CAPACITORS

1. An automobile spring extends 0.2 m for 5000 N load. The ratio of potential energy stored in this spring when it has been compressed by 0.2 m to the potential energy stored in a 10 μF capacitor at a potential difference of 10000 V will be :–

(A) 1/4 (B) 1 (C) 1/2 (D) 2

2. A 40 μF capacitor in a defibrillator is charged to 3000 V. The energy stored in the capacitor is sent through the patient during a pulse of duration 2 ms. The power delivered to the patient is :–

(A) 45 kW (B) 90 kW (C) 180 kW (D) 360 kW

3. A parallel plate capacitor of capacitance C is connected to a battery and is charged to a potential difference V. Another capacitor of capacitance 2C is connected to another battery and is charged to potential difference 2V. The charging batteries are now disconnected and the capacitors are connected in parallel to each other in such a way that the positive terminal of one is connected to the negative terminal of the other. The final energy of the configuration is–

(A) Zero (B) $\frac{25CV^2}{6}$ (C) $\frac{3CV^2}{2}$ (D) $\frac{9CV^2}{2}$

4. A capacitor of value 4 μF charged at 50V is connected with another capacitor of value 2μF charged at 100V, in such a way that plates of similar charges are connected together. Before joining and after joining the total energy in multiples 10^{-2} J will be :–

(A) 1.5 and 1.33 (B) 1.33 and 1.5 (C) 3.0 and 2.67 (D) 2.67 and 3.0

5. Two conducting spheres of radii R_1 and R_2 are charged with charges Q_1 and Q_2 respectively. On bringing them in contact there is :–

(A) no change in the energy of the system

(B) an increase in the energy of the system if $Q_1R_2 \neq Q_2R_1$

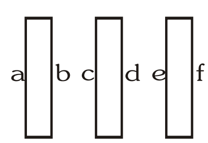
(C) always a decrease in energy of the system

(D) a decrease in energy of the system if $Q_1R_2 \neq Q_2R_1$

6. The distance between plates of a parallel plate capacitor is 'd'. Another thick metal plate of thickness d/2 and area same as that of plates is so placed between the plates, that it does not touch the plates. The capacity of the resultant capacitor :–

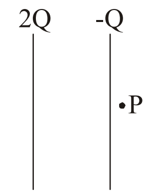
(A) remain same (B) becomes double (C) becomes half (D) becomes one fourth

7. Three parallel metallic plates, each of area A are kept as shown in the figure and charges Q_1, Q_2 and Q_3 are given to them. Edge effects are negligible. Calculate the charges on the two outermost surfaces 'a' and 'f'.



(A) $\frac{Q_1+Q_2+Q_3}{2}$ (B) $\frac{Q_1+Q_2+Q_3}{3}$ (C) $\frac{Q_1-Q_2+Q_3}{3}$ (D) $\frac{Q_1-Q_2+Q_3}{2}$

8. In the figure shown the plates of a parallel plate capacitor have unequal charges. Its capacitance is 'C'. P is a point outside the capacitor and close to the plate of charge–Q. The distance between the plates is 'd' then which statement is wrong



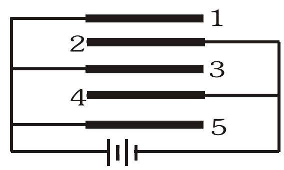
(A) A point charge at point 'P' will experience electric force due to capacitor

(B) The potential difference between the plates will be $\frac{3Q}{2C}$

(C) The energy stored in the electric field in the region between the plates is $\frac{9Q^2}{8C}$

(D) The force on one plate due to the other plate is $\frac{Q^2}{2\pi \in_0 d^2}$

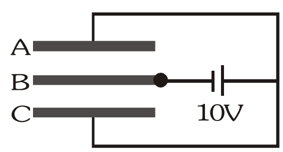
9. Five identical plates are connected across a battery as follows :



If the charge on plate 1 be +q, then the charges on the plates 2,3,4 and 5 are

(A) –q, +q,–q,+q (B) –2q, +2q,–2q,+q (C) –q, +2q,–2q,+q (D) None of the above

10. Three plates A,B and C each of area 0.1 m^2 are separated by 0.885 mm from each other as shown in the figure. A 10V battery is used to charge the system. The energy stored in the system is:



(A) 1 μJ (B) 10^{-1} μJ (C) 10^{-2} μJ (D) 10^{-3} μJ

11. N identical capacitor are joined in parallel and the combination is charged to a potential V. Now if they are separated and then joined in series then energy of combination will :–

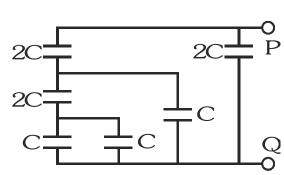
(A) remain same and potential difference will also remain same

