Exercise - I (Conceptual Questions) Build Up Your Understanding

CAPACITANCE, ENERGY STORED IN CAPACITOR & SPHERICAL CAPACITOR

1. The capacitance C of a capacitor is :-
(1) independent of the charge and potential of the capacitor.
(2) dependent on the charge and independent of potential.
(3) independent of the geometrical configuration of the capacitor.
(4) independent of the dielectric medium between the two conducting surfaces of the capacitor.

PCP001

2. To increase the charge on the plate of a capacitor implies to :-
(1) decrease the potential difference between the plates.
(2) decrease the capacitance of the capacitor.
(3) increase the capacitance of the capacitor.
(4) increase the potential difference between the plates.

PCP002

3. The net charge on a capacitor is :-
(1) 2q (2) q/2
(3) 0 (4) infinity

PCP003

4. The earth has Volume 'V' and Surface area 'A'; then its capacitance would be :
(1) $4\pi\epsilon_0\frac{A}{V}$ (2) $4\pi\epsilon_0\frac{V}{A}$
(3) $12\pi\epsilon_0\frac{V}{A}$ (4) $12\pi\epsilon_0\frac{A}{V}$

PCP004

5. Capacitors are used in electrical circuits where appliances need rapid :
(1) Current (2) Voltage
(3) Watt (4) Resistance

PCP005

6. Which of the following is called electrical energy tank?
(1) Resistor (2) Inductance
(3) Capacitor (4) Motor

PCP006

7. If the maximum circumference of a sphere is 2 m, then its capacitance in water would be :- (Dielectric constant of water = 81)
(1) 27.65 pF (2) 2385 pF
(3) 236.5 pF (4) 2865 pF

PCP007

8. The two parallel plates of a condenser have been connected to a battery of 300 V and the charge collected at each plate is 1 μC. The energy supplied by the battery is :
(1) 6×10^{-4}J (2) 3×10^{-4}J
(3) 1.5×10^{-4}J (4) 4.5×10^{-4}J

PCP008

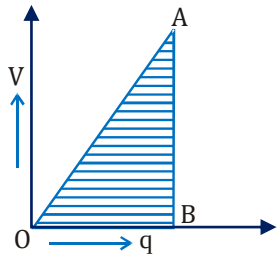
9. When a capacitor of value 200 μF charged to 200V is discharged separately through resistance of 2 ohms and 8 ohms, then heat produced in joule will respectively be:
(1) 4 and 16 (2) 16 and 4
(3) 4 and 8 (4) 4 and 4

PCP009

10. The potential to which a conductor is raised, depends on :-
(1) the amount of charge
(2) the geometry and size of the conductor
(3) both (1) and (2)
(4) None of these

PCP010

11. The charge q on a capacitor varies with voltage as shown in figure. The area of the triangle AOB represents :



(1) electric field between the plates
(2) electric flux between the plates
(3) energy density
(4) energy stored by the capacitor.

PCP011

12. An uncharged capacitor is connected to a battery. On charging the capacitor :-
(1) all the energy supplied is stored in the capacitor.
(2) half the energy supplied is stored in the capacitor.
(3) the energy stored depends upon the capacity of the capacitor only.
(4) the energy stored depends upon the time for which the capacitor is charged.

PCP012

CYLINDRICAL CAPACITOR PARALLEL PLATE CAPACITOR & EFFECT OF DIELECTRIC SLAB

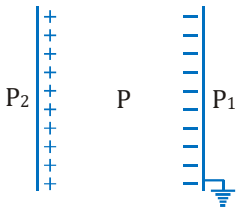
13. The capacity of parallel plate condenser depends on :
(1) the type of metal used
(2) the thickness of plates
(3) the potential difference applied across the plates
(4) the separation between the plates.

PCP013

14. A parallel plate capacitor has rectangular plates of 400 cm^2 area and are separated by a distance of 2 mm with air as the medium. What charge will appear on the plates if a 200 volt potential difference is applied across the capacitor?
(1) 3.54×10^{-6} C (2) 3.54×10^{-8} C
(3) 3.54×10^{-10} C (4) 1770.8×10^{-13} C

PCP014

15. There are two metallic plates of a parallel plate capacitor. One plate is given a charge +q while the other is earthed as shown. Points P, P_1 and P_2 are taken as shown in adjoining figure. Then the electric intensity is not zero at :



(1) P only (2) P_1 only
(3) P_2 only (4) P, P_1 and P_2

PCP015

16. The distance between the plates of a circular parallel plate capacitor of diameter 40 mm, whose capacity is equal to that of a metallic sphere of radius 1m will be :
(1) 0.01 mm (2) 0.1 mm
(3) 1.0 mm (4) 10 mm

PCP016

17. The energy density in a parallel plate capacitor is given as 2.1×10^{-9} J/m^3. The value of the electric field in the region between the plates is :
(1) 2.1 NC^{-1} (2) 21.6 NC^{-1}
(3) 72 NC^{-1} (4) 8.4 NC^{-1}

PCP017

18. A charged parallel plate capacitor of distance (d) has U_0 energy. A slab of dielectric constant (K) and thickness (d) is then introduced between the plates of the capacitor. The new energy of the system is given by :
(1) KU_0 (2) K^2U_0 (3) $\frac{U_0}{K}$ (4) $\frac{U_0}{K^2}$

PCP018

19. The energy and capacity of a charged parallel plate capacitor are U and C respectively. Now a dielectric slab of $\in_r = 6$ is inserted in it then energy and capacity becomes : (Assuming charge on plates remains constant)
(1) 6U, 6C (2) U, C
(3) $\frac{U}{6}$, 6C (4) U, 6C

PCP019

20. Distance between the plates of a parallel plate capacitor is 'd' and area of each plate is A. When a slab of dielectric constant K and thickness t is placed between the plates, its capacity becomes:
(1) $\frac{\varepsilon_0 A}{\left[d+t\left\{1-\frac{1}{K}\right\}\right]}$ (2) $\frac{\varepsilon_0 A}{\left[d+t\left\{1+\frac{1}{K}\right\}\right]}$
(3) $\frac{\varepsilon_0 A}{\left[d-t\left\{1+\frac{1}{K}\right\}\right]}$ (4) $\frac{\varepsilon_0 A}{\left[d-t\left\{1-\frac{1}{K}\right\}\right]}$

PCP020

21. When a slab of dielectric medium is placed between the plates of a parallel plate capacitor which is connected with a battery, then the charge on plates in comparision with earlier charge :
(1) is less
(2) is same
(3) is more
(4) depends on the nature of the material inserted

