of the fields caused by the individual charges
    b. cross product of the individual fields
    c. vector sum of the individual charges
    d. scalar sum of the fields caused by the individual charges

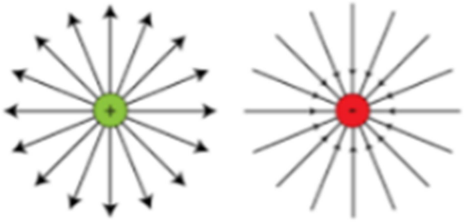
For question numbers 11-15, two statements are given- one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given

below:
Both A and R are true and R is the correct explanation of A.

a. Both A and R are true but R is not the correct explanation of A.
b. A is true but R is false.
c. A is false but R is true.

11. **Assertion (A):** A small metal ball is suspended in a uniform electric field with an insulated thread. If a high-energy X-ray beam falls on the ball, the ball will be deflected in the electric field.
Reason (R): X-rays emit photo-electrons and metal becomes negatively charged.
12. **Assertion (A):** Electron move away from a region of lower potential to a region of higher potential.
Reason (R): An electron has a negative charge.
13. **Assertion (A):** Ongoing away from a point charge or a small electric dipole, the electric field decreases at the same rate in both cases.
Reason (R): Electric field is inversely proportional to the square of the distance from the charge.
14. **Assertion (A):** When charges are shared between two bodies, there occurs no loss of charge but there does occur a loss of energy.
Reason (R): In case of sharing of charges, conservation of energy fails.
15. **Assertion (A):** A metallic shield in form of a hollow shell may be built to block an electric field.
Reason (R): In a hollow spherical shield, the electric field inside it is zero at every point.

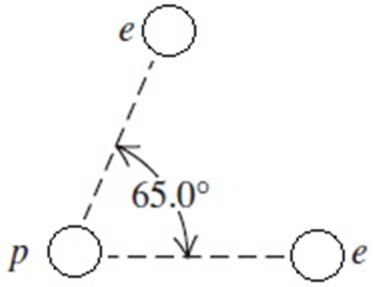
Answer questions 16-20 based on the following case study:
A charge is a property associated with the matter due to which it experiences and produces an electric and magnetic field. Charges are scalar in nature and they add up like real numbers. Also, the total charge of an isolated system is always conserved. When the objects rub against each other charges acquired by them must be equal and opposite.



Electric field lines of a positive point charge Electric field lines of a negative point charge

16. The cause of charging is:
    a. the actual transfer of protons
    b. the actual transfer of electrons
    c. the actual transfer of neutrons
    d. none of the above
17. Pick the correct statement.

    a. The glass rod gives protons to silk when they are rubbed against each other.
    b. The glass rod gives electrons to silk when they are rubbed against each other.
    c. The glass rod gains protons from silk when they are rubbed against each other.
    d. The glass rod gains electrons when they are rubbed against each other.
18. If two electrons are each 1.5×10−10m from a proton, as shown in Figure, magnitude of the net electric force they will exert on the proton is



    a. 1.97×10−8N
    b. 2.73×10−8N
    c. 3.83×10−8N
    d. 4.63×10−8N
19. A charge is a property associated with the matter due to which it produces and experiences :

    a. electric effects only
    b. magnetic effects only
    c. both electric and magnetic effects
    d. none of these
20. The cause of quantization of electric charges is:

    a. transfer of an integral number of neutrons
    b. transfer of an integral number of protons
    c. transfer of an integral number of electrons

d. none of the above

Electrostatic Potential and Capacitance

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1. For a parallel plate capacitor and a dielectric of dielectric constant K, when a dielectric material is inserted between the plates while charge is _____ , the potential difference between the plates decreases by a factor K.
    a. varies continuously
    b. increased
    c. decreased
    d. kept constant
2. In the capacitor of capacitance C, charge Q and energy W is stored. If charge is increased upto 2 Q, the energy stored will be
    a. 2 W
    b. W4
    c. 4W
    d. W2
3. The capacitance of a parallel plate capacitor is 5 μF . When a glass slab of thickness equal to the separation between the plates is introduced between the plates, the potential difference reduces to 18 of the original value. The dielectric constant of glass is
    a. 8
    b. 5
    c. 1.6
    d. 40
4. Dielectric polarization is the phenomenon, in which atomic dipoles are aligned
    a. at an acute angle to the direction of the electric field
    b. perpendicular to the direction of the electric field
    c. in the direction of the electric field
    d. opposite to the direction of the electric field
5. When two charged conductors are connected by a wire,
    a. there is always gain of energy
    b. there is loss or gain of energy depending upon the potentials
    c. there will not be any change in energy
    d. there is always loss of energy
6. A charged sphere of radius a is put in contact with another uncharged sphere of radius b. The ratio of original surface density to that of final surface density of charge on first sphere is

