CLASS:XII SUBJECT: PHYSICS UNIT-1. ELECTROSTATICS ASSIGNMENT – No.01

Problems based on Coulombs Law, Electric Field and Electric Dipole:

1. Explain why?
   i. Electric field lines never intersect each other.
   ii. Electric field lines are continuous curve.
   iii. Electric field lines are always normal to the surface of a conductor.
   iv. Electric field lines do not pass through a conductor.
   v. Electric field lines tend to contract length wise and expand laterally.
   vi. Electric field is zero in the cavity of a hollow charged conductor.
   vii. Net charge in the interior of a charged conductor is zero
   viii. Electric field lines do not form closed loop.
2. Draw electric field lines, for https://mywebpathshala.com/
   i. Uniform electric field and non-uniform electric field.
   ii. q<o and q>o
   iii. $q_1 q_2 < 0$ and $q_1 < q_2$, separated by a finite distance.
   iv. A dipole
3. If a metallic sheet is placed between two charges, then how will the electric force between them changed.
4. How far apart the two electrons be, if the force between them equals the weight of an electron? What in case of protons. **Ans: 5.1 m, 0.117 m**
5. The electrostatic force of interaction between two charges 6μC and 2μC is 12N. If -2μC charges is added to each of the charges, then find the new force of interaction. **Ans: zero**
6. Force between two identical charges placed at a distance r in vacuum is F. Now a slab of dielectric of dielectric constant 4 is inserted between these two charges. If the thickness of the slab is r/2 then what will be the force acting between two charges. **Ans: F/4**
7. Three charges, each equal to q are placed at the three corners of a square of side a. find the electric field at the fourth corner. **Ans: $(2\sqrt{2} +1)\, q/8\pi \varepsilon_0 a^2$**
8. Two identical spheres, having charge of opposite sign attract each other with a force of 0.108 N when separated by 0.5m. The spheres are connected by a conducting wire, which then removed, and thereafter they repel each other with a force of 0.036 N. What were the initial charges on the spheres?
9. Two identical metallic spheres, having unequal, opposite charges are placed at a distance 0.90 m apart in air. After bringing them in contact with each other, they are again placed at the same distance apart. Now the force of repulsion between them is 0.025 N. calculate the final charge on each of them. **Ans: 1.5×10^{-6} C**
10. Two point charge q_1 and q_2 are 3m apart and their combined charge is 20μC. if one repels the other with a force of 0.075 N, what are the two charges? **Ans: 15μC, 5μC**
11. Two point charge + 9e and +e are kept at a distance from each- other. Where should we place a third charge q on the line joining the two charges so that it may be in equilibrium? **Ans: 3a/4 from +9e charge**
12. A charge **q** is to be divided on two objects. What should be the value of the charges on the objects so that the force between the objects can be maximum? **Ans: q/2**
13. Two similarly and equally charged identical metal spheres **A** and **B** repel each other with a force 2.0×10^{-5} N. A third identical, uncharged sphere **C** is touched with **A** and then placed at the midpoint between A and B. What is the electrostatic force on C. **Ans: 2.0×10^{-5} N, towards A**
14. Calculate the intensity of electric field due to a helium nucleus at a distance of 1Å from the nucleus. **Ans: 2.88×10^{11} N/C**
15. If an oil drop of weight 3.2×10^{-19} N is balanced in an electric field of 5×10^5 N/C**,** find charge on the drop. **Ans:** 6.4×10^{-19} C Home - www.mywebpathshala.com

