PRE-MEDICAL

PHYSICS

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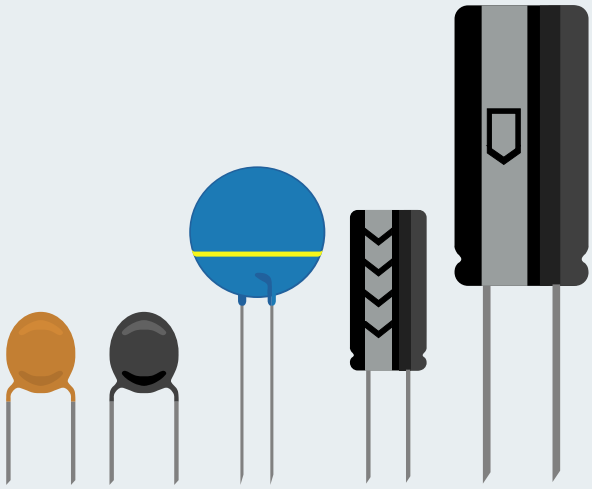


EXERCISE

Capacitor

ENGLISH MEDIUM

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.

CP0001

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.

CP0002

3. The net charge on a capacitor is :-

(1) 2q (2) q/2 (3) 0 (4) infinity

CP0003

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) $12\pi\epsilon_0\frac{A}{V}$

CP0004

5. Capacitors are used in electrical circuits where appliances need rapid :

(1) Current (2) Voltage

(3) Watt (4) Resistance

CP0005

6. Which of the following is called electrical energy tank?

(1) Resistor (2) Inductance

(3) Capacitor (4) Motor

CP0006

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

CP0007

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

CP0008

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

CP0009

10. The potential to which a conductor is raised, depends on :-

(1) the amount of charge

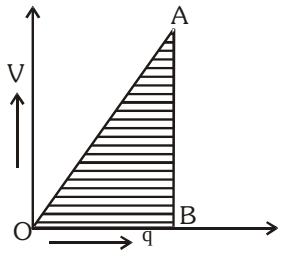
(2) the geometry and size of the conductor

(3) both (1) and (2)

(4) None of these

CP0010

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.

CP0011

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.

CP0012

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.

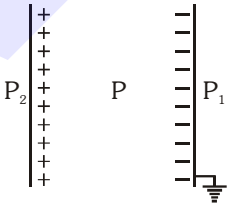
CP0013

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

CP0014

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



CP0015

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

CP0016

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}

CP0017

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) $\frac{U_0}{K^2}$

CP0018

19. The energy and capacity of a charged parallel plate capacitor are U and C respectively. Now a dielectric slab of ϵ_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

CP0019

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) $\frac{\varepsilon_0 A}{\left[d - t\left\{1 - \frac{1}{K}\right\}\right]}$

CP0020

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

CP0021

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

CP0022

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

CP0023

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

CP0024

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

CP0025

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.

CP0026

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.

CP0027

28. Can a metal be used as a medium for dielectric ?

(1) Yes

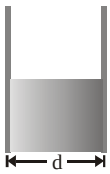
(2) No

(3) Depends on its shape

(4) Depends on dielectric

CP0028

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 :-



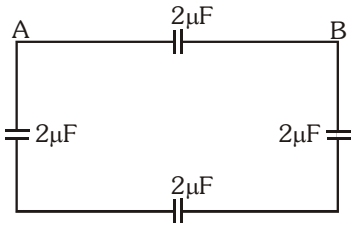
(1) 400% (2) 66.6%

(3) 33.3% (4) 200%

CP0029

COMBINATION OF CAPACITORS & SHARING OF CHARGES

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

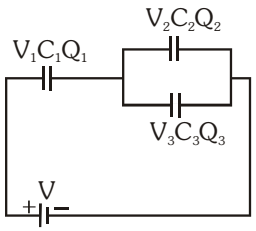


(1) 8 μF (2) 6 μF

(3) $\frac{8}{3}\mu F$ (4) $\frac{3}{8}\mu F$

CP0030

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)