a. ab
b. a+ba
c. ba+b
d. ba

7. A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system:
   a. decreases by a factor of 2
   b. increases by a factor of 4
   c. increases by a factor of 2
   d. remains the same
8. In a region, the potential is represented by V(x, y, z) = 6x - 8xy - 8y + 6yz, where V is N volts and x, y, z are in metres. The electric force experienced by a charge of 2 coulomb situated at point (1, 1, 1) is:
   a. 435 N
   b. 65 N
   c. 24 N
   d. 30 N
9. Three capacitors connected in series have an effective capacitance of 2 μF. If one of the capacitors is removed, the effective capacitance becomes 3 μF. The capacitance of the capacitor that is removed is
   a. 32μF
   b. 23μF
   c. 6 μF
   d. 1 μF
10. The electric potential at a point (x, y, z) is given by $V = -x^2y - xz^3 + 4$. The electric field $E\rightarrow$ at that point is:
    a. E→=i^2xy+j^(x2+y2)+k^(3xz−y2)
    b. E→=i^z3+j^xyz+k^z2
    c. E→=i^(2xy−z3)+j^xu2+k^3z2x
    d. E→=i^(2xy+z3)+j^x2+k^3xz2

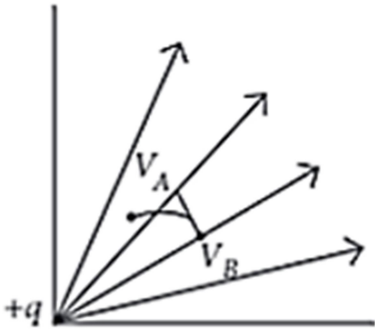
a. Both A and R are true and R is the correct explanation of A.
b. Both A and R are true but R is not the correct explanation of A.
c. A is true but R is false.
d. A is false but R is true.

11. **Assertion (A):** Three equal charges are situated on a circle of radius r such that they form an equilateral triangle, then the electric field intensity at the center is zero.
    Reason (R): The force on the unit positive charge at the center, due to

the three equal charges is represented by the three sides of a triangle taken in the same order. Therefore, the electric field intensity at the center is zero.

12. **Assertion (A):** Electric potential and electric potential energy are different quantities.
    Reason (R): For a system of positive test charge and point charge electric potential energy = electric potential.
13. **Assertion (A):** Increasing the charge on the plates of a capacitor means increasing the capacitance.
    Reason (R): For a capacitor $Q = CV \Rightarrow Q \propto C$.
14. **Assertion (A):** If the distance between parallel plates a capacitor is halved and dielectric constant is made three times then the capacitance becomes six times.
    Reason (R): Capacitance of the capacitor does not depend upon the nature of the material of the plates of the capacitor.
15. **Assertion (A):** Electric energy resides out of the spherical isolated conductor.
    Reason (R): The electric field at any point inside the conductor is zero.

Answer questions 16-20 based on the following case study:
Electrostatic potential energy of a system of point charges is defined as the total amount of work done in bringing the different charges to their respective positions from infinitely charge mutual separations. The work is stored in the system of two point charges in the form of electrostatic potential energy U of the system. Electric potential difference between any points A and B in an electric field is the amount of work done in moving a unit positive test charge from A to B along any path agents the electrostatic force $V_B - V_A = W_{AB}/q_o = \int \vec{E} \cdot d\vec{l}$.



16. A test charge is moved from a lower potential point to a higher potential point. The potential energy of test charge will
    a. remain the same
    b. increase

c. decrease
d. become zero

17. Which of the following statement is not true?

a. Electrostatic force is a conservative force.
b. Potential energy of charge q at a point is the work done per unit charge in bringing a charge from any point to infinity.
c. Spring force and gravitational force are a conservative force.
d. Both electrostatic force is a conservative force and Spring force and gravitational force are conservative force.

18. Work done in moving a charge from one point to another inside a uniformly charged conducting sphere is

a. always zero
b. non-zero
c. may be zero
d. none of these

19. The work done in bringing a unit positive charge from infinite distance to a point at distance x from a positive charge Q is W. Then the potential ϕ at that point is

a. WQx
b. W
c. Wx
d. WQ

20. If 1 μC charge is shifted from A to B and it is found that work done by an external force is 40 μ J. In doing so against electrostatics force, the potential difference $V_A - V_B$ is

a. 40V
b. -40V
c. 20V
d. -60V

Current Electricity

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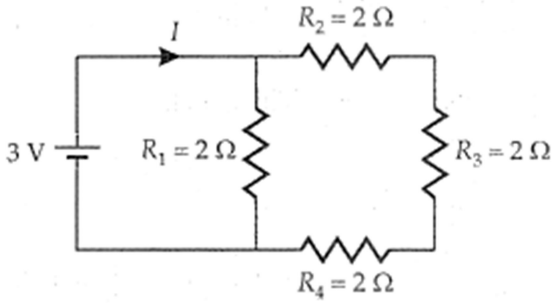
1. Which of the following is responsible for the flow of current in a conductor?
    a. Protons
    b. Positive ions
    c. Protons and holes
    d. Free electrons
2. A carbon resistance is having the following coding: green, orange, black, gold. The resistance of the resistor is:
    a. $53 \times 10^0 \pm 5\%$
    b. $53 \times 10^0 \pm 10\%$
    c. $53 \times 10^1 \pm 5\%$
    d. $53 \times 10 \pm 10\%$
3. What is the current I in the circuit as below?