PCP021

22. A glass slab is put within the plates of a charged parallel plate condenser. Which of the following quantities does not change?
(1) energy of the condenser
(2) capacity
(3) intensity of electric field
(4) charge

PCP022

23. A parallel plate capacitor is connected to a battery and a dielectric slab is inserted between the plates, then which quantity increase :
(1) potential difference
(2) electric field
(3) stored energy
(4) E.M.F. of battery

PCP023

24. A parallel plate capacitor is charged by a battery. After charging the capacitor, battery is disconnected and a dielectric plate is inserted between the plates. Then which of the following statements is not correct there is a/an?
(1) increase in the stored energy
(2) decrease in the potential difference
(3) decrease in the electric field
(4) increase in the capacitance

PCP024

25. A parallel plate capacitor is charged by a battery. After charging the capacitor, battery is disconnected and distance between the plates is decreased then which of the following statement is correct?
(1) electric field does not remain constant
(2) potential difference is increased
(3) the capacitance decreases
(4) the stored energy decreases

PCP025

26. A parallel plate capacitor is connected with a battery whose potential difference remains constant. If the plates of the capacitor are shifted apart then the intensity of electric field :
(1) decreases and charge on plates also decreases.
(2) remains constant but charge on plates decreases.
(3) remains constant but charge on the plates increases.
(4) increases but charge on the plates decreases.

PCP026

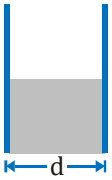
27. A parallel plate capacitor is charged with a battery and afterwards the battery is removed. if now, with the help of insulating handles, the distance between the plates is increased, then
(1) charge on capacitor increases and capacity decreases.
(2) potential difference between the plates increases.
(3) capacity of capacitor increases.
(4) value of energy stored in capacitor decreases.

PCP027

28. Can a metal be used as a medium for dielectric?
(1) Yes
(2) No
(3) Depends on its shape
(4) Depends on dielectric

PCP028

29. A parallel plate air capacitor has a capacitance C. When it is half filled with a dielectric of dielectric constant 5, the percentage increase in the capacitance will be :-

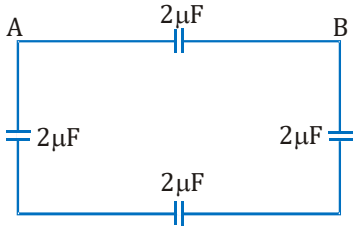


(1) 400% (2) 66.6% (3) 33.3% (4) 200%

PCP029

COMBINATION OF CAPACITORS & SHARING OF CHARGES

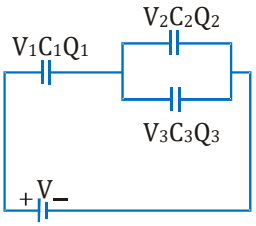
30. The equivalent capacitance between the points A and B in the given diagram is :



(1) 8 μF (2) 6 μF (3) $\frac{8}{3}$μF (4) $\frac{3}{8}$μF

PCP030

31. In an adjoining figure three capacitors C_1, C_2 and C_3 are joined to a battery. The correct condition will be :



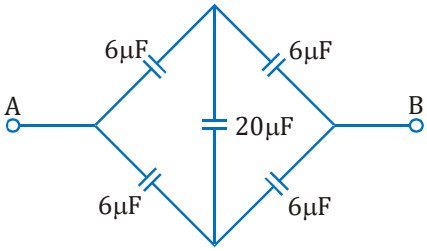
(1) $Q_1 = Q_2 = Q_3$ and $V_1 = V_2 = V_3 = V$
(2) $Q_1 = Q_2 + Q_3$ and $V = V_1 + V_2 + V_3$
(3) $Q_1 = Q_2 + Q_3$ and $V = V_1 + V_2$
(4) $Q_2 = Q_3$ and $V_2 = V_3$
(Symbols have their usual meanings)

PCP031

32. 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 :
(1) 4 component capacitors
(2) 12 component capacitors
(3) 48 component capacitors
(4) 16 component capacitors

PCP032

33. The effective capacity of the network between terminals A and B is :



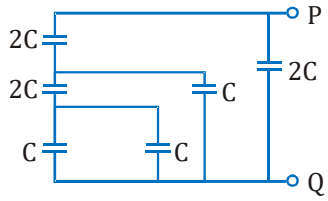
(1) 6 μF (2) 20 μF (3) 3 μF (4) 10 μF

PCP033

34. A series combination of two capacitances of value 0.1 μF and 1μF is connected with a source of voltage 500 volts. The potential difference in volts across the capacitor of value 0.1 μF will be:
(1) 50 (2) 500 (3) 45.5 (4) 454.5

PCP034

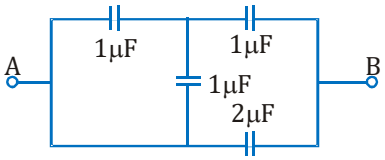
35. The value of equivalent capacitance of the combination shown in figure, between the points P and Q is :



(1) 3C (2) 2C (3) C (4) C/3

PCP035

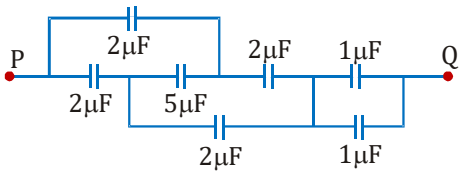
36. The equivalent capacitance between points A and B of the circuit shown will be :



(1) $\frac{2}{3}$ μF (2) $\frac{5}{3}$ μF
(3) $\frac{8}{3}$ μF (4) $\frac{7}{3}$ μF

PCP036

37. The effective capacitance between the points P and Q of the arrangement shown in the figure is :



(1) (1/2) μF (2)1 μF
(3) 2 μF (4) 1.33 μF

PCP037

38. Two spheres of radii R_1 and R_2 having equal charges are joined together with a copper wire. If V is the potential of each sphere after they are separated from each other, then the initial charge on both spheres was :

(1) $\frac{V}{k}(R_1 + R_2)$ (2) $\frac{V}{2k}(R_1 + R_2)$
(3) $\frac{V}{3k}(R_1 + R_2)$ (4) $\frac{V}{k}\frac{(R_1 R_2)}{(R_1 + R_2)}$

PCP038

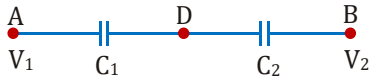
39. Two spheres of radii 1 cm and 2 cm have been charged with 1.5×10^{-8} and 0.3×10^{-7} coulombs of positive charge. When they are connected with a wire, charge :
(1) will flow from the first to the second
(2) will flow from the second to the first
(3) will not flow at all
(4) may flow either from first to second, or from the second to first, depending upon the length of the connecting wire