CP0031

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

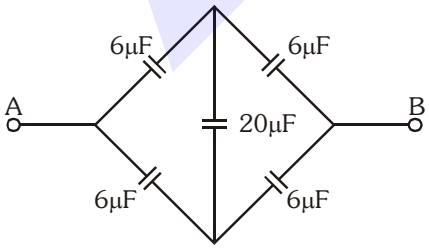
(2) 12 component capacitors

(3) 48 component capacitors

(4) 16 component capacitors

CP0032

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

CP0033

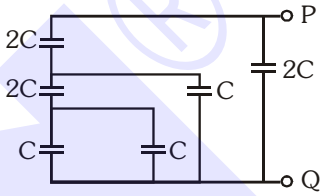
34. A series combination of two capacitances of value 0.1 μF and 1μF is connected with a source of voltage 500 volts. The potential difference in volts across the capacitor of value 0.1 μF will be:

(1) 50 (2) 500

(3) 45.5 (4) 454.5

CP0034

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

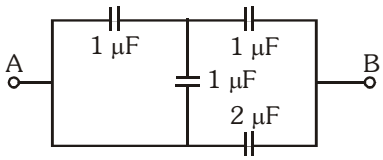


(1) 3C (2) 2C

(3) C (4) C/3

CP0035

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

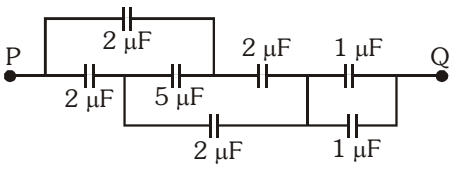


(1) $\frac{2}{3}$ μF (2) $\frac{5}{3}$ μF

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

CP0036

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

CP0037

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) $\frac{V}{k}\frac{(R_1R_2)}{(R_1+R_2)}$

CP0038

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 posiitve 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

CP0039

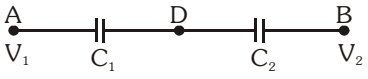
40. Half of the space between a parallel plate capacitor is filled with a medium of dielectric constant K parallel to the plates. If initially the capacity was C, then the new capacity will be :

(1) 2KC/(1+K) (2) C (K+1)/2

(3) CK/(1+K) (4) KC

CP0040

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) $\frac{C_2V_1-C_1V_2}{C_1+C_2}$

CP0042

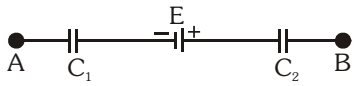
42. A circuit has a section AB as shown in the figure with E = 10 V, C_1 = 1.0 μF, C_2 = 2.0 μF and the potential difference V_A-V_B = 5 V. The voltage across C_1 is :

(1) Zero

(2) 5 V

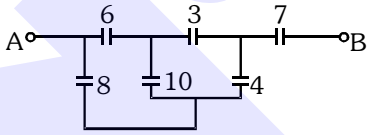
(3) 10 V

(4) 15 V



CP0043

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

CP0044

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) $C < C_1/2$

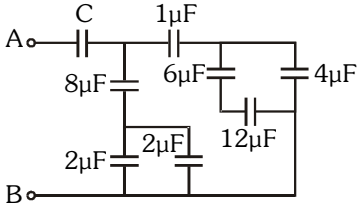
(2) $C_1/2 < C < C_1$

(3) $C_1 < C < C_2$

(4) $C_2 < C < 2C_2$

CP0045

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



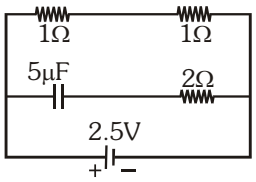
(1) $\frac{23}{32}\mu F$ (2) $\frac{32}{23}\mu F$