(B) remain same and potential difference will become NV

(C) increase N times and potential difference will become NV

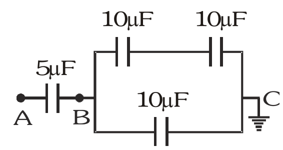
(D) increase N time and potential difference will remains same

12. The value of equivalent capacitance of the combination shown in figure between the points P and Q is :–



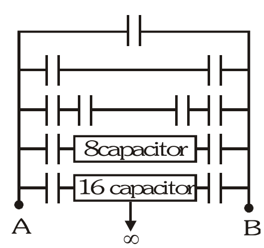
(A) 3 C (B) 2 C (C) C (D) C/3

13. In the given circuit if point C is connected to the earth and a potential of +2000 V is given to point A, the potential at B is :–



(A) 1500 V (B) 1000 V (C) 500 V (D) 400 V

14. An infinite number of identical capacitors each of capacitance 1μ F are connected as in adjoining figure. Then the equivalent capacitance between A and B is



(A) 1μ F (B) 2μ F (C) 1/2 μF (D) ∞

15. A parallel plate capacitor is made by stacking n equally spaced plates connected alternatively. If the capacitance between any two adjacent plates is C, then the resultant capacitance is–

(A) (n – 1)C (B) (n + 1)C (C) C (D) nC

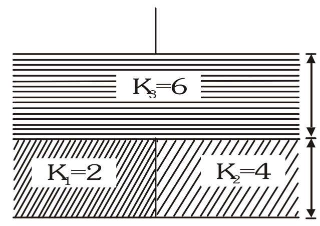
16. Two parallel plate capacitors whose capacities are C and 2 C respectively, are joined in parallel. These are charged by V potential difference. If the battery is now removed and a dielectric of dielectric constant K is filled in between the plates of the capacitor C, then what will be the potential difference across each capacitor ?

(A) $\frac{V}{K+2}$ (B) $\frac{2V}{K+2}$ (C) $\frac{3V}{K+2}$ (D) $\frac{2+K}{3V}$

17. A parallel plate capacitor with air between the plates has a capacitance of 9 pF. The separation between its plates is 'd'. The space between the plates is now filled with two dielectrics. One of the dielectric has dielectric constant K_1 = 3 and thickness $\frac{d}{3}$ while the other one has dielectric constant K_2 = 6 and thickness $\frac{2d}{3}$. Capacitance of the capacitor is now

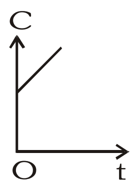
(A) 1.8 pF (B) 45 pF (C) 40.5 pF (D) 20.25 pF

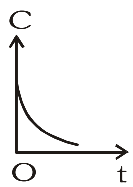
18. A parallel plate capacitor of capacitance C (without dielectrics) is filled by dielectric slabs as shown in figure. Then the new capacitance of the capacitor is

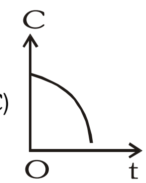


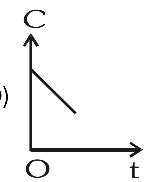
(A) 3.9 C (B) 4 C (C) 2.4 C (D) 3 C

19. Dielectric sheet placed between the plates of parallel plate capacitor. Now capacitor is charged and battery is disconnected. Now t = 0 sheet is taken out very slowly then which of the following is correct for the variation of capacitance with time

(A) 

(B) 

(C) 

(D) 

20. A fully charged capacitor has a capacitance C. It is discharged through a small coil of resistance wire embedded in a thermally insulated block of specific heat capacity s and mass m. If the temperature of the block is raised by ΔT, the potential difference V across the capacitance is–

(A) $\sqrt{\dfrac{2mC\Delta T}{s}}$ (B) $\dfrac{mC\Delta T}{s}$ (C) $\dfrac{ms\Delta T}{C}$ (D) $\sqrt{\dfrac{2ms\Delta T}{C}}$

21. The capacitance (C) for an isolated conducting sphere of radius (a) is given by $4\pi\varepsilon_0 a$. This sphere is enclosed within an earthed concentric sphere. The ratio of the radii of the spheres being $\dfrac{n}{(n-1)}$ then the capacitance of such a sphere will be increased by a factor-

(A) n (B) $\dfrac{n}{(n-1)}$ (C) $\dfrac{(n-1)}{n}$ (D) a.n

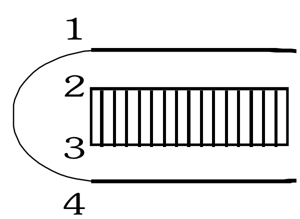
22. Two capacitor having capacitance 8 μF and 16μF have breaking voltage 20V & 80 V. They are combined in series. The maximum charge they can store individually in the combination is-

(A) 160 μC (B) 200 μC (C) 1280 μC (D) None of these

23. A capacitor of capacitance 1 μF withstands the maximum voltage 6 kV while a capacitor of 2μF withstands the maximum voltage 4 kV. What maximum voltage will the system of these two capacitor withstands if they are connected in series ?