PCP039

40. Half of the space between a parallel plate capacitor is filled with a medium of dielectric constant K parallel to the plates. If initially the capacity was C, then the new capacity will be :
(1) 2KC/(1+K) (2) C (K+1)/2
(3) CK/(1+K) (4) KC

PCP040

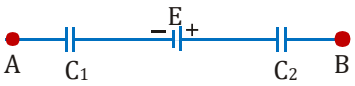
41. Two capacitances C_1 and C_2 in a circuit are joined as shown in figure The potential of point A is V_1 and that of B is V_2. The potential of point D will be :



(1) $\frac{1}{2}(V_1+V_2)$ (2) $\frac{C_2V_1+C_1V_2}{C_1+C_2}$
(3) $\frac{C_1V_1+C_2V_2}{C_1+C_2}$ (4) $\frac{C_2V_1-C_1V_2}{C_1+C_2}$

PCP041

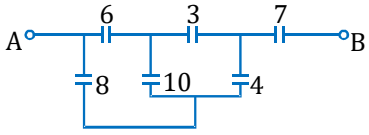
42. A circuit has a section AB as shown in the figure with E = 10 V, C_1 = 1.0 μF, C_2 = 2.0 μF and the potential difference $V_A - V_B$ = 5 V. The voltage across C_1 is :



(1) Zero (2) 5 V (3) 10 V (4) 15 V

PCP042

43. In the circuit diagram shown all the capacitors are in μF. The equivalent capacitance between points A & B is (in μF) :



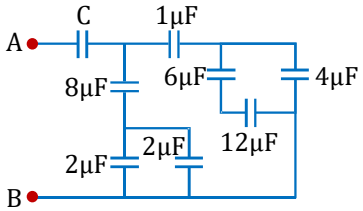
(1) 14/5 (2) 7.5
(3) 3/7 (4) None of these

PCP043

44. Two capacitances C_1 and C_2 are connected in series; assume that $C_1 < C_2$. The equivalent capacitance of this arrangement is C, where :
(1) $C < C_1/2$ (2) $C_1/2 < C < C_1$
(3) $C_1 < C < C_2$ (4) $C_2 < C < 2C_2$

PCP044

45. In the following circuit the resultant capacitance between A & B is 1μF. Find the value of C :

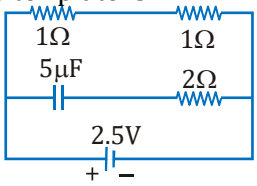


(1) $\frac{23}{32}$ μF (2) $\frac{32}{23}$ μF (3) $\frac{13}{23}$ μF (4) $\frac{23}{13}$ μF

PCP045

CHARGING AND DISCHARGING OF CAPACITORS & CAPACITOR'S CIRCUIT

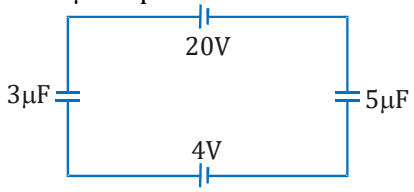
46. A capacitor of capacitance 5 μF is connected as shown in the figure. The internal resistance of the cell is 0.5 Ω. The amount of charge on the capacitor plate is :



(1) 0 (2) 5 μC (3) 10 μC (4) 25 μC

PCP046

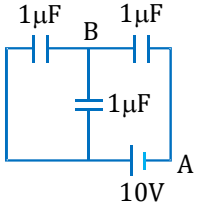
47. In the given circuit, the potential difference across 3 μF capacitor will be :



(1) 16 V (2) 10 V (3) 6 V (4) 4 V

PCP047

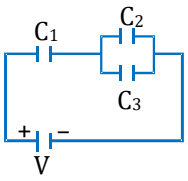
48. If potential of A is 10 V, then potential of B is :



(1) 25/3 V (2) 50/3 V
(3) 100/3 V (4) 50 V

PCP048

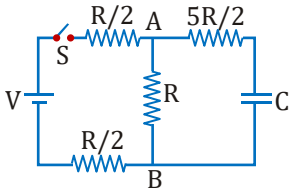
49. Capacitance $C_1 = 2C_2 = 2C_3$ and potential difference across C_1, C_2 and C_3 are V_1, V_2 and V_3 respectively then :



(1) $V_1 = V_2 = V_3$ (2) $V_1 = 2V_2 = 2V_3$
(3) $2V_1 = V_2 = V_3$ (4) $2V_1 = 2V_2 = V_3$

PCP049

50 In the circuit shown in figure, the battery is an ideal one with emf V. The capacitor is initially uncharged. Switch S is closed at time t = 0.



The final charge Q on the capacitor is :

(1) $\frac{CV}{2}$ (2) $\frac{CV}{3}$ (3) CV (4) $\frac{CV}{6}$

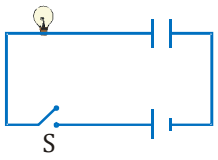
PCP050

51. In previous question, what is the current in the steady state is ?

(1) $\frac{V}{2R}$ (2) $\frac{V}{R}$ (3) $\frac{2V}{R}$ (4) $\frac{V}{3R}$

PCP051

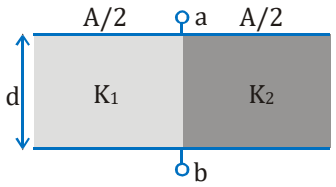
52. A bulb, a capacitor and a battery are connected together as shown here, with switch S initially open. When the switch S is closed, which one of the following is true?



(1) The bulb will light up for an instant when the capacitor starts charging.
(2) The bulb will light up when the capacitor is fully charged
(3) The bulb will not light up at all
(4) The bulb will light up and go off at regular intervals.

PCP052

53. The capacity of a parallel plate air capacitor is 10 μF. As shown in the figure this capacitor is divided into two equal parts; these parts are filled by media of dielectric constants $K_1 = 2$ and $K_2 = 4$. Capacity of this arrangement will be :



(1) 20 μF (2) 30 μF (3) 10 μF (4)40 μF

PCP053

54. Three capacitors, each of value 1 μF are so combined that the resultant capacity is 1.5 μF. Then :
(1) All three capacitors are connected in parallel.
(2) All three capacitors are connected in series.
(3)Third capacitor is in series with a parallel combination of the other two.
(4)Third capacitor is in parallel with a series combination of the other two.