(3) $\frac{13}{23}\mu F$ (4) $\frac{23}{13}\mu F$

CP0046

CHARGING AND DISCHARGING OF CAPACITORS & CAPACITOR'S CIRCUIT

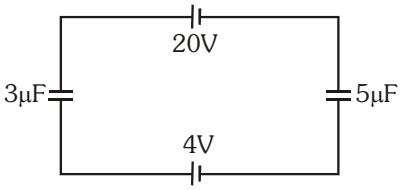
46. A capacitor of capacitance 5 μF is connected as shown in the figure. The internal resistance of the cell is 0.5 Ω. The amount of charge on the capacitor plate is :



(1) 0
(2) 5 μC
(3) 10 μC
(4) 25 μC

CP0047

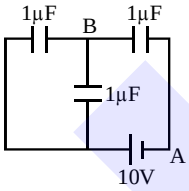
47. In the given circuit, the potential difference across 3 μF capacitor will be :



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

CP0048

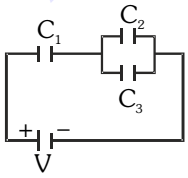
48. If potential of A is 10 V, then potential of B is :



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

CP0049

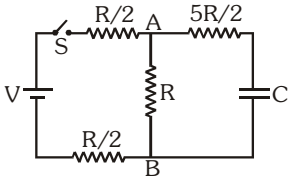
49. Capacitance $C_1 = 2C_2 = 2C_3$ and potential difference across C_1, C_2 and C_3 are V_1, V_2 and V_3 respectively then :



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

CP0050

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) $\frac{CV}{6}$

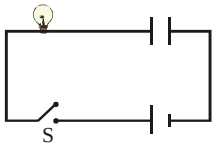
CP0051

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) $\frac{V}{3R}$

CP0052

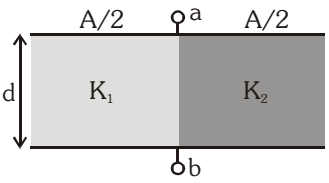
52. A bulb, a capacitor and a battery are connected together as shown here, with switch S initially open. When the switch S is closed, which one of the following is true ?



(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.

CP0053

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

CP0054

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.

CP0055

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 $Q_1R_2 \neq Q_2R_1$

CP0056

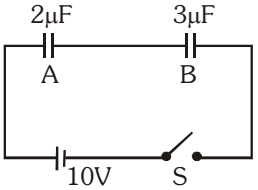
56. A capacitor is charged with a battery and energy stored is U. After disconnecting the battery another capacitor of same capacity is connected in parallel with it. The energy stored in each capacitor is:
(1) U/2 (2) U/4 (3) 4 U (4) 2 U

CP0057

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

CP0058

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 :



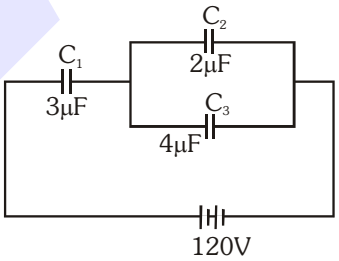
(1) the potential difference across the plates of A is 4 V and across the plates of B is 6 V
(2) the p.d. across the plates of A is 6 V and across the plates of B is 4 V
(3) the ratio of electrical energies stored in A and B is 2 : 3
(4) the ratio of charges on A and B is 3 : 2

CP0059

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

CP0060

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

CP0061

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

CP0062

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

CP0063

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) $\frac{R_1R_2}{R_2-R_1}$

CP0064

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

CP0065

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

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

CP0066

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

CP0067

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

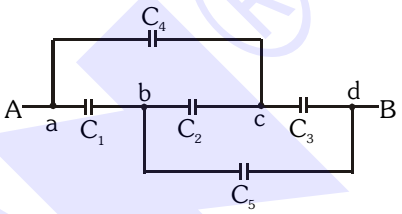
CP0068

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

CP0069

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

CP0070

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

CP0071

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

CP0072

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

CP0073

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

CP0074

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

CP0075

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

CP0076

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) $\frac{C}{2}, 2V$

CP0077

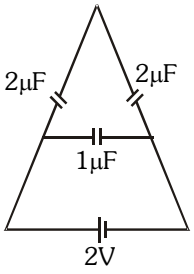
77. The charge (in μC) on any one of the 2μF capacitor and 1μF capacitor will be given respectively as :

