CBSE

ELECTROSTATIC POTENTIAL AND CAPACITANCE WS 1

Class 12 - Physics

1. The energy stored in a capacitor of capacitance C and potential V is given by: **[1]**

   a) $\frac{1}{2}C^2V$ b) $\frac{1}{2}\mathrm{CV}$

   c) $\frac{1}{2}C^2V^2$ d) $\frac{1}{2}CV^2$

2. The capacitance of a parallel plate capacitor is $10\mu\mathrm{F}$. When a dielectric plate is introduced in between the plates, its potential becomes $\frac{1}{4}$ th of its original value. What is the value of the dielectric constant of the plate introduced? **[1]**

   a) 20 b) 4

   c) 40 d) 2.5

3. Potential energy of two equal +ve charges 1μC each held 1 m apart in air is: **[1]**

   a) $9 \times 10^{-3} eV$ b) $9 \times 10^{-3} J$

   c) zero d) 1 J

4. A series combination of n_1 capacitors, each of value C_1 is charged by a source of potential difference 4V. When another parallel combination of n_2 capacitors, each of value C_2, is charged by a source of potential difference V, it has the same (total) energy stored in it, as the first combination has. The value of C_2, in terms of C_1, is then: **[1]**

   a) $\frac{2C_1}{n_1n_2}$ b) $2\frac{n_2}{n_1}C_1$

   c) $16\frac{n_2}{n_1}C_1$ d) $\frac{16C_1}{n_1n_2}$

5. In the process of charging of a capacitor, the current produced between the plates of the capacitor is: where symbols have their usual meanings. **[1]**

   a) $\varepsilon_0\frac{\mathrm{d}\phi_\mathrm{E}}{\mathrm{dt}}$ b) $\mu_0\frac{\mathrm{d}\phi_E}{\mathrm{dt}}$

   c) $\frac{1}{\mu_0}\frac{\mathrm{d}\phi_E}{dt}$ d) $\frac{1}{\varepsilon_0}\frac{\mathrm{d}\phi_\mathrm{E}}{\mathrm{dt}}$

6. For a charged conductor of arbitrary shape, inside the conductor **[1]**

   a) V= 0 and $\mathrm{E} \neq 0$ b) E and V are zero

   c) E = 0, but V is same as on the surface and non-zero d) E is non-uniform but V is zero everywhere

7. Which of the following is not the property of equipotential surfaces? **[1]**

   a) They are concentric spheres for uniform electric fields. b) They can be imaginary spheres.

   c) They do not cross each other. d) Rate of change of potential with distance on them is zero.

8. The action of the dielectric to increase the capacitance is due to **[1]**

a) neutralization of charges

b) electric polarization

c) movement of charges to the sides of dielectric

d) dipole orienting parallel to the plates

9. If the potential difference between the plates of a capacitor is increased by 0.1%, the energy stored in the capacitor increases by **[1]**

a) 0.1%

b) 0.11%

c) 0.2%

d) 0.144%

10. The earth has volume V and surface area A, then capacitance would be: **[1]**

a) $12\pi\varepsilon_0\frac{V}{A}$

b) $4\pi\varepsilon_0\frac{V}{A}$

c) $4\pi\varepsilon_0\frac{A}{V}$

d) $12\pi\varepsilon_0\frac{A}{V}$

11. An electric charge 10^{-3} μ C is placed at the origin (0, 0) of the (x-y) coordinate system. Two points A and B are situated at $(\sqrt{2}, \sqrt{2})$ and (2, 0) respectively. The potential difference between points A and B will be **[1]**

a) zero

b) 9 volt

c) 4.5 volt

d) 2 volt

12. 0.2 F capacitor is charged to 600 V by a battery, on removing the battery, it is connected with another parallel plate condenser of 1 F. the potential decreases to: **[1]**

a) 300 V

b) 100 V

c) 600 V

d) 120 V

13. A large solid sphere with uniformly distributed positive charge has a smooth narrow tunnel through its centre. A small particle with a negative charge, initially at rest far from the sphere, approaches it along the line of the tunnel, reaches its surface with a speed v, and passes through the tunnel. Its speed at the centre of the sphere will be **[1]**

a) $\sqrt{1.5}v$

b) 0

c) $\sqrt{2}v$

d) v

14. The plates of a parallel plate capacitor are 10 cm apart and have area equal to $2m^2$. If the charge on each plate is $8.85 \times 10^{-10}C$, the electric field at a point **[1]**