PCP054

55. 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 :
(1) no change in the energy of the system
(2) an increase in the energy of the system if $Q_1R_2 \neq Q_2R_1$
(3) always a decrease in the energy of the system
(4) a decrease in the energy of the system if $Q_1R_2 \neq Q_2R_1$

PCP055

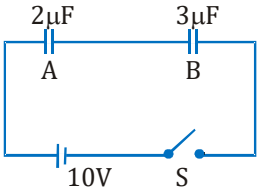
56. A capacitor is charged with a battery and energy stored is U. After disconnecting the battery another capacitor of same capacity is connected in parallel with it. The energy stored in each capacitor is:
(1) U/2 (2) U/4 (3) 4 U (4) 2 U

PCP056

57. Three capacitors of capacitances 3 μF, 10 μF and 15 μF are connected in series to a voltage source of 100 V. The charge on 15 μF is :
(1) 50 μC (2) 160 μC
(3) 200 μC (4) 280 μC

PCP057

58. Two capacitors A and B are connected in series with a battery as shown in the figure. When the switch S is closed and the two capacitors get charged fully, then :



(1) the potential difference across the plates of A is 4 V and across the plates of B is 6 V
(2) the p.d. across the plates of A is 6 V and across the plates of B is 4 V
(3) the ratio of electrical energies stored in A and B is 2 : 3
(4) the ratio of charges on A and B is 3 : 2

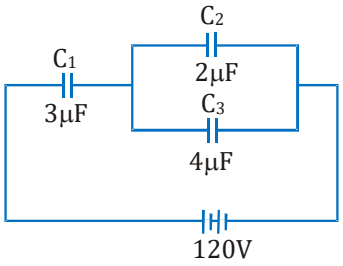
PCP058

59. 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 :

(1) $\frac{1}{4}$ (2) 1 (3) $\frac{1}{2}$ (4) 2

PCP059

60. The charge on each capacitors shown in figure and the potential difference across them will be respectively :-



(1) 240μC, 80μC, 160μC and 80 V, 40 V, 40 V
(2) 300μC, 75μC, 150μC and 40 V, 80 V, 60 V
(3) 220μC, 70μC, 140μC and 60 V, 50 V, 40 V
(4) none of these

PCP060

61. Three capacitance 2 μF, 3 μF and 6 μF are connected in series with a 10 volt battery, then charge on 3 μF capacitor is :

(1) 5 μC (2) 10μC (3) 11μC (4) 15μC

PCP061

62. Two charged spheres having radii a and b are joined with a wire then the ratio of electric field E_a/E_b on their respective surfaces is :

(1) a/b (2) b/a (3) a^2/b^2 (4) b^2/a^2

PCP062

63. A solid conducting sphere of radius R_1 is surrounded by another concentric hollow conducting sphere of radius R_2. The capacitance of this assembly is proportional to:

(1) $\frac{R_2 - R_1}{R_1R_2}$ (2) $\frac{R_2 + R_1}{R_1R_2}$

(3) $\frac{R_1R_2}{R_1 + R_2}$ (4) $\frac{R_1R_2}{R_2 - R_1}$

PCP063

64. Two spherical conductors A and B of radius a and b (b > a) are placed in air concentrically. B is given a charge + Q coulombs and A is grounded. The equivalent capacitance of these is :

(1) $4\pi\in_0 \frac{ab}{(b-a)}$ (2) $4\pi\in_0 (a + b)$

(3) $4\pi\in_0 b$ (4) $4\pi\in_0 \frac{b^2}{(b-a)}$

PCP064

65. Time constant of a series R–C circuit is :-

(1) +RC (2) –RC (3) $\frac{R}{C}$ (4) $\frac{C}{R}$

PCP065

66. Energy per unit volume for a capacitor having area A and separation d kept at potential difference V is given by :

(1) $\frac{1}{2}\in_0 \frac{V^2}{d^2}$ (2) $\frac{1}{2\in_0} \frac{V^2}{d^2}$

(3) $\frac{\varepsilon_0 V^2 A^2}{2d^2}$ (4) $\frac{1}{2}\frac{V^2A^2}{\varepsilon_0 d^2}$

PCP066

67. A capacitor of capacity C_1 charged upto a voltage V and then connected to an uncharged capacitor of capacity C_2. Then final potential difference across each will be :

(1) $\frac{C_2V}{C_1 + C_2}$ (2) $\frac{C_1V}{C_1 + C_2}$

(3) $\left(1 + \frac{C_2}{C_1}\right)V$ (4) $\left(1 - \frac{C_2}{C_1}\right)V$

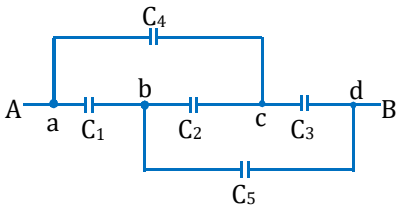
PCP067

68. A conducting sphere of radius 10 cm is charged with 10 μC. Another uncharged sphere of radius 20 cm is allowed to touch it for some time. After that, if the spheres are separated, then surface density of charge on the spheres will be in the ratio of :

(1) 1 : 4 (2) 1 : 3 (3) 2 : 1 (4) 1 : 1

PCP068

69. In the given figure, the capacitors C_1, C_3, C_4, C_5 have a capacitance 4 μF each. If the capacitor C_2 has a capacitance 10 μF, then effective capacitance between A and B will be:



(1) 2 μF (2) 4 μF (3) 6 μF (4) 8 μF

PCP069

70. 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 one joined to the negative plate of the other. The potential difference across each will be

(1) 3 V (2) Zero (3) 6 V (4) 4 V

PCP070

71. A capacitor of 0.2 μF capacitance is charged to 600 V. After removing the battery, it is connected with a 1.0 μF capacitor in parallel, then the potential difference across each capacitor will become :

(1) 300 V (2) 600 V
(3) 100 V (4) 120 V

PCP071

72. Mean electric energy density between the plates of a charged capacitor is :
Here q = Charge on capacitor A = Area of each plate of the capacitor

(1) $q^2/(2\in_0 A^2)$ (2) $q/(2\in_0 A^2)$
(3) $q^2/(2\in_0 A)$ (4) None of these

PCP072

73. If potential difference across a capacitor is changed from 15 V to 30 V, work done is W. The work done when potential difference is changed from 30 V to 60 V, will be :

(1) W (2) 4W (3) 3 W (4) 2 W

PCP073

74. Three capacitors each of capacity 4 μF are to be connected in such a way that the effective capacitance is 6 μF. This can be done by :-