(1) 1,2

(2) 2,1

(3) 1,1

(4) 2,2



CP0078

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

CP0079

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

CP0080

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) $C_sC_p=C_1C_2$

CP0081

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

CP0083

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

CP0084

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

CP0085

EXERCISE-I (Conceptual Questions) ANSWER KEY

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

EXERCISE-II (Previous Year Questions) AIPMT/NEET

AIPMT 2006

1. A parallel plate air capacitor is charged to a potential difference of V volts. After disconnecting the charging battery the distance between the plates of the capacitor is increased using an insulating handle. As a result the potential difference between the plates :-

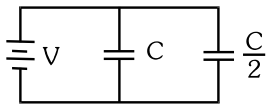
(1) decreases (2) does not change

(3) becomes zero (4) increases

CP0086

AIPMT 2007

2. Two condensers, one of capacity C and the other of capacity $\frac{C}{2}$, are connected to a V-volt battery, as shown.



The work done by battery in charging fully both the condensers is :-

(1) $\frac{1}{2}CV^2$ (2) $2\ CV^2$

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

CP0088

AIPMT 2008

3. The energy required to charge a parallel plate condenser of plate separation d and plate area of cross-section A such that the uniform electric field between the plates is E, is :-

(1) $\in_0 E^2\ Ad$ (2) $\frac{1}{2}\in_0 E^2\ Ad$

(3) $\frac{1}{2}\in_0 E^2\ /A.d$ (4) $\in_0 E^2/Ad$

CP0089

AIPMT 2009

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

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

CP0090

AIPMT (Pre) 2010

5. 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) $\frac{16C_1}{n_1n_2}$ (2) $\frac{2C_1}{n_1n_2}$

(3) $16\frac{n_2}{n_1}C_1$ (4) $2\frac{n_2}{n_1}C_1$

CP0091

AIPMT (Mains) 2010

6. Two parallel metal plates having charges + Q and – Q face each other with a certain separation between them. If the plates are now dipped in kerosene oil tank, the electric field between the plates will :-

(1) increase (2) decrease

(3) remain same (4) become zero

CP0092

AIPMT(Pre) 2011 & AIPMT (Mains) 2012

7. A parallel plate condenser has a uniform electric field E (V/m) in the space between the plates. If the distance between the plates is d (m) and area of each plate is A (m^2) the energy (joules) stored in the condenser is :-

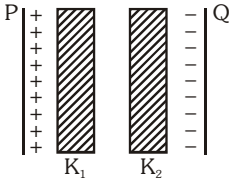
(1) $E^2Ad/\in_0$ (2) $\frac{1}{2}\in_0 E^2$

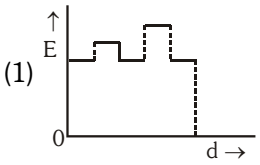
(3) $\in_0 EAd$ (4) $\frac{1}{2}\in_0 E^2Ad$

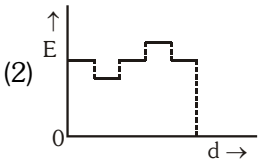
CP0094

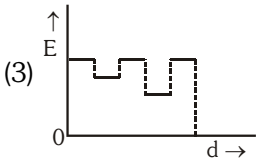
AIPMT 2014

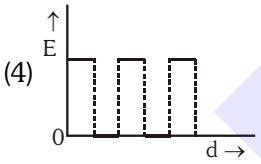
8. Two thin dielectric slabs of dielectric constants K_1 and K_2 ($K_1 < K_2$) are inserted between the plates of a parallel plate capacitor, as shown in the figure. The variation of electric field 'E' between the plates with distance 'd' as measured from plate P is correctly shown by :-



(1) 

(2) 

(3) 

(4) 

CP0098

AIPMT 2015

9. 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.