a) between the plates will be zero

b) outside the plates will be zero

c) between the plates will be $25\mathrm{NC}^{-1}$

d) between the plates will change from point to point

15. The magnitude of the electric field in the annular region of a charged cylindrical capacitor **[1]**

a) varies as $\frac{1}{r^2}$ where r is the distance from the axis

b) varies as $\frac{1}{r}$ where r is the distance from the axis

c) is the same throughout

d) is higher near the outer cylinder than near the inner cylinder

16. An electrolytic capacitor is marked 8 μF, 220 V. It can be used in a circuit where the p.d. across the capacitor may be **[1]**

a) 200 V

b) 300 V

c) 1000 V

d) 500 V

17. A long, hollow conducting cylinder is kept co-axially inside another long, hollow conducting cylinder of a larger radius. Both the cylinders are initially electrically neutral. **[1]**

Which of the following statements is correct based on the above-mentioned condition?

a) No potential difference appears between the two cylinders when same charge density is given to both the cylinders.

b) A potential difference appears between the two cylinders when a charge density is given to the outer cylinder.

c) No potential difference appears between the two cylinders when a uniform line charge is kept along the axis of the cylinders.

d) A potential difference appears between the two cylinders when inner cylinder is charged.

18. In a certain charge distribution, all points having zero potential can be joined by a circle S. Points inside S have positive potential and points outside S have negative potential. A positive charge, which is free to move, is placed inside S. **[1]**

a) It will remain in equilibrium

b) It may move, but will ultimately return to its starting point

c) It must cross S at some time

d) It can move inside S, but it cannot cross S

19. Capacitance (in F) of a spherical conductor of radius 1 m is **[1]**

a) 10^{-6}

b) $1 \cdot 1 \times 10^{-10}$

c) 10^{-3}

d) 9×10^{-9}

20. A parallel plate capacitor is charged to V volt by a battery. The battery is disconnected and the separation between the plates is halved. The new potential difference across the capacitor will be **[1]**

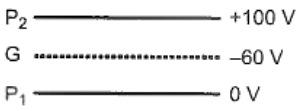
a) $\frac{V}{2}$

b) 2V

c) V

d) $\frac{V}{4}$

21. Following figure represents a parallel plate capacitor with a grid halfway with the voltages shown; an electron starting from plate P_1 will: **[1]**



a) not be able to reach the plate P_2

b) reach P_2 with 100 eV kinetic energy

c) reach P_2 with 40 eV kinetic energy

d) reach P_2 with 140 eV kinetic energy

22. The surface charge density (in C/m^2) of the earth is about: **[1]**

a) 10^{9}

b) -10^{9}

c) 10^{-9}

d) -10^{-9}

23. A parallel plate capacitor is charged by connecting it to a battery. Which of the following will remain constant if the distance between the plates of the capacitor is increased in this situation? **[1]**

a) Energy stored

b) Capacitance

c) Electric field

d) Potential difference

24. Submarine cables act as **[1]**

a) spherical capacitor

b) cylindrical capacitor with inner cylinder earthed

c) parallel plate capacitor

d) cylindrical capacitor with outer cylinder earthed

25. A metal plate of thickness half the separation between the capacitor plates of capacitance C, is inserted between the plates. The new capacitance is **[1]**

a) $\frac{C}{2}$

b) zero

c) C

d) 2C

26. The capacity of a pure capacitor is 1 farad. In DC circuit, its effective resistance will be **[1]**

a) infinite

b) zero

c) 1 ohm

d) 2 ohm

27. The dimension of $\frac{1}{2}\varepsilon_0 E^2$ where ε_0 is the permittivity of free space and E is the electric field, is **[1]**

a) $ML^{-1}T^{-2}$

b) MLT^{-1}

c) ML^2T^{-2}

d) ML^2T^{-1}

28. The dielectric constant K of an insulator will be - **[1]**

a) 0.4

b) 4

c) - 4

d) 0

29. A parallel plate air capacitor has capacity C distance of separation between plates is d and potential difference V is applied between the plates. Force of attraction between the plates of the parallel plate air capacitor is **[1]**

a) $\frac{CV^2}{2d}$

b) $\frac{C^2V^2}{2d^2}$

c) $\frac{C^2V^2}{2d}$

d) $\frac{CV^2}{d}$

30. A parallel plate capacitor of value $1.77\mu\text{F}$ is to be designed using a dielectric material (dielectric constant 200, breakdown strength of $3 \times 10^{-6}\text{Vm}^{-1}$). In order to make such a capacitor, which can withstand a potential difference of 20 V across the plates, the separation d between the plates and the area A of the plates should be **[1]**

a) $d = 10^{-5}$ m, $A = 10^{-2}$ m^2

b) $d = 10^{-4}$ m, $A = 10^{-4}$ m^2

c) $d = 10^{-4}$ m, $A = 10^{-5}$ m^2

d) $d = 10^{-6}$ m and $A = 10^{-4}$ m^2

31. Top of the stratosphere has an electric field E (in units of V/m) nearly equal to: **[1]**

a) 0

b) 10

c) 100

d) 1000

32. Capacitance of a parallel plate capacitor can be increased by **[1]**

a) decreasing the area of plates.