(1) connecting all of them in series
(2) connecting all of them in parallel
(3) connecting two in series and one in parallel
(4) connecting two in parallel and one in series

PCP074

75. A capacitor is connected to a 10 V battery. The charge on plates is 40 μC when medium between plates is air. The charge on the plates become 100 μC when the space between the plates is filled with oil. The dielectric constant of oil is :

(1) 2.5 (2) 4 (3) 6.25 (4) 10

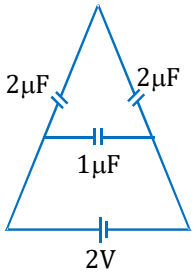
PCP075

76. Two capacitor each having a capacitance C and breakdown voltage V are joined in series. The effective capacitance and maximum working voltage of the combination is :-

(1) 2C, 2V (2) $\frac{C}{2}, \frac{V}{2}$
(3) 2C, V (4) $\frac{C}{2}$,2V

PCP076

77. The charge (in μC) on any one of the 2μF capacitor and 1μF capacitor will be given respectively as :



(1) 1,2 (2) 2,1 (3) 1,1 (4) 2,2

PCP077

78. The electric field between the plates of a parallel plate capacitor when connected to a certain battery is E_0. If the space between the plates of the capacitor is filled by introducing a material of dielectric constant K without disturbing the battery connections; the field between the plates will be :

(1) KE_0

(2) E_0

(3) $\frac{E_0}{K}$

(4) None of the above

PCP078

79. 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 :

(1) 45 kW (2) 90 kW

(3) 180 kW (4) 360 kW

PCP079

80. Two capacitors with capacity C_1 and C_2, when connected in series, have a capacitance C_s and when connected in parallel have a capacitance C_p. Which of the following is true?

(1) $C_s = C_1+C_2$ (2) $C_p = \frac{C_1C_2}{C_1+C_2}$

(3) $\frac{C_s}{C_p} = \frac{C_1}{C_2}$ (4) $C_sC_p = C_1C_2$

PCP080

81. Two metallic spheres of radii R_1 and R_2 are connected by a thin wire. If + q_1 and + q_2 are the charges on the two spheres then :

(1) $\frac{q_1}{q_2} = \frac{R_1^2}{R_2^2}$ (2) $\frac{q_1}{q_2} = \frac{R_1}{R_2}$

(3) $\frac{q_1}{q_2} = \frac{R_1^3}{R_2^3}$ (4) $\frac{q_1}{q_2} = \frac{\left(R_1^2-R_2^2\right)}{\left(R_1^2+R_2^2\right)}$

PCP081

82. Two spheres have radii 10 cm & 20 cm. One of the sphere is given 150 μC charge and connected by a wire. Their common potential will be -

(1) 9×10^6 volts (2) $4{\cdot}5 \times 10^6$ volts

(3) $1{\cdot}8 \times 10^6$ volts (4) $1{\cdot}35 \times 10^9$ volts

PCP082

83. Total energy stored in a 900 μF capacitor at 100 volts is transferred into a 100 μF capacitor. The potential drop across the new capacitor is (in volts)

(1) 900 (2) 200

(3) 100 (4) 300

PCP083

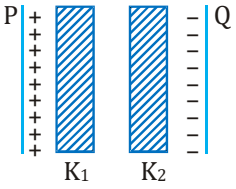
EXERCISE-I (Conceptual Questions) ANSWER KEY

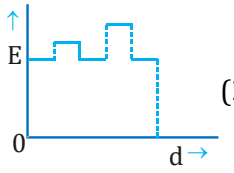
Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	1	4	3	3	1	3	4	2	4	3	4	2	4	2	1
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	2	2	3	3	4	3	4	3	1	4	1	2	2	4	3
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	3	3	1	4	1	3	2	2	3	1	3	3	1	2	2
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	3	2	2	1	1	1	1	2	4	4	2	3	2	2	1
Question	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Answer	2	2	4	4	1	1	2	3	2	4	3	1	2	3	1
Question	76	77	78	79	80	81	82	83							
Answer	4	4	2	2	4	2	2	4							

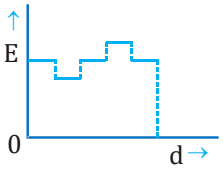
Exercise - II (Previous Year Questions) AIPMT/NEET

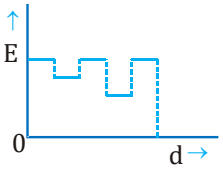
AIPMT 2014

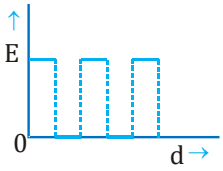
1. Two thin dielectric slabs of dielectric constants K_1 and K_2 ($K_1 < K_2$) are inserted between the plates of a parallel plate capacitor, as shown in the figure. The variation of electric field 'E' between the plates with distance 'd' as measured from plate P is correctly shown by :-



(1) 

(2) 

(3) 

(4) 

PCP091

AIPMT 2015

2. A parallel plate air capacitor of capacitance C is connected to a cell of emf V and then disconnected from it. A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is **incorrect**?

(1) The energy stored in the capacitor decreases K times.

(2) The change in energy stored is $\frac{1}{2}CV^2\left(\frac{1}{K}-1\right)$.

(3) The charge on the capacitor is not conserved.

(4) The potential difference between the plates decreases K times.

PCP092

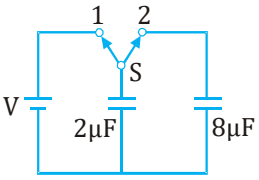
Re-AIPMT 2015

3. A parallel plate air capacitor has capacity 'C' and separation between the plates is 'd'. A potential difference 'V' is applied between the plates. Force of attraction between the plates of the parallel plate air capacitor is :-

(1) $\frac{C^2V^2}{2d^2}$ (2) $\frac{C^2V^2}{2d}$ (3) $\frac{CV^2}{2d}$ (4) $\frac{CV^2}{d}$

PCP093

NEET-I 2016

4. 

A capacitor of 2μF is charged as shown in the diagram. When the switch S is turned to position 2, the percentage of its stored energy dissipated is:

(1) 0% (2) 20% (3) 75% (4) 80%

PCP094

NEET(UG)-2017

5. 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 :-

(1) Decreases by a factor of 2

(2) Remains the same

(3) Increases by a factor of 2

(4) Increases by a factor of 4

PCP096

NEET(UG) 2018

6. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A, is :-

(1) independent of the distance between the plates.