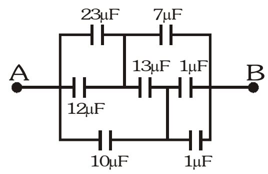
(A) 10 kV (B) 12 kV (C) 8 kV (D) 9 kV

24. Four identical plates 1,2,3 and 4 are placed parallel to each other at equal distance as shown in the figure. Plates 1 and 4 are joined together and the space between 2 and 3 is filled with a dielectric of dielectric constant k=2. The capacitance of the system between 1 and 3 & 2 and 4 are C_1 and C_2 respectively. The ratio $\dfrac{C_1}{C_2}$ is-



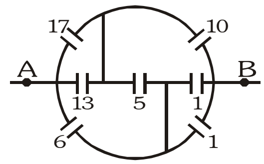
(A) $\dfrac{5}{3}$ (B) 1 (C) $\dfrac{3}{5}$ (D) $\dfrac{5}{7}$

25. The equivalent capacitance across A & B is



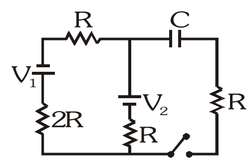
(A) $\frac{28}{3}$ μf (B) $\frac{15}{2}$ μF (C) 15 μF (D) None of these

26. The equivalent capacitance across AB (all capacitance in μF) is



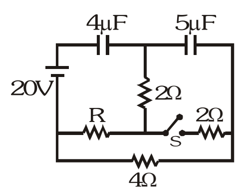
(A) $\frac{20}{3}$ μF (B) 9μF (C) 48μF (D) None of these

27. The time constant of the shown circuit for charging is



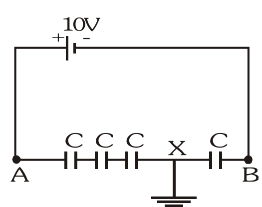
(A) $\frac{5}{3}$RC (B) $\frac{5}{2}$RC (C) $\frac{7}{4}$RC (D) $\frac{7}{3}$RC

28. The heat produced in the capacitors on closing the switch S is



(A) 0.0002 J (B) 0.0005 J (C) 0.00075 (D) Zero

29. Four identical capacitors are connected in series with a battery of emf 10V. The point X is earthed. Than the potential of point A is–



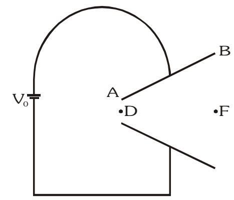
(A) 10 V (B) 7.5 V (C) –7.5 V (D) 0 V

ANSWER KEY LEVEL –1

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	B	B	C	A	D	B	A	D	B	B	B	A	C	B	A	C	C	A	D	D
Que.	21	22	23	24	25	26	27	28	29											
Ans.	A	A	D	B	B	B	C	D	B											

MCQs with one or more then one correct answer

1. In the given figure, a capacitor of non–parallel plates is shown. The plates of capacitor are connected by a cell of emf V_0. If σ denotes surface charge density and E denotes electric field. Then

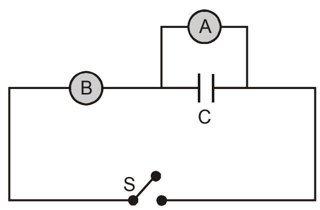


(A) $\sigma_A > \sigma_B$ (B) $E_F > E_D$ (C) $E_F = E_D$ (D) $\sigma_A = \sigma_B$

2. The area of the plates of a parallel plate capacitor is A and the gap between them is d. The gap is filled with a non–homogeneous dielectric whose dielectric constant varies with the distance 'y' from one plate as : $K = \lambda \sec\left(\frac{\pi y}{2d}\right)$, where λ is a dimensionless constant. The capacitance of this capacitor is

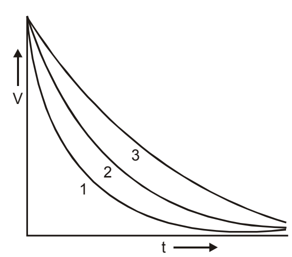
(A) $\frac{\pi\varepsilon_0\lambda A}{2d}$ (B) $\frac{\pi\varepsilon_0\lambda A}{d}$ (C) $\frac{2\pi\varepsilon_0\lambda A}{d}$ (D) None

3. A capacitor of capacitance C is connected to two voltmeters A and B. A is ideal, having infinite resistance, while B has resistance R. The capacitor is charged and then the switch S is closed. The readings of A and B will be equal



(A) At all times (B) After time RC
(C) After time RC ℓn 2 (D) Only after a very long time