16. ABC is an equilateral triangle having each side is 0.05 m. Two charges of magnitude +50/3 nC and –50/3 nC are kept at vertices A and B respectively. What will be magnitude and direction of resultant field at C. **Ans: 60 kN/C parallel to AB**
17. An electric dipole is placed in an electric field of magnitude 4×10^5 NC^{-1} by making an angle of 60° with it and experiences a torque of 8√3 Nm. If the length of the dipole is 4cm, determine the magnitude of either charge of the dipole. **Ans: 10^{-3}C**
18. Calculate the field due to an electric dipole of length 10cm and consisting of charge of ± 100μC at a point 20 cm from each charge. **Ans: 1125×10^7 NC^{-1}**
19. Electric charges q,q,-2q are placed at the corners of an equilateral triangle ABC of side l. Find the magnitude of electric dipole moment of the system. **Ans.√3ql**
20. Obtain the formula for the electric field due to a long thin wire of uniform linear charge density λ without using Gauss's law. **Ans. $E = \lambda / 2\pi\varepsilon_o r$**
21. If the linear charge density of a cylinder is 4μC/m then find electric field intensity at a point 3.6m from the axis. **Ans: 2.0×10^6 N/C** Home - www.mywebpathshala.com
22. A particle of mass m and charge –e is project with horizontal speed 1m/s into an electric field of intensity E directed towards down . Find (a) The vertical component of its acceleration (b) Horizontal and vertical displacement after time t (c) Equation of trajectory. **Ans: (a) $a_y = eE/m$ (b) t, $eEt^2/2m$ (c) $eEx^2 / 2m$**
23. Two identical charged spheres are suspended by string of equal lengths. The strings make an angle of 30° with each other. When suspended in a liquid of density 8 gcm^{-3}, the angle remains the same. If density of material of the material of the sphere is 16 gcm^{-3}, what is dielectric constant of the liquid?**Ans:2**
24. A charge Q is placed at each of the opposite corners of a square. A charge q is placed at each of the other two opposite two corners. If the net electrical forces on Q is zero, then find the value of Q/q. **Ans: -2√2**
25. Two particles A and B, each having a charge Q, are placed at **d** distance apart. Where a particle of charge q should be placed on the perpendicular bisector of AB so that it experiences maximum force? What is the magnitude of maximum force? **Ans: d / 2√2**
26. Two particles have equal masses of 5.0 g each and opposite charges of $+4\times10^{-5}$ C and - 4×10^{-5} C. they are released from the rest with a separation of 1.0 m between them. Find the speed of the particles when the separation is reduced to 50 cm. **Ans: 54 m/s**
27. A solid sphere of radius R has a charge Q distributed in the volume with a charge density $\rho = Kr^a$, where ***K*** and ***a*** are constants and ***r*** is the distance from its centre. If the electric field at r = R/2 is 1/8 times that at r =R. find value of a. **Ans: 2**
28. If 10^9 electrons move out of a body to another body every second, how much time is required to get a total charge of 1 C on other body? **Ans: 200 years**
29. Three equal charges, each having a magnitude of 4.0×10^{-6} C, are placed at the three corners of a right-angled triangle of sides 3 cm, 4 cm and 5 cm. Find the magnitude of force on the charge at the right – angled corner.

Problems based on Electric Flux Gauss's Law:

30. Find the total electric flux, leaving a spherical surface of radius 1cm and surrounding an electric dipole. **Ans: 0**
31. Calculate the electric flux through each of the six faces of a closed cube of length **l**, if a charge q is placed (a) at its centre and (b) at one of its vertices.
32. 10. The electric field in a certain region of space is $(5\hat{\imath} + 4\hat{\jmath} - 4\hat{k}) \times 10^5$ NC^{-1}. Calculate electric flux due to this field over an area of $(2\hat{\imath} - \hat{\jmath}) \times 10^{-2} m^2$. **Ans: 6×10^3 Nm^2 C^{-1}**
33. Given a uniform electric field $\vec{E} = 5 \times 10^3\ \hat{\imath}$ NC^{-1}, find the flux of this field through a square of 10cm on a side whose plane is parallel to the Y-Z plane. What would be the flux through the same square if the plane makes a 30° angle with the X-axis? **Ans: (i) 50 Nm^2C^{-1} (ii) 25 Nm^2C^{-1}**