(2) linearly proportional to the distance between the plates

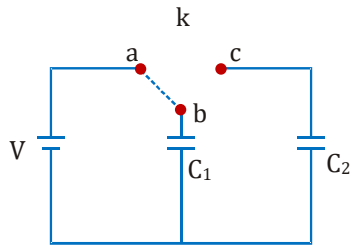
(3) proportional to the square root of the distance between the plates.

(4) inversely proportional to the distance between the plates.

PCP097

NEET(UG) 2019 (Odisha)

7. Two identical capacitors C_1 and C_2 of equal capacitance are connected as shown in the circuit. Terminals a and b of the key k are connected to charge capacitor C_1 using battery of emf V volt. Now disconnecting a and b the terminals b and c are connected. Due to this, what will be the percentage loss of energy?



(1) 75% (2) 0%
(3) 50% (4) 25%

PCP098

8. Two metal spheres, one of radius R and the other of radius 2R respectively have the same surface charge density σ. They are brought in contact and separated. What will be the new surface charge densities on them?

(1) $\sigma_1 = \frac{5}{6}\sigma,\ \sigma_2 = \frac{5}{2}\sigma$

(2) $\sigma_1 = \frac{5}{2}\sigma,\ \sigma_2 = \frac{5}{6}\sigma$

(3) $\sigma_1 = \frac{5}{2}\sigma,\ \sigma_2 = \frac{5}{3}\sigma$

(4) $\sigma_1 = \frac{5}{3}\sigma,\ \sigma_2 = \frac{5}{6}\sigma$

PCP099

NEET(UG) 2020

9. The capacitance of a parallel plate capacitor with air as medium is 6 μF. With the introduction of a dielectric medium, the capacitance becomes 30 μF. The permittivity of the medium is :

($\varepsilon_0 = 8.85 \times 10^{-12}\ C^2\ N^{-1}\ m^{-2}$)

(1) $5.00\ C^2\ N^{-1}\ m^{-2}$

(2) $0.44 \times 10^{-13}\ C^2\ N^{-1}\ m^{-2}$

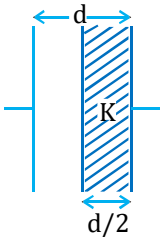
(3) $1.77 \times 10^{-12}\ C^2\ N^{-1}\ m^{-2}$

(4) $0.44 \times 10^{-10}\ C^2\ N^{-1}\ m^{-2}$

PCP100

NEET(UG) 2020 (Covid-19)

10. A parallel plate capacitor having cross-sectional area A and separation d has air in between the plates. Now an insulating slab of same area but thickness d/2 is inserted between the plates as shown in figure having dielectric constant K(= 4). The ratio of new capacitance to its original capacitance will be,

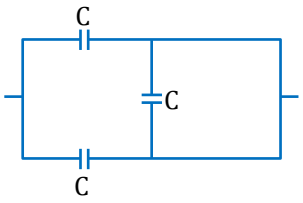


(1) 2 : 1 (2) 8 : 5
(3) 6 : 5 (4) 4 : 1

PCP101

NEET(UG) 2021

11. The equivalent capacitance of the combination shown in the figure is :



(1) 3C (2) 2C
(3) C/2 (4) 3C/2

PCP102

12. A parallel plate capacitor has a uniform electric field '$\vec{E}$' in the space between the plates. If the distance between the plates is 'd' and the area of each plate is 'A', the energy stored in the capacitor is :

(ε_0 = permittivity of free space)

(1) $\frac{1}{2}\varepsilon_0 E^2$ (2) $\varepsilon_0 EAd$

(3) $\frac{1}{2}\varepsilon_0 E^2 Ad$ (4) $\frac{E^2 Ad}{\varepsilon_0}$

PCP103

13. Polar molecules are the molecules :

(1) having zero dipole moment.

(2) acquire a dipole moment only in the presence of electric field due to displacement of charges.

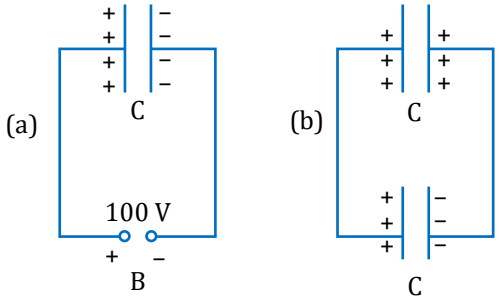
(3) acquire a dipole moment only when magnetic field is absent.

(4) having a permanent electric dipole moment.

PCP104

NEET(UG) 2022

14. A capacitor of capacitance C = 900 pF is charged fully by 100 V battery B as shown in figure (a). Then it is disconnected from the battery and connected to another uncharged capacitor of capacitance C = 900 pF as shown in figure (b). The electrostatic energy stored by the system (b) is:



(1) 3.25×10^{-6} J

(2) 2.25×10^{-6} J

(3) 1.5×10^{-6} J

(4) 4.5×10^{-6} J

PCP105

RE-NEET(UG) 2022

15. The distance between the two plates of a parallel plate capacitor is doubled and the area of each plate is halved. If C is its initial capacitance, its final capacitance is equal to:

(1) 2C (2) C/2

(3) 4C (4) C/4

PCP107

16. The effective capacitances of two capacitors are 3μF and 16 μF, when they are connected in series and parallel respectively. The capacitance of two capacitors are :

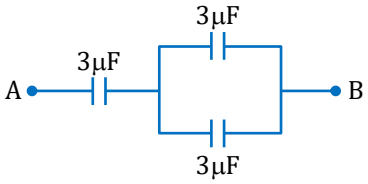
(1) 10 μF, 6 μF (2) 8 μF, 8 μF

(3) 12 μF, 4 μF (4) 1.2 μF, 1.8 μF

PCP108

NEET(UG) 2023

17. The equivalent capacitance of the system shown in the following circuit is :



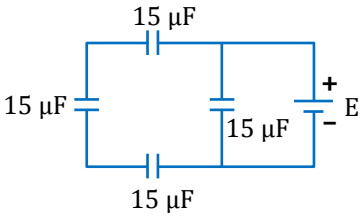
(1) 3μF (2) 6μF

(3) 9μF (4) 2μF

PCP128

RE-NEET(UG) 2023

18. The equivalent capacitance of the arrangement shown in figure is :



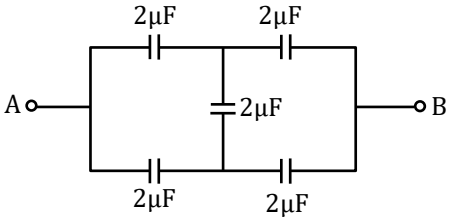
(1) 30 μF (2) 15 μF

(3) 25 μF (4) 20 μF

PCP129

NEET(UG) 2024

19. In the following circuit, the equivalent capacitance between terminal A and terminal B is :



(1) 2μF (2) 1μF (3) 0.5μF (4) 4μF

PCP130

20. If the plates of a parallel plate capacitor connected to a battery are moved close to each other, then

A. the charge stored in it, increases.
B. the energy stored in it, decreases.
C. its capacitance increases.
D. the ratio of charge to its potential remains the same.
E. the product of charge and voltage increases.