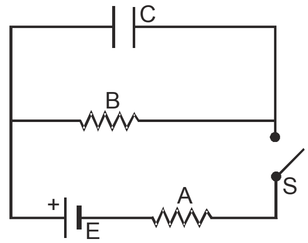
4. Three identical capacitors A, B and C are charged to the same potential and then made to discharge through three resistances R_A, R_B and R_C, where $R_A > R_B > R_C$. Their potential differences (V) are plotted against time t, giving the curves 1, 2 and 3. The relations between A, B, C and 1, 2, 3 is/are -



(A) $1 \rightarrow A$ (B) $2 \rightarrow B$ (C) $1 \rightarrow C$ (D) $3 \rightarrow A$

5. When a capacitor discharges through a resistance R, the time constant is τ and the maximum current in the circuit is i_0 –
(A) The initial charge on the capacitor was $i_0\tau$
(B) The initial charge on the capacitor was $1/2\ i_0\tau$
(C) The initial energy stored in the capacitor was $i_0^2 R\tau$
(D) The initial energy stored in the capacitor was $1/2\ i_0^2 R\tau$

6. In the circuit shown, A and B are equal resistances. When S is closed, the capacitor C charges from the cell of emf E and reaches a steady state



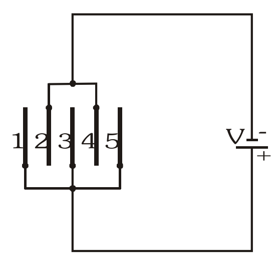
(A) During charging, more heat is produced in A than in B.
(B) In the steady state, heat is produced at the same rate in A and B.
(C) In the steady state, energy stored in C is $1/4\ CE^2$.
(D) In the steady state, energy stored in C is $1/8\ CE^2$

7. Capacitors $C_1 = 1\mu F$ and $C_2 = 2\mu F$ are separately charged from the same battery. They are then allowed to discharge separately through equal resistors–
(A) The currents in the two discharging circuits at t = 0 is zero.
(B) The currents in the two discharging circuits at t = 0 are equal but not zero.
(C) The currents in the two discharging circuits at t = 0 are unequal.
(D) C_1 loses 50% of its initial charges sooner than C_2 loses 50% of its initial charge.

8. A number of capacitors, each of capacitance 1 μF and each one of which gets punctured if a potential difference just exceeding 500 volt is applied are provided. Then an arrangement suitable for giving a capacitor of capacitance 3 μF across which 2000 volt may be applied requires at least :–

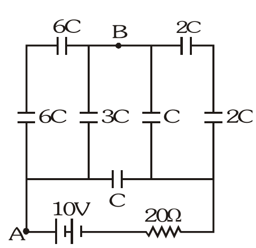
(A) 4 component capacitors
(B) 12 component capacitors
(C) 48 component capacitors
(D) 16 component capacitors

9. Five identical capacitor plates, each of area A, are arranged such that adjacent plates are at distance d apart. The plates are connected to a source of emf V as shown in figure. Then the charges on plates 1 and 4 are, respectively



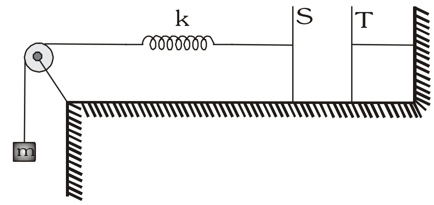
(A) $\frac{\varepsilon_0 AV}{d}, \frac{2\varepsilon_0 AV}{d}$
(B) $\frac{2\varepsilon_0 AV}{d}, \frac{-2\varepsilon_0 AV}{d}$
(C) $\frac{\varepsilon_0 AV}{d}, \frac{-2\varepsilon_0 AV}{d}$
(D) $\frac{\varepsilon_0 AV}{d}, \frac{-\varepsilon_0 AV}{d}$

10. For the circuit shown here, the potential difference between points A and B is



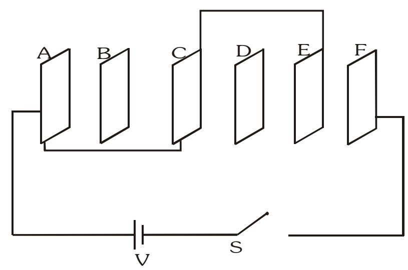
(A) 2.5 V
(B) 7.5 V
(C) 10 V
(D) Zero

11. The plates S and T of an uncharged parallel plate capacitor are connected across a battery. The battery is then disconnected and the charged plates are now connected in a system as shown in the figure. The system shown is in equilibrium. All the strings and spring are insulating and massless. The magnitude of charge on one of the capacitor plates is : [Area of plates = A]