CP0101

Re-AIPMT 2015

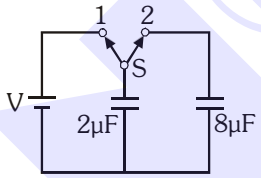
10. A parallel plate air capacitor has capacity 'C' and separation between the plates is 'd'. A potential difference 'V' is applied between the plates. Force of attraction between the plates of the parallel plate air capacitor is :-

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

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

CP0102

NEET-I 2016

11. 

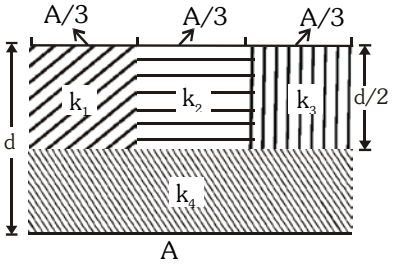
A capacitor of 2μF is charged as shown in the diagram. When the switch S is turned to position 2, the percentage of its stored energy dissipated is:

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

CP0103

NEET-II 2016

12. A parallel-plate capacitor of area A, plate separation d and capacitance C is filled with four dielectric materials having dielectric constants k_1, k_2, k_3 and k_4 as shown in the figure below. If a single dielectric material is to be used to have the same capacitance C in this capacitor, then its dielectric constant k is given by :-



(1) $\frac{2}{k}=\frac{3}{k_1+k_2+k_3}+\frac{1}{k_4}$

(2) $\frac{1}{k}=\frac{1}{k_1}+\frac{1}{k_2}+\frac{1}{k_3}+\frac{3}{2k_4}$

(3) $k = k_1 + k_2 + k_3 + 3k_4$

(4) $k = \frac{2}{3}(k_1 + k_2 + k_3) + 2k_4$

CP0104

NEET(UG)-2017

13. 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

CP0105

NEET(UG) 2018

14. 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

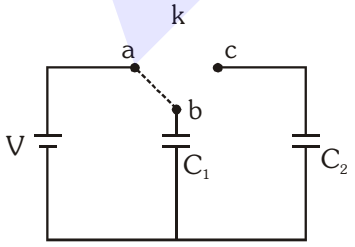
(3) proportional to the square root of the distance between the plates.

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

CP0110

NEET(UG) 2019 (Odisha)

15. 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%

CP0158

16. 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) $\sigma_1 = \frac{5}{3}\sigma,\ \sigma_2 = \frac{5}{6}\sigma$

CP0159

NEET(UG) 2020

17. 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) $0.44 \times 10^{-13}\ C^2\ N^{-1}\ m^{-2}$

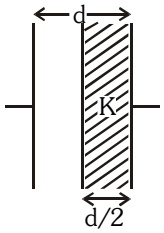
(3) $1.77 \times 10^{-12}\ C^2\ N^{-1}\ m^{-2}$

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

CP0160

NEET(UG) 2020 (Covid-19)

18. 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,



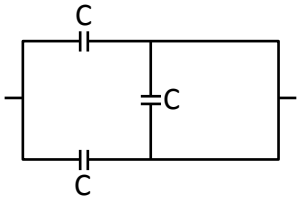
(1) 2 : 1 (2) 8 : 5

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

CP0161

NEET(UG) 2021

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



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

CP0162

20. 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) $\frac{E^2 Ad}{\varepsilon_0}$

CP0163

21. 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.

CP0164

NEET(UG) 2021 (Paper-2)

22. Choose the wrong option :

(1) The capacitance of spherical capacitor is $\frac{4\pi\varepsilon_0 r_1 r_2}{r_1 - r_1}$

(2) The energy density between plates of capacitor is $\frac{1}{2}\varepsilon_0 E^2$.

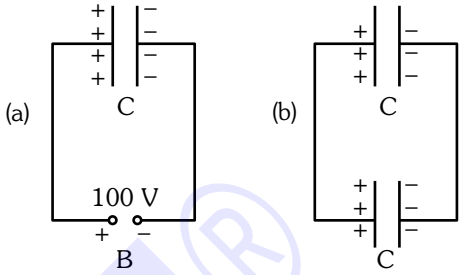
(3) The force between plates of parallel plate capacitor is $\frac{Q^2}{2A\varepsilon_0}$.