34. A spherical Gaussian surface encloses a charge of 8.85×10^{-8}C. (i) Calculate the electric flux passing through the surface. (ii) If the radius of the Gaussian surface is doubled, how would the flux change?
Home - www.mywebpathshala.com **Ans: (i) 10^4 Nm^2 C^{-1} (ii) No change**

35. An infinitely long wire is stretched horizontally 4 metre above the surface of the earth. It carries a charge 1μC per cm of its length. Calculate its electric field at a point on the earth's surface vertically below the wire.
Ans: 4.5×10^5 Vm^{-1}

36. A particle of mass 5×10^{-6}g is kept over a large horizontal sheet of charge density 4×10^{-6} Cm^{-2}. What charge should be given to this particle, so that if released, it does not fall down? How many electrons should be removed to give this charge? **Ans: 2.16×10^{-13} C, 1.355×10^6**

37. A point charge of 24 μC is located at the vertex of a cube. What is the electric flux through the face of the cube which does not pass through the vertex? **Ans: 1.13×10^5 Nm^2C^{-1}.**

38. A hemisphere surface of radius R, placed in a uniform electric field of intensity E parallel to the axis of circular plane, Find the electric flux Φ through it. **Ans. $\pi R^2 E$.**

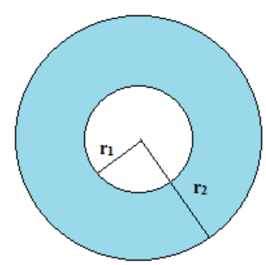
39. A cylinder of radius R and length L is placed in a uniform electric field E parallel to the cylinder axis. Find the total electric flux passing through the surface of the cylinder. **Ans. Zero**

40. A spherical charged conductor has σ as the surface density of charge. The electric field on its surface is E. If the radius of the sphere is doubled keeping the surface density of charge unchanged, what will be the electric field on the surface of the new sphere? **Ans. E**

41. It has been experimentally observed that the electric field in a large region of the earth's atmosphere is directed vertically down. At an altitude of 300 m the electric field is 60 Vm^{-1}. At an altitude of 200 m the electric field is 100 Vm^{-1}. Calculate the net amount of charge contained in a cube 100 m on edge located between 200 m and 300 m altitude. **Ans: 3.54×10^{-6} C**

42. The volume charge density in a given space is constant throughout and equal to ρ. Find the total electric flux through a cubicle Gaussian surface of edge a entirely inside this space. **Ans: $\rho a^3 / \varepsilon_o$**

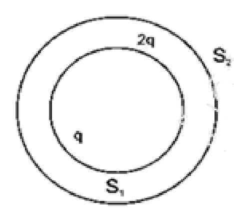
43. A solid sphere of radius R_1 and volume charge density $\rho = \rho_o / r$ is enclosed by a hollow sphere of radius R_2 with negative surface charge density σ, such that the total charge in the system is zero, ρ_o is a positive constant and r is the distance from the center of the sphere. Find the ratio of R_2 / R_1. **Ans: $\sqrt{(\rho_o / 2\sigma)}$**



44. A charge Q is distributed uniformly within the material of a hollow sphere of inner and outer radii r_1 and r_2 as shown in figure 1. Find the electric field at a point P at a distance **x** away from the center for $r_1 < x < r_2$. **Ans: $KQ(x^3 - r_1^3) / x^2 (r_2^3 - r_1^3)$** Fig ☞

45. Two large conducting plates are placed parallel to each other with a separation of 2.0 cm between them. An electron starting from rest near one plate reaches the other plate in 2 microseconds. Find the surface charge density on the inner surface. **Ans: 5.0×10^{-14}C/m²**

46. S1 and S2 are two hollow concentric spheres enclosing charges q and 2q respectively. Fig ☞



a) What is the ratio of electric flux through S_1 and S_2?
b) How will the electric flux through sphere S_1 change, if a medium of dielectric constant 5 is introduced in the sphere S1 in place of air? **Ans: 1:3, q/5 ε_o**