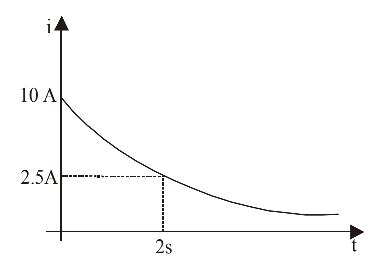
(A) $\sqrt{2mgA\varepsilon_0}$ (B) $\sqrt{\frac{4mgA\varepsilon_0}{k}}$ (C) $\sqrt{mgA\varepsilon_0}$ (D) $\sqrt{\frac{2mgA\varepsilon_0}{k}}$

12. A, B, C, D, E, F are conducting plates each of area A and any two consecutive plates separated by a distance d. The net energy stored in the system after the switch S is closed is:



(A) $\frac{3\varepsilon_0 A}{2d}V^2$ (B) $\frac{5\varepsilon_0 A}{12d}V^2$ (C) $\frac{\varepsilon_0 A}{2d}V^2$ (D) $\frac{\varepsilon_0 A}{d}V^2$

13. The figure shows, a graph of the current a discharging circuit of a capacitor through a resistor of resistance 10Ω:



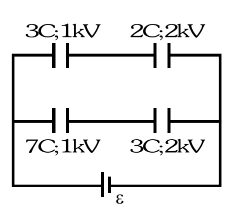
(A) The initial potential difference across the capacitor is 100 volt.

(B) The capacitance of the capacitor is $\frac{1}{10\ell n2}$ F.

(C) The total heat produced in the circuit will be $\frac{500}{\ell n2}$ joules

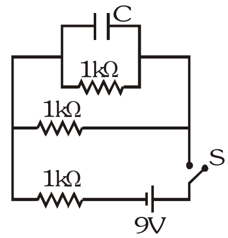
(D) The thermal power in the resistor will decreases with a time constant $\frac{1}{2\ell n2}$ second.

14. The diagram shows four capacitors with capacitance and break down voltages as mentioned. What should be the maximum value of the external emf source such that no capacitor breaks down?



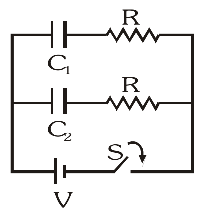
(A) 2.5 kV (B) 10/3kV (C) 3 kV (D) 1 kV

15. A capacitor C = 100 μF is connected to three resistor each of resistance 1kΩ and a battery of emf 9V. The switch S has been closed for long time so as to charge the capacitor. When switch S is opened, the capacitor discharges with time constant–



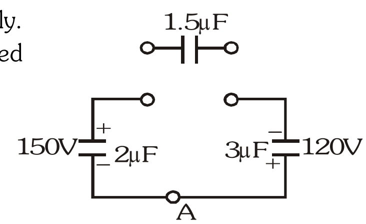
(A) 33 ms (B) 5 ms (C) 3.3 ms (D) 50 ms

16. In the circuit shown in figure $C_1 = 2C_2$. Switch S is closed at time t=0. Let i_1 and i_2 be the currents flowing through C_1 and C_2 at any time t, then the ratio i_1/i_2



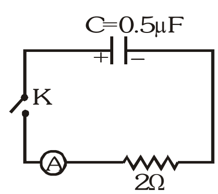
(A) is constant (B) increases with increase in time t
(C) decreases with increase in time t (D) first increases then decreases

17. Two capacitors of 2μF and 3μF are charged to 150 volt and 120 volt respectively. The plates of capacitor are connected as shown in the figure. A discharged capacitor of capacity 1.5μF falls to the free ends of the wire. Then–



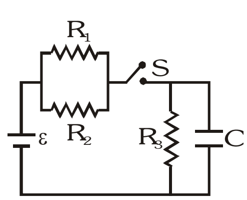
(A) charge on the 1.5μF capacitor is 180μC
(B) charge on the 2μF capacitor is 120 μF
(C) charge flows through A from right to left
(D) charge flows through A from left to right.

18. A charged capacitor is allowed to discharge through a resistor by closing the key at the instant t = 0. At the instant t = (ℓn4)μs, the reading of the ammeter falls half the initial value. The resistance of the ammeter is equal to–



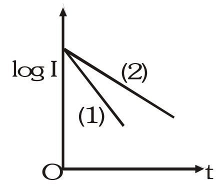
(A) 1MΩ (B) 1Ω (C) 2Ω (D) 2MΩ

19. The circuit shown in the figure consists of a battery of emf ε=10 V; a capacitor of capacitance C=1.0 μF and three resistor of values R_1 = 2Ω, R_2 = 2Ω and R_3 = 1Ω. Initially the capacitor is completely uncharged and the switch S is open. The switch S is closed at t = 0.