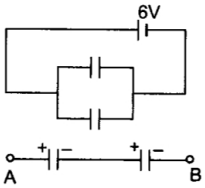
b) decreasing the distance between the plates.

c) increasing the thickness of the plates.

d) increasing the distance between the plates.

33. Two identical parallel-plate capacitors are connected in parallel and joined to a 6-V battery. The battery is then **[1]**

disconnected and the two capacitors are joined in series, as shown. The potential difference between the mints A and B is



a) 24 V

b) 3 V

c) 6 V

d) 12V

34. If a dielectric plate of thickness t is placed between the plates of a parallel plate capacitor of plate distance d, the capacitance becomes half of the original value. The dielectric constant of the plate will be **[1]**

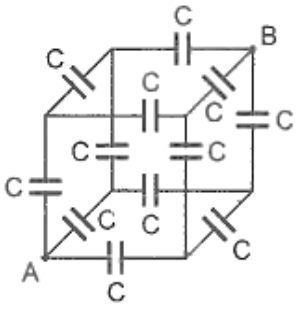
a) $\frac{2t}{2d+t}$

b) $\frac{t}{d-t}$

c) $\frac{t}{d+t}$

d) $\frac{2t}{2d-t}$

35. The equivalent capacity between points A and B shown in the figure is: **[1]**



a) $(\frac{5}{6})C$

b) C

c) 30 C

d) $(\frac{6}{5})C$

36. A charged particle is placed between the two plates of a charged parallel plate capacitor. It experiences a force F. If one plate is removed, then the force on the particle will be **[1]**

a) 2F

b) $\frac{F}{2}$

c) Zero

d) F

37. The potential at the centre of the sphere, if the hollow metallic sphere of radius 10 cm is charged such that the potential of its surface is 70 V, is **[1]**

a) 35 V

b) 7 V

c) 70 V

d) 100 V

38. Four capacitors each of 25μF are connected in parallel. The voltmeter across them shows a dc of 200 V. The charge on each plate of capacitor is: **[1]**

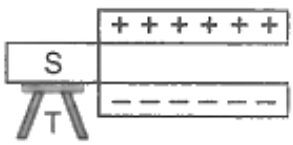
a) $\pm 2 \times 10^{-3} C$

b) $\pm 5 \times 10^{-2} C$

c) $\pm 2 \times 10^{-2} C$

d) $\pm 5 \times 10^{-3}\ C$

39. A frictionless dielectric slab S is placed on a frictionless table T near a charged parallel plate capacitor C having frictionless plates as shown in the diagram. The slab is held between them. When the slab is released: **[1]**



a) none is true

b) it would stay on the table

c) it would be pulled inside and would come to rest occupying the space in between the plates

d) it would be pulled by the capacitor and will move out of the other end

40. A parallel plate capacitor of 1 μF capacity is discharging through a resistor. If its energy reduces to half in one second, the value of resistance will be: **[1]**

a) $\frac{9}{\ln(2)}\mathrm{M}\Omega$

b) $\frac{4}{\ln(2)}\mathrm{M}\Omega$

c) $\frac{2}{\ln(2)}\mathrm{M}\Omega$

d) $\frac{16}{\ln(2)}\mathrm{M}\Omega$

41. A capacitor of capacitance C is fully charged by a 200 V supply. It is then discharged through a small coil of resistance wire embedded in a thermally insulated block of specific heat $2.5 \times 10^2 \mathrm{Jkg^{-1}K^{-1}}$ and of mass 0.1 kg. If the temperature of the block rises by 0.4 K, what is the value of C? **[1]**

a) 500 μF

b) 400 μF

c) 300 μF

d) 200 μF

42. A capacitor of capacitance C_1 is charged upto potential V and then connected in parallel to an uncharged capacitor of capacitance C_2. The final potential difference across each capacitor will be: **[1]**