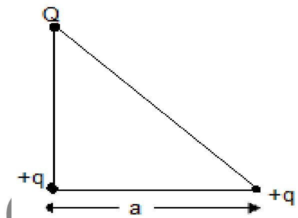
47. An electric flux of -6×10^3 Nm^2/C passes normally through a spherical Gaussian surface of radius 10 cm due to a point charge placed at the center.
i. What is the charge enclosed by the Gaussian surface? **Ans: - 53.1×10^{-9} C. Same/Unchanged**
ii. If radius of the Gaussian surface is doubled, how much flux would pass through the surface?

48. Careful measurement of the electric field at the surface of a black box indicates that the net outward flux through the surface of the box is 8.0×10^3N –m^3C^{-1}
(i) What is the net charge inside the box?

(ii) If the net outward flux through the surface of the box were zero, could you conclude that there were no charges inside the box. Why or why not?

49. An isolated conductor of any shape has a net charge of +10μC. Inside the conductor there is a cavity, within which a point charge of +3μC. what is the charge on the cavity wall? On the outer surface of the conductor? **Ans: -3μC, +13μC**

Problems based on Electric Potential and Electric Potential Energy:



50. Three charges Q, + q and + q are placed at the vertices of a right angled isosceles triangle as shown in fig2. if net electrostatic energy of the configuration is zero ,then find the value of Q. **Ans: $-2q/(2+\sqrt{2})$** Fig ☞

51. Draw equi-potential surface, for (a) single charge (b) $q_1 q_2 > 0$ and $q_1 = q_2$, separated by a finite distance. (c) an electric dipole .

52. Two charges 5 x 10^{-8}C and -3 x 10^{-8}C are located 16cm apart. At what point (s) on the line joining the two charges is the electric potential zero? Take the potential at infinity to be zero. **Ans. X = 40cm**

53. A proton is moved in a uniform electric field of 1.7x10^{-4} N /C between two points A and B separated by a distance of 0.1 m.

i. What is the potential difference between the points? **Ans: 1.7x10^{-5} V**

ii. How much work is done in the above process? **Ans: 2.72x10^{-24} J**

54. The kinetic energy of a charge particle decreases by 10 J as it moves from a point at potential 100 V to a point at potential 200 V. Find the charge on the particle. **Ans: 0.1C**

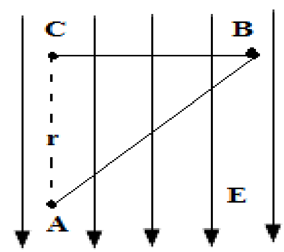
55. Two points A and B are located in diagrammatically opposite directions of a point charge of +2 μC at distances 2.0 m and 1.0 m respectively from it. Determine the potential difference $V_A - V_B$. **Ans: -9x10^3 V.**

56. A charge of 8mC is located at the origin. Calculate the work done in taking a small charge of -2 x 10^{-9}C from a point P (0, 0,3cm) to a point Q (0,4cm,0), via a point R (0,6cm,9cm.).

57. Two concentric spheres of radii R and r have similar charges with equal surface densities (σ). What is the electric potential at their common centre? **Ans. $\sigma(R+r)/\varepsilon_o$**

58. Two identical rings each of radius R are co-axially placed. The distance between their centers is R. Same charge Q is placed on each ring. How much work will be done in moving a test charge from the centre of one ring to that of the other? **Ans. Zero**

59. Four equal charges Q are placed at the four corners of a square of side **a** each. Find the work done in removing a charge – Q from its centre to infinity. **Ans. $\sqrt{2}\, Q^2/(\pi\varepsilon_o a)$**



60. A charge Q is distributed over two concentric hollow spheres of radii r and R (>r) such that the surface densities are equal. Find the potential at the common centre.
Ans. $Q(R+r)/4\pi\varepsilon_o(R^2+r^2)$

61. A unit positive charge move in an electric field E along the path A to B to C. as shown in figure 4 .Find the potential difference between point A and C.