(A) The current through resistor R_3 at the moment the switch closed is zero
(B) The current through resistor R_3 a long time after the switch closed is 5A.
(C) The ratio of current through R_1 and R_2 is always constant
(D) The maximum charge on the capacitor during the operation is 5μC

20. A capacitor of capacity C is charged to a steady potential difference V and connected in series with an open key and a pure resistor 'R'. At time t=0, the key is closed. If I = current at time t, a plot of log I against 't' is as shown in (1) in the graph. Later one of the parameters i.e. V,R or C is changed keeping the other two constant, and the graph (2) is recorded. Then–



(A) C is reduced (B) C is increased (C) R is reduced (D) R is increased

21. A parallel plate capacitor is connected to a cell. Its positive plate A and its negative plate B have charges +Q and –Q respectively. A third plate C, identical to A and B, with charge +Q, is now introduced midway between A and B, parallel to them. Which of the following are correct :

(A) Charge on the inner face of B is now $-\frac{3Q}{2}$

(B) There is no change in the potential difference between A and B

(C) Potential difference between A and C is one–third of the potential difference between B and C

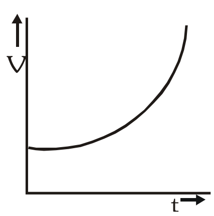
(D) Charge on the inner face of A is now $\frac{Q}{2}$

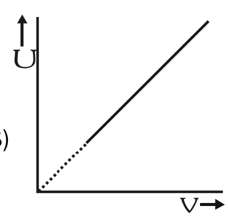
22. A parallel plate capacitor A is filled with a dielectric whose dielectric constant varies with applied voltage as K = V. An identical capacitor B of capacitance C_0 with air as dielectric is connected to voltage source V_0 = 30V and then connected to the first capacitor after disconnecting the voltage source. The charge and voltage on capacitor :

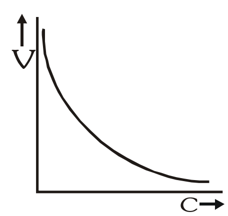
(A) A are $25C_0$ and 25V (B) A are $25C_0$ and 5V

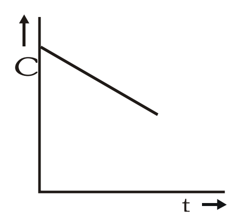
(C) B are $5C_0$ and 5V (D) B are $5C_0$ and 25V

23. A parallel plate capacitor has a dielectric slab in it. The slab just fills the space inside the capacitor. The capacitor is charged by a battery and then battery is disconnected. Now the slab is started to pull out slowly at t=0. If at time t, capacitance of the capacitor is C, potential difference across is V and energy stored in it is U, then which of the following graphs are correct?

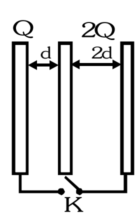
(A)


(B)


(C)


(D)


24. Three large plates are arranged as shown. How much charge will flow through the key k if it is closed ?

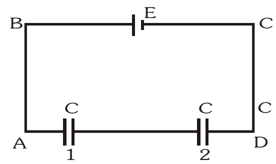


(A) $\frac{5Q}{6}$ (B) $\frac{4Q}{3}$ (C) $\frac{3Q}{2}$ (D) None of these

25. A capacitor of capacitance C is charged to a potential difference V from a cell and then disconnected from it. A charge +Q is now given to its positive plate. The potential difference across the capacitor is-

(A) V (B) $V+\frac{Q}{C}$ (C) $V+\frac{Q}{2C}$ (D) $V-\frac{Q}{C}$, if $V < CV$

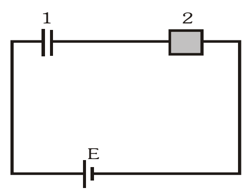
26. In the adjoining figure, capacitor (1) and (2) have a capacitance 'C' each. When the dielectric of dielectric constant K is inserted between the plates of one of the capacitor, the total charge flowing through battery is-



(A) $\frac{KCE}{K+1}$ from B to C (B) $\frac{KCE}{K+1}$ from C to B

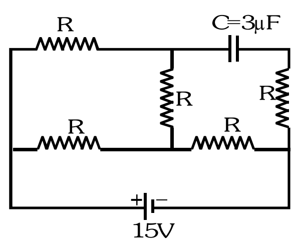
(C) $\frac{(K-1)CE}{2(K+1)}$ from B to C (D) $\frac{(K-1)CE}{2(K+1)}$ from C to B

27. Two identical capacitors 1 and 2 are connected in series to a battery as shown in figure. Capacitor 2 contains a dielectric slab of dielectric constant k as shown. Q_1 and Q_2 are the charges stored in the capacitors. Now the dielectric slab is removed and the corresponding charges are Q'_1 and Q'_2. Then



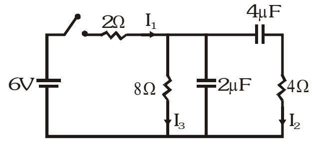
(A) $\frac{Q_1'}{Q_1} = \frac{k+1}{k}$ (B) $\frac{Q_2'}{Q_2}=\frac{k+1}{2}$ (C) $\frac{Q_2'}{Q_2}=\frac{k+1}{2k}$ (D) $\frac{Q_1'}{Q_1}=\frac{k}{2}$

28. In the circuit shown, the cell is ideal, with emf = 15V. Each resistance is of 3Ω. The potential difference across the capacitor is



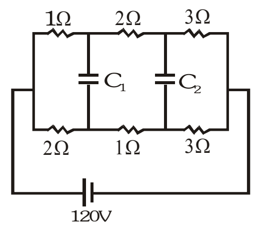
(A) zero (B) 9V (C) 12V (D) 15V

29. In the circuit shown in the figure, the switch S is initially open and the capacitor is initially uncharged. I_1, I_2 and I_3 represent the current in the resistance 2Ω, 4Ω and 8Ω respectively.