Choose the most appropriate answer from the options given below :

(1) A, B and E only (2) A, C and E only
(3) B, D and E only (4) A, B and C only

PCP131

RE-NEET(UG) 2024

21. A 12 pF capacitor is connected to a 50V battery, the electrostatic energy stored in the capacitor in nJ is :

(1) 15 (2) 7.5 (3) 0.3 (4) 150

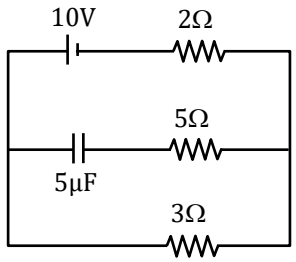
PCP132

22. The capacitance of a capacitor with charge q and a potential difference V depends on:

(1) both q and V
(2) the geometry of the capacitor
(3) q only
(4) V only

PCP133

23. The steady state current in the circuit shown below is:



(1) 0.67 A
(2) 1.5 A
(3) 2 A
(4) 1 A

PCP134

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	3	3	3	4	1	1	3	4	4	2	2	3	4	2	4
Question	16	17	18	19	20	21	22	23							
Answer	3	4	4	1	2	1	2	3							

Exercise – III (Analytical Questions) Master Your Understanding

1. A parallel plate air capacitor is connected to a battery. The quantities charge, voltage, electric field and energy associated with the capacitor are given by Q_0, V_0, E_0 and U_0 respectively. A dielectric slab is now inserted to fill the space between the plates with battery still in connection. The corresponding quantities now given by Q, V E and U are related to the previous one as :

(a) $Q > Q_0$ (b) $V > V_0$ (c) $E > E_0$ (d) $U > U_0$

(1) only (a) is correct

(2) only a & c are correct

(3) only a & d are correct

(4) all of above are correct

PCP109

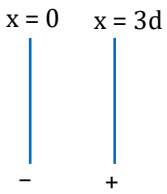
2. A dielectric slab of thickness d is inserted in a parallel plate capacitor whose negative plate is at x = 0 and positive plate is at x = 3d. The slab is equidistant from the plates. The capacitor is given some charge. As one goes from 0 to 3d:

(a) The magnitude of the electric field remains the same

(b) The direction of the electric field remains the same

(c) The electric potential increases continuously

(d) The electric potential increases at first, then decreases and again increases



(1) a and c are correct

(2) b and c are correct

(3) a, b and c are correct

(4) All are correct

PCP110

3. The plates of a parallel plate capacitor are, not exactly parallel. The surface charge density therefore:

(a) Is higher at the closer end

(b) The surface charge density will not be uniform

(c) Each plate will have the same potential at each point

(d) The electric field is smallest where the plates are closest

(1) only a is correct

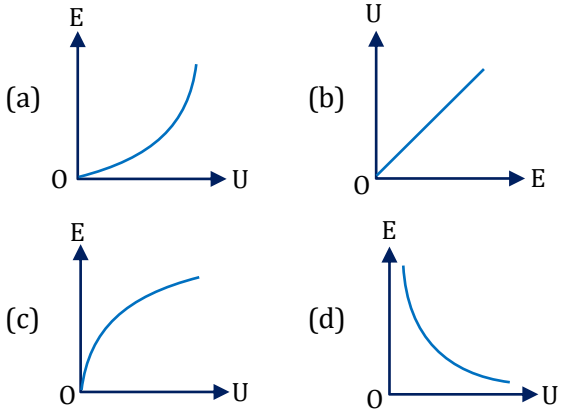
(2) only b & c are correct

(3) a & c are correct

(4) a, b & c are correct

PCP111

4. If at distance r from a positively charged particle, electric field strength and energy density are E and U, respectively, which of the following graphs is correct?

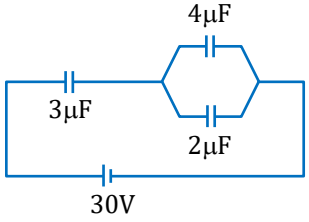


(1) only a (2) only b

(3) only c (4) a, b, d

PCP112

5. In the circuit shown in figure, match the following two columns.

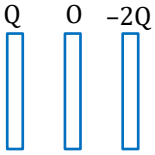


	Column-I		Column-II
(I)	Charge given by battery	(a)	20 μC
(II)	Charge of 4μF capacitor	(b)	30 μC
(III)	Charge of 2 μF capacitor	(c)	60 μC
(IV)	Charge of 3 μF capacitor	(d)	40 μC

(1) I-a, II-d, III-b, IV-c
(2) I-c, II-d, III-a, IV-c
(3) I-b, II-a, III-c, IV-d
(4) I-c, II-d, III-c, IV-a

PCP113

6. Three identical metal plates with large surface areas are kept parallel to each other as shown in fig. The leftmost plate is given charge Q, the rightmost given charge –2Q and the middle one remains neutral. Then



	Column-I		Column-II
i.	The charge appearing on outer surface of the rightmost plate	a.	$+\frac{Q}{2}$
ii.	The charge appearing on outer surface of the leftmost plate	b.	$-\frac{Q}{2}$
iii.	The charge appearing on left surface of the middle plate	c.	$-\frac{3Q}{2}$
iv.	The charge appearing on right surface of the middle plate	d.	$\frac{3Q}{2}$

(1) i-b, ii-b, iii-d, iv-c (2) i-c, ii-b, iii-d, iv-c
(3) i-b, ii-a, iii-c, iv-d (4) i-b, ii-b, iii-c, iv-d

PCP114

7. Match the following –

	List-I		List-II
(P)	Self-energy of a uniformly charged spherical shell	(1)	$\frac{1}{8\pi\varepsilon_0}\frac{Q^2}{R}$
(Q)	Energy stored per unit volume of a charged air filled capacitor	(2)	$\frac{1}{4\pi\varepsilon_0}\frac{2Q^2}{R^2}$
(R)	Force between two circular plates of a charged parallel plate capacitor, radius of the plates being R and separation R/32	(3)	$\frac{1}{4\pi\varepsilon_0}\frac{Q^2}{R}$
(S)	Work done by electric field in moving a point charge Q from the surface of a uniformly charged sphere of radius R and moving it to infinity, total charge on the sphere = Q	(4)	$\frac{1}{2}\varepsilon_0 E^2$

Codes :

	P	Q	R	S
(1)	3	1	4	2
(2)	2	1	3	4
(3)	1	4	2	3
(4)	4	1	2	3

PCP115

8. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : Mutual force of attraction between two plates of isolated capacitor is independent of presence of dielectric slab between plates.