Ans: E r Fig ☞

62. The electric potential V at any point x,y,z (all in metres) in space is given by $V = 4x^2$ volt. Find the electric field at the point (1m,0,2m) in volt / metre. **Ans. 8 along negative x-axis**

63. The potential inside a charge ball depends only on the distance r of the point from its centre according to the following relation $V = (Ar^2 + B)$ volt. Find the charge density inside the ball. **Ans. $-6\varepsilon_o A$**

64. Two positive charges of magnitude **q** are placed at the ends of a side 1 of a square of side **2a**. Two negative charges of the same magnitude are kept at the other corners. Starting from the rest, if a charge **Q** moves from the middle of side 1 to the center of the square, what is its kinetic energy at the center of square? **Ans: $2KqQ(\sqrt{5}-1)/a\sqrt{5}$**

65. A charge A of 8.0 μC is situated at a distance of 1.00 metre from a charge B of -2.0 μC, as shown. Calculate the potential at the mid – point C between A and B. also calculate the potential at D which is at a distance of 0.80m from A and 0.20m from B. How much work will be done in taking 0.02 μC of charge from D to C? **Ans. 1.08 x 10^5V, zero, 2.16 x 10^{-3}J**

66. A point – charge of 6.0 x 10^{-8} C is situated at the coordinate origin. How much work will be done in taking an electron from the point x = 3m to x = 6m? **Ans. 1.44 x 10-^{17}J**

67. Two point charge of 4μC and -2 μC are placed 1 m apart in air. At what point on the line joining the charges is the electrostatic potential zero? **Ans. At (2/3) m from 4μC**

68. Two plane metallic plates are at a distance of 2 cm. These are connected to a battery of 1000V. A proton is placed between these plates. Find out (i) intensity of electric field between the plates, (ii) force on the proton. Will the proton experience different forces at different places between the two plates?
Ans. (i) 50,000 V m^{-1}, (ii) 8.0 x 10^{-15} N. since the electric field between the plates is uniform at all places, the proton will experience same force at each place.

69. An α – particle is accelerated through 10^6 V. (i) What will be its kinetic energy? (ii) If a proton be accelerated through the same potential difference, then how much kinetic energy will it gain? (ii) Which particle will gain more velocity if both start from rest? **Ans. (i) 3.2 x 10^{-13} J, (ii) 1.6 x 10^{-13} J, (iii) proton**

70. An early model for an atom considered it to have a positively charged point nucleus of charge *Ze*, surrounded by a uniform density of negative charge up to a radius *R*. The atom as a whole is neutral. For this model, what is the electric field at a distance *r*<R from the nucleus and at a distance r>R?
Ans. $E_r = \frac{Ze}{4\pi\varepsilon_o}\left(\frac{1}{r^2} - \frac{r}{R^3}\right)$, **E= 0**

71. The distance between two protons is 1.0 x 10^{-10}m. if they are made free, what will be the kinetic energy of each when they are away at a very large distance from each other? If one proton is kept fixed and only other is freed then what will be its kinetic energy? **Ans. 1.15 x 10^{-18}J, 2.30 x 10^{-18} J**

72. Eight charged drops of water, each of radius 1 mm and having a charge of 10^{-10} C, combine to form a bigger drop. Determine the potential of the bigger drop. **Ans. 3600 V**

73. 27 identical drops of mercury are charged to the same potential of 10 V. What will be the potential if all the charged drops are made to combine to form one large drop? Assume the drops to be spherical. **Ans. 90 V**

74. Charge of 2, 4 and 6 μC is placed at the three corners of a square. Find what charge must be placed at the fourth corner so that the total potential at the centre of the square is zero. **Ans. -12μC**