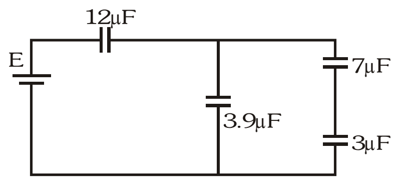
(A) Just after the switch S is closed, I_1 = 3A, I_2 = 3A and I_3 = 0
(B) Just after the switch S is closed, I_1 =3A, I_2 = 0 and I_3 = 0
(C) Long time after the switch S is closed, I_1 = 0.6A, I_2 = 0 and I_3 = 0
(D) Long time after the switch S is closed, $I_1 = I_2 = I_3$ = 0.6A.

30. In the circuit shown in figure $C_1=C_2$ = 2μF. Then charge stored in



(A) capacitor C_1 is zero
(B) capacitor C_2 is zero
(C) both capacitor is zero
(D) capacitor C_1 is 40 μC

31. Four capacitors and a battery are connected as shown. The potential drop across the 7μF capacitor is 6V. Then the



(A) potential difference across the 3μF capacitor is 10V
(B) charge on the 3μF capacitor is 42μC
(C) e.m.f. of the battery is 30V
(D) potential difference across the 12μF capacitor is 10V.

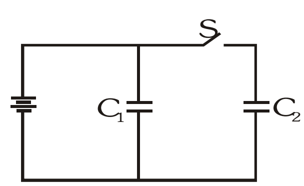
32. A capacitor C is charged to a potential difference V and battery is disconnected. Now if the capacitor plates are brought close slowly by some distance

(A) Some +ve work is done by external agent
(B) Energy of capacitor will decrease
(C) Energy of capacitor will increase
(D) None of the above

33. A parallel plate capacitor of plate area A and plate separation d is charged to potential difference V and then the battery is disconnected. A slab of dielectric constant K is then inserted between the plates of the capacitor so as to fill the space between the plates. If Q,E and W denote respectively, the magnitude of charge on each plate, the electric field between the plates (after the slab is inserted) and the work done on the system, in question, in the process of inserting the slab, then

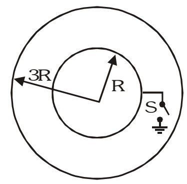
(A) $Q=\frac{\varepsilon_o AV}{d}$
(B) $Q=\frac{\varepsilon_o KAV}{d}$
(C) $E=\frac{V}{Kd}$
(D) $W=-\frac{\varepsilon_0 AV^2}{2d}\left(1-\frac{1}{K}\right)$

34. Two capacitors of equal capacitance ($C_1=C_2$) are shown in the figure. Initially, while the switch S is open, one of the capacitors is uncharged and the other carries charge Q_0. The energy stored in the charged capacitor is U_0. Sometimes after the switch is closed, the capacitors C_1 and C_2 carry charges Q_1 and Q_2, respectively; the voltage across the capacitors are V_1 and V_2; and the energies stored in the capacitors are U_1 and U_2. Which of the following statements is incorrect ?



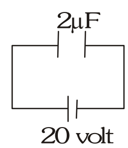
(A) $Q_0 = \frac{1}{2}(Q_1 + Q_2)$
(B) $Q_1=Q_2$
(C) $V_1=V_2$
(D) $U_1=U_2$
(E) $U_0 = U_1 + U_2$

35. Two thin conducting shells of radii R and 3R are shown in the figure. The outer shell carries a charge +Q and the inner shell is neutral. The inner shell is earthed with the help of a switch S.