    a. 1 A
    b. 1.2 A
    c. 0.5 A
    d. 2 A
4. The equivalent resistance of two resistances P and Q which are in series is
    a. PQ(P+Q)
    b. P×PP+Q
    c. Q×Q(P+Q)
    d. P + Q
5. Two cells of 1.25 V and 0.75 V are connected in series with anode of one connected to cathode of the other. The effective voltage will be
    a. 0.75 V
    b. 0.50 V
    c. 1.25 V
    d. 2.0 V

6. The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of 10 Ω is:
    a. 1.0 Ω
    b. 0.5 Ω
    c. 0.8 Ω
    d. 0.2 Ω
7. A wire of resistance 10 Ω is elongated by 10%. The resistance of the elongated wire is:
    a. 12.1 Ω
    b. 13.1 Ω
    c. 10.1 Ω
    d. 11.1 Ω
8. The internal resistance of the primary cell is 4 Ω. It generates a current of 0.2 A in an external resistance of 21 Ω. The rate at which chemical energy is consumed which is providing the current is:
    a. 5 J/s
    b. 0.42 J/s
    c. 0.24 J/s
    d. 1 J/s
9. Meter Bridge is used to
    a. determine unknown emf 'e'
    b. determine unknown voltage v
    c. determine unknown power 'P'
    d. determine unknown resistance R
10. A cell of emf 1.5 V and internal resistance 2 Ω is connected to two resistors of 5 Ω and 8 Ω in series. The potential difference across the 5 Ω resistor will be:
    a. 0.33 V
    b. 0.5 V
    c. 1 V
    d. 3.3 V

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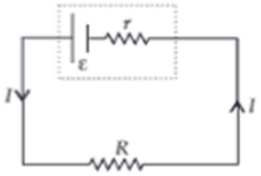
11. **Assertion:** A potentiometer of a longer length is used for accurate measurement.
    Reason: The potential gradient for a potentiometer of longer length with a given source of e.m.f. becomes small.
12. **Assertion (A):** Gases become conducting only when their pressure is lowered.
    Reason (R): At low pressure, the discharge current is high.
13. **Assertion (A):** A current continues to flow in the superconducting coil even after the switch is off.
    Reason (R): Superconducting coils show the Meissner effect.
14. **Assertion (A):** In a parallel combination of electrical appliances, total power consumption is equal to the sum of the powers of the individual appliances.
    Reason (R): In parallel combination, the voltage across each appliance is the same, as required for the proper working of the electrical appliances.
15. **Assertion (A):** Light is produced in gases in the process of electric discharge through them at high pressure.
    Reason (R): At high-pressure electrons of gaseous atoms collide and reach an excited state.

Answer questions 16-20 based on the following case study:
Emf of a cell is the maximum potential difference between two electrodes of the cell when no current is drawn from the cell. Internal resistance is the resistance offered by the electrolyte of a cell when the electric current flows through it. The internal resistance of a cell depends upon the following factors; (i) distance between the electrodes (ii) nature and temperature of the electrolyte (iii) nature of electrodes (iv) area of electrodes.



For a freshly prepared cell, the value of internal resistance is generally low and goes on increasing as the cell is put to more and more use. The potential difference between the two electrodes of a cell in a closed circuit is called terminal potential difference and its value is always less than the emf of the cell in a closed circuit. It can be written as $V=\varepsilon-Ir$.

16. The terminal potential difference of two electrodes of a cell is equal to emf of the cell when
    a. $I \neq 0$

b. $I = 0$
c. both $I \neq 0$ and $I = 0$
d. neither $I \neq 0$ and $I = 0$

17. A cell of emf ε and internal resistance r gives a current of 0.5 A with an external resistance of 12Ω and a current of 0.25 A with an external resistance of 25Ω. What is the value of internal resistance of the cell?

a. 5 Ω
b. 1 Ω
c. 7 Ω
d. 3 Ω

18. Choose the wrong statement.

a. Potential difference across the terminals of a cell in a closed circuit is always less than its emf.
b. Internal resistance of a cell decrease with the decrease in temperature of the electrolyte.
c. Potential difference versus current graph for a cell is a straight line with a -ve slope.
d. Terminal potential difference of the cell when it is being charged is given as $V = \varepsilon + Ir$.

19. An external resistance R is connected to a cell of internal resistance r, the maximum current flows in the external resistance, when

i. $R = r$
ii. $R < r$
iii. $R > r$
iv. $R = 1r$

17. IF external resistance connected to a cell has been increased to 5 times, the potential difference across the terminals of the cell increases from 10 V to 30 V. Then, the emf of the cell is

a. 30 V
b. 60 V
c. 50 V
d. 40 V