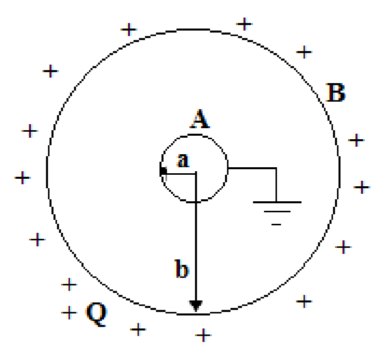
75. A wire is bent in a circle of radius 10 cm. It is given a charge of 200 μC which spreads uniformly. Calculate the electric potential at the centre of the circle. **Ans. 1.8 x 10^7 V**

76. In an atom two protons are separated by a distance of 3 x 10^{-10}m and an electron is at a distance of 1.5 x 10^{-10} m from each proton. Calculate the potential energy of this system. **Ans. -7.68 x 10^{-19} J**

Problems based on Capacitance and Capacitors:

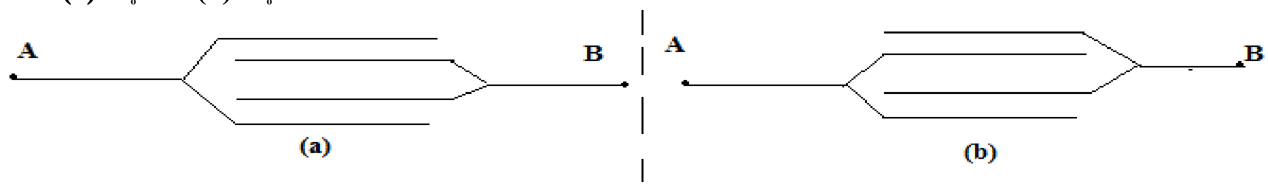
77. Two spherical conductors A and B of radii **a** and **b** (b>a) are placed concentrically in air as shown in figure 5. B is given a charge +Q and A is earthed. Find the equivalent capacitance of the system.

Ans. $4\pi\varepsilon_o$ **{b^2 / b – a}** Fig ☞

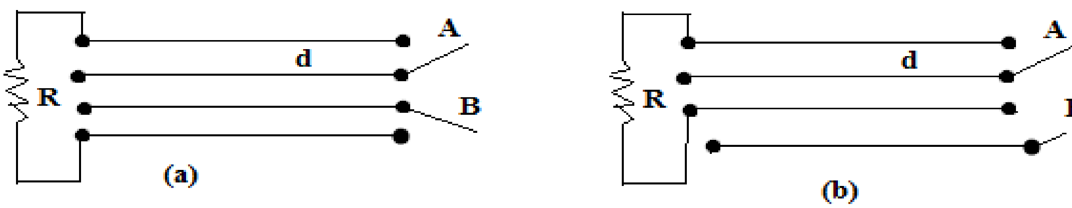


78. Four metallic plates, each with a surface area of one side A, are placed at a distance d apart from each other as shown in figure. (i) Two inner plates are connected to point B and the other two plates to another point A as shown in **fig (a)** and (ii) The alternate plates are connected to points A and

B as shown in **fig. (b)** Then find the capacitance of the system.
Ans. (a) $2\varepsilon_o A/d$ (b) $3\varepsilon_o A/d$



79. Four metallic plates, each with a surface area of one side A, are placed at a distance d from earth other. The plates reconnected as shown in the **figure (a).**what will be capacitance of the system between A and B.
Ans. $3\ \varepsilon_o A/2d$



80. Four metallic plates, each with a surface area of one side A, are placed at a distance d from earth other. The plates reconnected as shown in the **figure (b)**.what will be capacitance of the system between A and B.
Ans. $2\ \varepsilon_o A/3d$

81. Show that the force on each plate of a parallel plate capacitor has a magnitude equal to ($^1/_2$) QE, where Q is the charge on the capacitor and E is the magnitude of electric field between the plates. Explain the origin of the factor ½.