a) $\left(1+\frac{C_2}{C_1}\right)V$

b) $\left(1-\frac{C_2}{C_1}\right)V$

c) $\frac{C_1V}{C_1+C_2}$

d) $\frac{C_2V}{C_1+C_2}$

43. Two capacitors of capacitances 3 μF and 6 μF are charged to a potential of 12 V each. They are now connected to each other, with the positive plate of each joined to the negative plate of the other. The potential difference across each will be **[1]**

a) 3 V

b) 4 V

c) 6 V

d) zero

44. A variable capacitor and an electroscope are connected in parallel to a battery. The reading of the electroscope would be decreased by **[1]**

a) Decreasing the battery potential

b) Increasing the area of overlapping of the plates

c) Decreasing the distance between the plates

d) Placing a dielectric between the plates

45. It is possible to have a positively charged body at **[1]**

a) positive potential

b) negative potential

c) zero potential

d) all of these

46. The equivalent capacity of two capacitors in series is 3 μF and in parallel is 16 μF. Their individual capacities are **[1]**

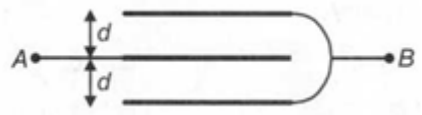
a) 12, 2

b) 12, 4

c) 8, 8

d) 10, 16

47. Three plates of common surface area A are connected as shown in figure. The effective capacitance will be **[1]**



a) 3ε0 A/D

b) ε0 A/D

c) $\frac{3}{2}$ε0 A/D

d) 2ε0 A/D

48. Three capacitors each of capacitance C and of breakdown voltage V are joined in series. The capacitance and breakdown voltage of the combination will be: **[1]**

a) 3C, 3V

b) $\frac{C}{3}, \frac{V}{3}$

c) $\frac{C}{3}$, 3v

d) 3C, $\frac{V}{3}$

49. With the rise in temperature, the dielectric constant K of a liquid: **[1]**

a) increases

b) decreases

c) changes erratically

d) remains unchanged

50. If the diameter of earth is 128×10^2 km, then its capacitance will be **[1]**

a) 331 μF

b) 711 μF

c) 111 μF

d) 211 μF

51. In series combination of capacitors, potential drops across the individual capacitors is **[1]**

a) inverse ratio of charges stored

b) direct ratio of capacitors

c) indirect ratio of capacitors

d) inverse ratio of capacitors

52. If the charge on a capacitor is increased by 2 coulomb, the energy stored in it increases by 21%. The original charge on the capacitor (in coulomb) is - **[1]**

a) 30

b) 20

c) 40

d) 10

53. The work done in carrying a charge Q once round a circle of radius r with charge q at the centre of the circle is **[1]**

a) $\frac{1}{4\pi\varepsilon_0} \cdot \frac{Q}{r}$

b) $\frac{Q \cdot q}{2r}$

c) $\frac{Q \cdot q}{4\pi\varepsilon_0 r}$

d) zero

54. When a capacitor is connected to a battery, **[1]**

a) a current flows in the circuit for sometime and then decreases to zero

b) the current keeps on decreasing

c) the current keeps on increasing

d) no current flows in the circuit at all

55. The ratio of charge to potential of a body is known as **[1]**

a) capacitance

b) inductance

c) conductance

d) resistance

56. The effective capacitance of two capacitors of capacitances C_1 and C_2 (with $C_2 > C_1$) connected in parallel is $\frac{25}{6}$ times the effective capacitance when they are connected in series. The ratio $\frac{C_2}{C_1}$ is **[1]**

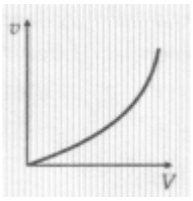
a) $\frac{25}{6}$

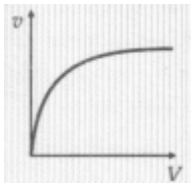
b) $\frac{5}{3}$

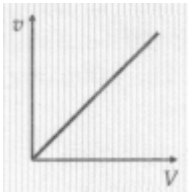
c) $\frac{4}{3}$

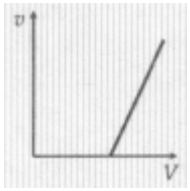
d) $\frac{3}{2}$

57. The velocity v acquired by an electron starting from rest and moving through potential difference V is shown by which of the following graphs? **[1]**

a) 

b) 

c) 

d) 