(4) The capacitance of cylindrical capacitor is $\frac{2\pi\varepsilon_0}{\ln(r_2 / r_1)}$

CP0165

NEET(UG) 2022

23. 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

CP0166

NEET(UG) 2022 (Overseas)

24. Three capacitors, each of capacitance 0.3 μF are connected in parallel. This combination is connected with another capacitor of capacitance 0.1 μF in series. Then the equivalent capacitance of the combination is:

(1) 0.09 μF (2) 0.1 μF

(3) 0.01 μF (4) 0.9 μF

CP0167

Re-NEET(UG) 2022

25. 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

CP0168

26. 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

CP0169

EXERCISE-II (Previous Year Questions) ANSWER KEY

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

EXERCISE-III (Analytical Questions) Master Your Understanding

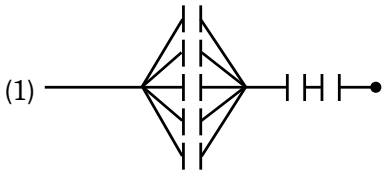
1. An air capacitor, a capacitor with a dielectric and a capacitor with a conducting slab (thickness one half the separation between the plates of parallel plate air capacitor are introduced in both cases) has capacity C_1, C_2 and C_3 respectively then :

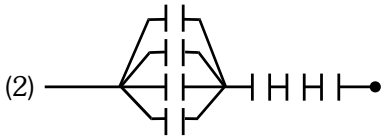
(1) $C_1 > C_2 > C_3$ (2) $C_2 > C_3 > C_1$

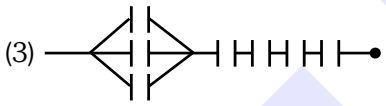
(3) $C_3 > C_2 > C_1$ (4) $C_3 > C_1 > C_2$

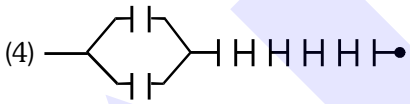
CP0117

2. Seven capacitors each of capacitance 2 μF are to be connected so as to have a total capacity of $\frac{10}{11}$μF . Which will be the combination shown ?

(1) 

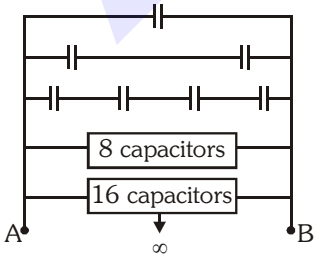
(2) 

(3) 

(4) 

CP0119

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



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

CP0120

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

(1) 1.5 and 1.33 (2) 1.33 and 1.5

(3) 3.0 and 2.67 (4) 2.67 and 3.0

CP0122

5. A 3 μF capacitor is charged to a potential of 300 V and 2 μF capacitor is charged to 200 V. The capacitors are then connected in parallel with plates of opposite polarities joined together. What amount of charge will flow, when the plates are so connected?

(1) 1300 μC (2) 800 μC

(3) 600 μC (4) 300 μC

CP0123

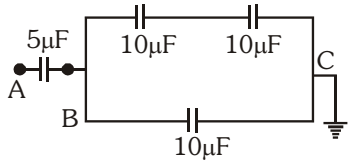
6. Two parallel plate capacitors whose capacitances are C and 2 C respectively, are joined in parallel. These are charged to V potential difference. If the battery is now removed and a dielectric of dielectric constant K is filled in between the plates of the capacitor C, then what will be the potential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