82. The plate separation in a parallel plate condenser is **d** and plate area is **A**. If it is charged to **V** volts, then what amount of work will be done in increasing the plate separation to 2d? **Ans. $\varepsilon_0 AV^2/2d$**

83. A parallel plate condenser of capacity C is connected to a battery and is charged to a potential V. Another condenser of capacity 2C is connected to another battery and is charged to a potential 2V. The charging batteries are removed and now the condensers are connected in parallel in such a way that the positive plate of one is connected to negative plate of the other. Find the final energy of this system. **Ans.$3CV^2/2$**

84. The energy of a charged capacitor is U. Another identical capacitor is connected parallel to the first capacitor, after disconnecting the battery. Find the total energy of system of these capacitors. **Ans. U/2**

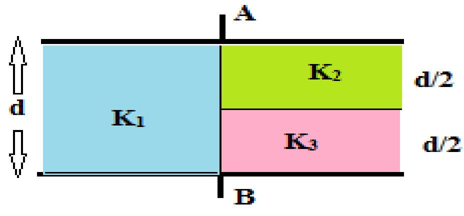
85. A 10μF capacitor and a 20μF capacitor are connected in series across a 200 V supply line. The charged capacitors are then disconnected from the line and reconnected with their positive plates together and negative plates together and no external voltage is applied. Find the potential difference across each capacitor.**Ans.44.4V**

86. Two identical parallel plate capacitors are placed in series and connected to a constant voltage source of V volt. If one of the capacitor is completely immersed in a liquid of dielectric constant K, then the potential difference between the plates of the other capacitor will change to? **Ans. K V/K+1**

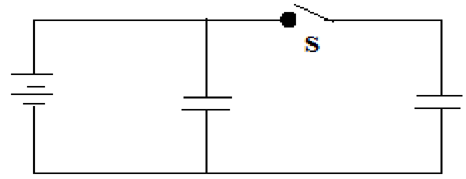
87. Two parallel plate capacitors of capacitances C and 2C are connected in parallel and charged to a potential difference V_o. The battery is then disconnected and the region between the plates of the capacitor C is completely filled with a material of dielectric constant 2. Find the potential difference across capacitors.
Ans: $3V_o/4$

88. A $4x10^{-6}$ F capacitor is charged by a 200V supply. It is then disconnected from the supply and is connected across another uncharged 2 μF capacitor. How much energy of the first capacitor is lost? **Ans:$2.26x\ 10^{-2}$J**

89. Calculate the capacitance of the capacitor shown in the **figure (a)**.



(a)



(b)

90. Figure (b) shows two identical parallel plate capacitors connected to a battery with a switch S closed. The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of K = 3. Find the ratio of the total electrostatic energy stored in both the capacitors before and after the introduction of the slab. **Ans: 0.6**

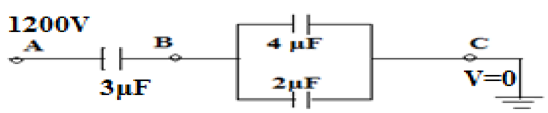
91. The outer cylinder of a cylindrical capacitor of length 0.15m and radii 1.61cm and 1.5cm is earthed while inner cylinder of this capacitor is given a charge of 8μC. Find the capacitance and the potential of the inner part of the capacitor. **Ans: 1.18×10^{-10} F, 6.78×10^{4} V**

92. A parallel plate air capacitor consists of two circular plate of diameter 8cm. At what distance should the plates be placed so as to have the same capacity as that of a sphere of diameter 20cm? **Ans: 4.00 mm**