(A) With the switch S open, the potential of the inner sphere is equal to that of the outer
(B) When the switch S is closed, the potential of the inner sphere becomes zero
(C) With the switch S closed, the charge attained by the inner sphere is $-Q/3$
(D) By closing the switch the capacitance of the system increases

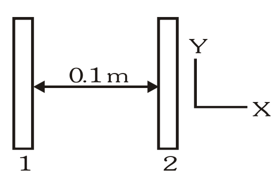
36. In the figure a capacitor of capacitance 2μF is connected to a cell of emf 20 volt. The plates of the capacitor are drawn apart slowly to double the distance between them, The work done by the external agent on the plates is :



(A) – 200μJ (B) 200μJ (C) 400μJ (D) – 400μJ

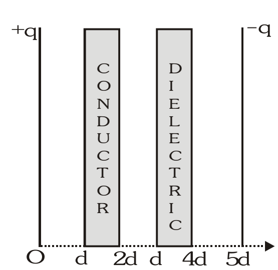
37. An uncharged capacitor having capacitance C is connected across a battery of emf V. Now the capacitor is disconnected and then reconnected across the same battery but with reversed polarity. Then which of the statement is incorrect
(A) After reconnecting, heat energy produced in the circuit will be equal to two–third of the total energy supplied by battery.
(B) After reconnecting, no energy is supplied by battery.
(C) After reconnecting, whole of the energy supplied by the battery is converted into heat.
(D) After reconnecting, thermal energy produced in the circuit will be equal to $2CV^2$.

38. Two insulating plates are both uniformly charged in such a way that the potential difference between them is $V_2 - V_1 = 20$ V. (i.e., plate 2 is at a higher potential). The plates are separated by d = 0.1 m and can be treated as infinitely large. An electron is released from rest on the inner surface of plate 1. What is its speed when it hits plate 2 ? (e = 1.6 10^{-19} C, m_e = 9.11 10^{-31} kg)

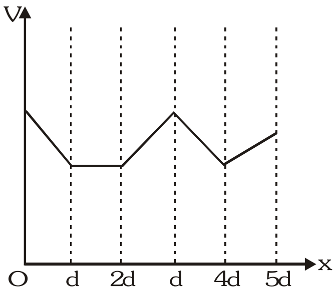


(A) 2.65 10^6 m/s (B) 7.02 10^{12} m/s (C) 1.87 10^6 m/s (D) 32 10^{-19} m/s

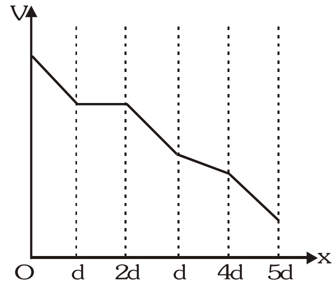
39. The distance between plates of a parallel plate capacitor is 5d. The positively charged plate is at x=0 and negatively charged plates is at x=5d. Two slabs one of conductor and the other of a dielectric of same thickness d are inserted between the plates as shown in figure. Potential (V) versus distance x graph will be



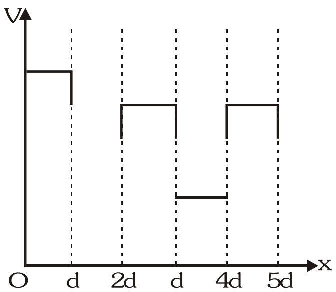
(A)



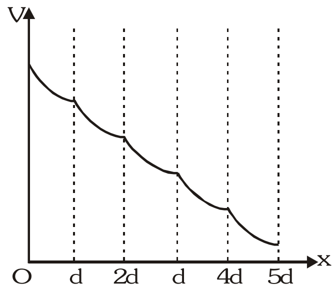
(B)



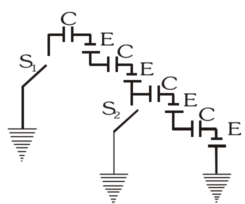
(C)



(D)



40. In the given circuit, all the capacitors are initially uncharged. After closing the switch S_1 for a long time suddenly S_2 is also closed and kept closed for a long time. Total heat produced after closing S_2 will be:



(A) $4\ CE^2$ (B) $\frac{1}{2}CE^2$ (C) $2\ CE^2$ (D) 0

41. A conducting body 1 has some initial charge Q, and its capacitance is C. There are two other conducting bodies, 2 and 3, having capacitance : $C_2 = 2C$ and $C_3 \to \infty$. Bodies 2 and 3 are initially uncharged. Body 2 is touched with body 1. Then, body 2 is removed from body 1 and touched with body 3, and then removed. This process is repeated for N times. Then, the charge on body 1 at the end must be :

(A) $Q/3^N$ (B) $Q/3^{N-1}$ (C) Q/N^3 (D) None of these

42. A capacitor of capacitance C is initially charged to a potential difference of V volt. Now it is connected to a battery of 2V with opposite polarity. The ratio of heat generated to the final energy stored in the capacitor will be

(A) 1.75 (B) 2.25 (C) 2.5 (D) 1/2

ANSWER KEY — LEVEL -2

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	A	A	A	B,C,D	A,D	ABD	BD	C	C	A	A	C	ABCD	A	D
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	B	ABC	C	ABCD	B	ABCD	BC	ABCD	A	C	D	C	C	B	B,D
Que.	31	32	33	34	35	36	37	38	39	40	41	42			
Ans.	BCD	B	A,C,D	E	ABCD	B	B	A	B	D	A	B			