(1) $\frac{V}{K+2}$ (2) $\frac{2V}{K+2}$

(3) $\frac{3V}{K+2}$ (4) $\frac{(2+K)V}{3}$

CP0124

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

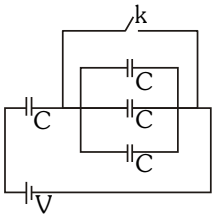


(1) 1500 V (2) 1000 V

(3) 500 V (4) 400 V

CP0125

8. The charge flowing through the cell on closing the key k is equal to :

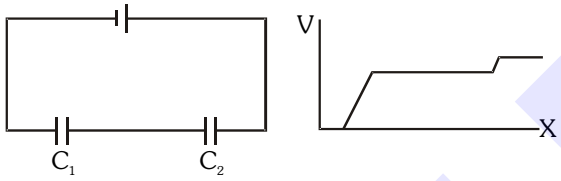


(1) $\frac{CV}{4}$ (2) 4CV

(3) $\frac{4}{3}CV$ (4) $\frac{3}{4}CV$

CP0126

9. Figure shows two capacitors connected in series and joined to a battery. The graph shows the variation in potential as one moves from left to right along the branch containing the capacitors. Then:



(1) $C_1 > C_2$

(2) $C_1 = C_2$

(3) $C_1 < C_2$

(4) The information is not sufficient to decide the relation between C_1 and C_2

CP0127

10. An air capacitor of capacity C = 10 μF is connected to a constant voltage battery of 12 V. Now the space between the plates is filled with a liquid of dielectric constant 5. The additional charge that flows now, from the battery to the capacitor is :

(1) 120 μC (2) 600 μC

(3) 480 μC (4) 24 μC

CP0129

11. Minimum number of 8 μF and 250 V capacitors required to make a combination of 16 μF and 1000 V are :

(1) 32 (2) 16

(3) 8 (4) 4

CP0130

12. In a capacitor of capacitance 20 μF the distance between the plates is 2 mm. If a dielectric slab of width 1 mm and dielectric constant 2 is inserted between the plates, then the new capacitance will be :

(1) 22 μF (2) 26.6 μF

(3) 52.2 μF (4) 13 μF

CP0131

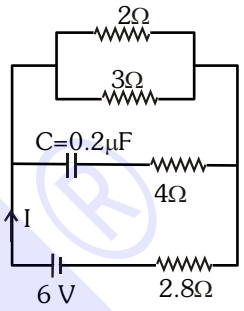
13. In the given figure the steady state current I is :

(1) zero

(2) 0.6 A

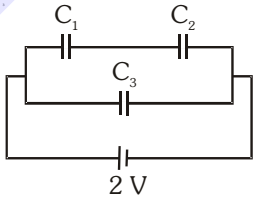
(3) 0.9 A

(4) 1.5 A



CP0132

14. Two capacitors C_1 = 2 μF and C_2 = 6 μF in series, are connected in parallel to a third capacitor C_3 = 4 μF. This arrangement is then connected to a battery of e.m.f. = 2 V, as shown in the figure. How much energy is given by the battery in charging the capacitors ?

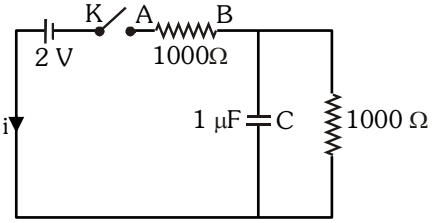


(1) 22×10^{-6} J (2) 11×10^{-6} J

(3) $\left(\frac{32}{3}\right) \times 10^{-6}$ J (4) $\left(\frac{16}{3}\right) \times 10^{-6}$ J

CP0133

15. When the key is pressed at time t = 0 then which of the following statements about the current i in the resistor AB of the given circuit is true ?



(1) at t = 0, i = 2 mA and it reduces to 1 mA at t = ∞

(2) i oscillates between 1 mA and 2 mA

(3) i = 2 mA at all time

(4) i = 1 mA at all time

CP0134

16. The combination of capacitors with C_1=3 μF, C_2 = 4 μF and C_3 = 2 μF is charged by connecting AB to a battery. Consider the following statements:

(I) Energy stored in C_1 = Energy stored in C_2+ Energy stored in C_3

(II) Charge on C_1= Charge on C_2 + Charge on C_3

(III) Potential drop across C_1 = Potential drop across C_2 = Potential drop across C_3

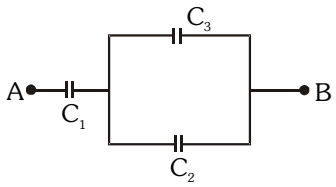
Which of these is are/correct ?