58. The angle between the electric lines of force and an equipotential surface: **[1]**

a) 45°

b) 0°

c) 180°

d) 90°

59. In electrolytic capacitors positive terminal is **[1]**

a) one on which aluminium oxide film is not formed

b) one on which aluminium oxide film is formed

c) none of the these

d) either of the two terminals

60. In a parallel plate capacitor, the distance between the plates is d and potential difference across plates is V. Energy stored per unit volume between the plates of capacitor is **[1]**

a) $\frac{1}{2}\varepsilon_0\frac{V^2}{d^2}$

b) $\frac{1}{2}\frac{V^2}{\varepsilon_0 d^2}$

c) $\frac{1}{2}\varepsilon_0\frac{V^2}{d}$

d) $\frac{Q^2}{2V^2}$

61. Across each of two capacitors of capacitance 1μF and 4μ F, a potential difference of 10 V is applied. Then positive plate of one is connected to the negative plate of the other, and negative plate of one is connected to the positive plate of the other. After contact: **[1]**

a) charge on each is zero

b) charge on each is the same but non-zero

c) charge on each is different but zero

d) charge on each is different but non-zero

62. A capacitor is charged by connecting a battery across its plates. It stores energy U. Now the battery is disconnected and another identical capacitor is connected across it. Then the energy stored by both capacitors of the system will be: **[1]**

a) $\frac{U}{4}$

b) U

c) $\frac{3U}{2}$

d) $\frac{U}{2}$

63. The capacitors, each of $4\mu\text{F}$ are to be connected in such a way that the effective capacitance of the combination is $6\mu\text{F}$. This can be achieved by connecting **[1]**

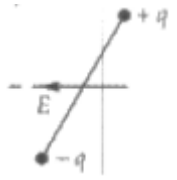
a) Two of them connected in parallel and the combination in series to the third.

b) Two of them connected in series and the combination in parallel to the third.

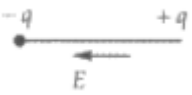
c) All three in series

d) All three in parallel

64. In which of the states shown in the figure, is potential energy of an electric dipole maximum? **[1]**

a) 

b) 

c) 

d) 

65. A 4 μF capacitor is charged to 400 V. If its plates are joined through a resistance of 2kΩ then heat produced in the resistance is: **[1]**

a) 0.16 J
b) 0.64 J
c) 0.32 J
d) 1.28 J

66. A tin nucleus has a charge + 50 e. If the proton is at 10^{-12} m from the nucleus, then the potential at this position is: (charge on proton = 1.6×10^{-19} Q) **[1]**

a) 7.2×10^4 V
b) 14.4×10^8 V
c) 1.44×10^4 V
d) 7.2×10^8 V

67. A hollow metal sphere of radius 10 cm is charged such that the potential at its surface is 80 V. The potential at the centre of the sphere is: **[1]**

a) 80 V
b) 8 V
c) 800 V
d) Zero

68. The dielectric constant for metal is: **[1]**

a) 100
b) infinite
c) 1000
d) zero

69. Four-point charges -Q, -q, 2q, and 2Q are placed, one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is: **[1]**

a) $Q = -\frac{1}{q}$
b) $Q = \frac{1}{q}$
c) Q = -q
d) Q = q

70. A point charge Q is moved along a circular path around another fixed point charge. So, the work done is **[1]**

a) always zero
b) zero only if Q returns to it's starting position
c) zero only if the two charges have the same magnitude
d) zero only if the two charges have the same magnitude and opposite signs

71. Dielectric constant of a medium is also known as: **[1]**

a) permeability
b) relative permeability
c) relative permittivity
d) permittivity

72. 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 **[1]**

a) 2 W

b) $\frac{W}{4}$

c) 4W

d) $\frac{W}{2}$

73. If the potential of a capacitor having capacity 8 pF is increased from 10 V to 20 V, then increase in its energy will be: **[1]**

a) 12×10^{-4} J

b) 4×10^{-6} J

c) 12×10^{-6} J

d) 4×10^{-4} J

74. If a unit positive charge is taken from one point to another over an equipotential surface, then: **[1]**

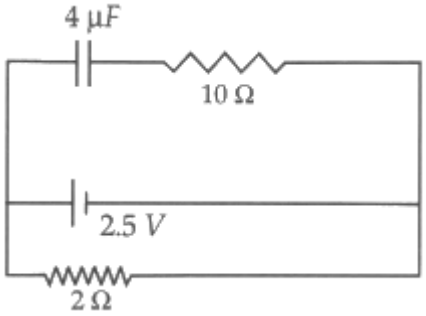
a) no work is done

b) work is done on the charge

c) work done is constant

d) work is done by the charge

75. A capacitor of 4 μF is connected as shown in the circuit Figure. The internal resistance of the battery is 0.5 Ω. The amount of charge on the capacitor plates will be : **[1]**



a) 8μC

b) 16μC

c) 4μC

d) 0