Reason (R) : Force of interaction between two charged bodies is independent of medium.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PCP116

9. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : It is not possible to make a spherical conductor of capacitance one farad.

Reason (R) : It is possible for earth as its radius is 6400 km.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PCP117

10. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : When two charged capacitors are connected in parallel, then total potential energy of system always decreases.

Reason (R) : During recombination charge flow from one capacitor to another capacitor so energy is lost in the form of heat and electromagnetic radiation.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PCP118

11. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : Circuits containing high capacity capacitors, charged to high voltage should be handled with caution, even when the current in the circuit is switched off.

Reason (R) : When an isolated capacitor is touched by hand or any other part of the human body, there is an easy path to the ground available for the discharge of the capacitor.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PCP119

12. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : If separation between plates of a parallel plate isolated charged capacitor is increased, its energy stored increases.

Reason (R) : Work done to more separate the plates get converted in electrostatic potential energy.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PCP120

13. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

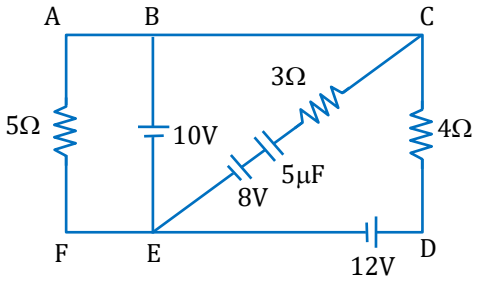
Assertion (A) : When a capacitor is charged by a battery, both the plates receive charge equal in magnitude, no matter size of plates are identical or not.

Reason (R) : The charge distribution on the plates of capacitor is in accordance with charge conservation principle.
In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PCP121

14. A network consisting of three resistors, three batteries, and a capacitor is shown in figure.



Column I	Column II
(A) Current in branch EB is	(P) 10 μC
(B) Current in branch CB is	(Q) 0.5 A
(C) Current in branch ED is	(R) 1.5 A
(D) Charge on capacitor is	(S) 5 μC
	(T) None

Options :-
(1) A → R, B → Q, C → Q, D → P
(2) A → R, B → Q, C → R, D → S
(3) A → Q, B → R, C → R, D → P
(4) A → R, B → Q, C → Q, D → S

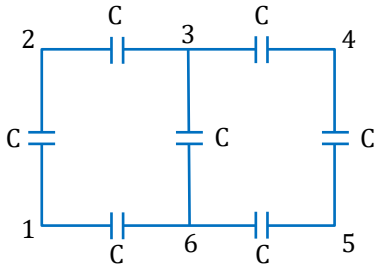
PCP122

15. **Statement–1** : If capacitor is filled with, same thickness (t) of dielectric (t < d) and conducting sheet one after another, then capacitance are C_1 and C_2 respectively then $C_1 < C_2$
Statement–2 : Capacitance is more in presence of metal sheet in compare to dielectric sheet as $K_{Conduct} > K_{dielectric}$

(1) Statement–1 is True, Statement–2 is True ; Statement–2 is a correct explanation for Statement–1.
(2) Statement–1 is True, Statement–2 is True ; Statement–2 is not a correct explanation for Statement–1.
(3) Statement–1 is True, Statement–2 is False.
(4) Statement–1 is False, Statement–2 is True.

PCP123

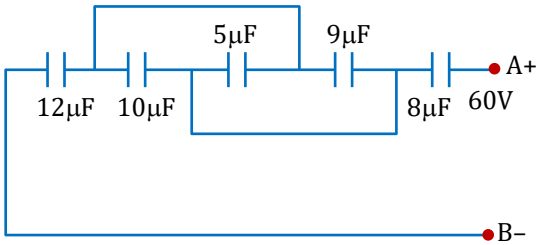
16. For the given circuit, select the incorrect alternative



(1) The equivalent capacitance between points 1 & 2 is $\frac{15C}{11}$
(2) The equivalent capacitance between points 3 & 6 is $\frac{5C}{3}$
(3) The equivalent capacitance between points 1 & 3 is $\frac{15C}{14}$
(4) The equivalent capacitance between points 3 & 5 is $\frac{14C}{15}$

PCP124

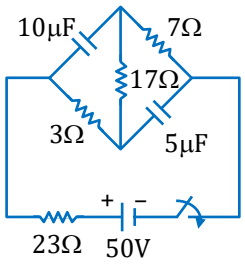
17. The equivalent capacitance between A and B is ..... and charge on 5μF capacitor is .....



(1) 4μF & 50 μC
(2) 5μF & 40 μC
(3) 8μF & 60 μC
(4) None

PCP125

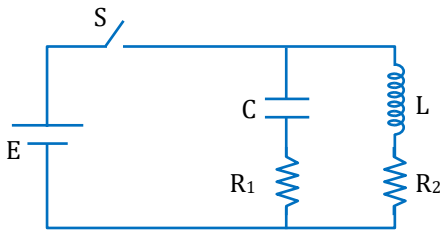
18. Write down the charge in μC on 10μF capacitor in steady state.



(1) 100 μC
(2) 150 μC
(3) 180 μC
(4) 200 μC

PCP126

19. In the circuit shown in figure E=25V, L=2H, C=60 μF, R_1 = 5Ω and R_2 = 10Ω. Switch S is closed at t = 0.



	Column-I		Column-II
(A)	Current through R_1 at t = 0	(P)	0
(B)	Current through R_2 at t = 0	(Q)	5A
(C)	Current through R_1 at t = ∞	(R)	2.5 A
(D)	Current through R_2 at t = ∞	(S)	None of these

Options :-

(1) A → P, B → Q, C → P, D → R

(2) A → Q, B → P, C → P, D → R

(3) A → Q, B → P, C → R, D → P

(4) A → P, B → R, C → P, D → Q

PCP127

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	3	2	4	3	2	4	3	1	3	4	1	1	1	1	1
Question	16	17	18	19											
Answer	4	1	4	2											