(1) I and II

(2) only II

(3) I and III

(4) only III



CP0135

17. If the distance between plates of a capacitor having capacity C & charge Q is doubled then the work done will be :

(1) $Q^2/4C$ (2) $Q^2/2C$

(3) Q^2/C (4) $2Q^2/C$

CP0136

18. A slab of copper of thickness $\frac{d}{2}$ is introduced between the plates of a parallel plate capacitor where d is the separation between its two plates. If the capacitance of the capacitor without the copper slab is C and with copper slab is C' then $\frac{C'}{C}$ is :-

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

CP0137

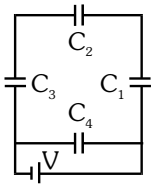
19. Two parallel plates of the same metal and same area are placed between the plates of a parallel plate capacitor of capacity C, If the thickness of each plate is equal to $\frac{1}{5}$th of the distance between the plates of the original capacitor then the capacity of the new capacitor is :-

(1) $\frac{5}{3}C$ (2) $\frac{3}{5}C$

(3) $\frac{3}{10}C$ (4) $\frac{10}{3}C$

CP0138

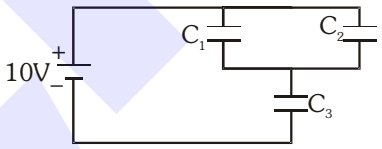
20. A network of four capacitors of capacity equal to C_1=C, C_2=2C, C_3=3C and C_4=4C are connected to a battery as shown in the figure. The ratio of the charges on C_2 and C_4 is :–



(1) $\frac{7}{4}$ (2) $\frac{22}{3}$ (3) $\frac{3}{22}$ (4) $\frac{4}{7}$

CP0139

21. A 10 volts battery is connected to three capacitors; C_1 = 2 μF , C_2 = 3 μF and C_3 = 5 μF, as shown. The charges on the capacitors C_1, C_2 and C_3 are respectively :



(1) 2 μC, 3 μC, 5 μC

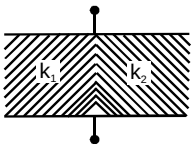
(2) 5 μC, 10 μC, 15 μC

(3) 10 μC, 15 μC, 25 μC

(4) 4 μC, 6 μC, 10 μC

CP0140

22. Two materials of dielectric constants k_1 and k_2 are introduced to fill the space between the two parallel plates of a capacitor as shown in figure. The capacity of the capacitor is :



(1) $\frac{A\in_0(k_1+k_2)}{2d}$ (2) $\frac{2A\in_0}{d}\left(\frac{k_1k_2}{k_1+k_2}\right)$

(3) $\frac{A\in_0}{d}\left(\frac{k_1k_2}{k_1+k_2}\right)$ (4) $\frac{A\in_0}{2d}\left(\frac{k_1+k_2}{k_1k_2}\right)$

CP0141

23. Two capacitors, 3 μF and 4 μF, are individually charged across a 6 V battery. After being disconnected from the battery, they are connected together with the negative plate of one connected to the positive plate of the other . What is the final total energy stored ?

(1) 1.26×10^{-4} J (2) 2.57×10^{-4} J

(3) 1.26×10^{-6} J (4) 2.57×10^{-6} J

CP0142

EXERCISE-III (Analytical Questions) ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**3**	**1**	**2**	**1**	**3**	**3**	**3**	**1**	**3**	**3**	**1**	**2**	**4**	**1**	**1**
Que.	16	17	18	19	20	21	22	23							
Ans.	**2**	**2**	**2**	**1**	**3**	**3**	**1**	**4**							