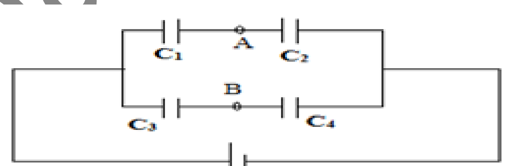
93. A 10μF capacitor is charged by a 30V DC supply and then connected across an uncharged 50μF capacitor. Calculate (i) the final potential difference across the combination and (ii) the initial and final energies. How will you account for the difference in energy? **Ans: 5V, 45×10^{-4} J, 75×10^{-5} J, heat loss.**

94. Two thin spherical conducting shells are at a large distance apart. One having radius 10cm carries a charge of +0.5μC and the other of radius 20cm carries a charge of + 0.7 μC. Find the charge on each shell when connected by a conducting wire. **Ans: 0.4μC, 0.8 μC.**

95. In the circuit shown in the below **figure (a)** find the charge on each capacitor and the potential at point B.



(a)



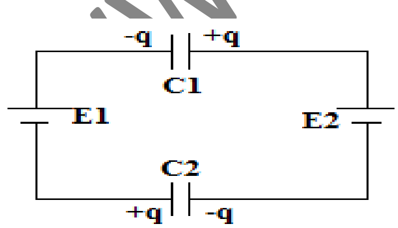
(b)

Ans: V_B =400 V, $q_3 = 2.4 \times 10^{-3}$ C, $q_4 = 1.6 \times 10^{-3}$ C

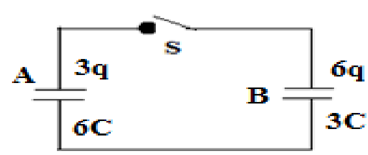
96. Four capacitors C_1=8μF, C_2=4μF, C_3=3μF, C_4=6μF are connected to a battery as shown in above **figure (b)** find the potential between point A and B. **Ans: 4 V**

97. A 2 μF parallel plate capacitor with a dielectric slab (K=5) between the plate is charged to 100 volt and then isolated (i) what will be the potential difference if the dielectric is removed? (ii) how much work will be done in removing the dielectric? **Ans: 500 V, 0.2 J** Home - www.mywebpathshala.com

98. Determine the potential difference across the plates of each capacitor of the network shown in the **figure (a)**. take $E_1 > E_2$. **Ans: $V_1 = (E_1 - E_2) C_2 / C_1 + C_2$**



(a)



(b)

99. In the given circuit shown in above **figure (b)** when switch S has been closed then charge on capacitor A and B respectively will be? **Ans: q_A = 6q, q_B = 3q**

100. A charge of +2.0 x10^{-8} C is placed on positive plate and a charge of -1.0 x10^{-8} C is placed on negative plate of a parallel plate capacitor of capacitance 1.2 x10^{-3} μF. Calculate the potential difference developed between the plates. **Ans: 12.5 V**

101. A charge of 20 μC is placed on the positive plate of an isolated parallel plate capacitor of capacitance 10 μF. Calculate the potential difference developed between the plates of capacitor. **Ans: 1 V.**

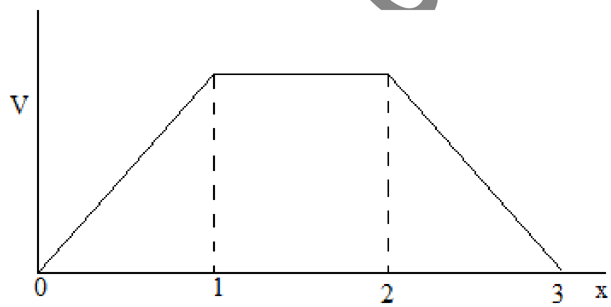
102. A large conducting plane has a surface charge density 1.0 x10^{-4} C/m^2. Find the electrostatic energy stored in a cubical volume of edge 1.0 cm in front of the plane. **Ans: 5.6 x 10^{-4} J.**

103. A capacitor of capacitance C is charged to a potential V. find the flux of the electric field through a close surface enclosing the capacitor. **Ans: zero**

104. An uncharged capacitor is connected to a battery. Show that half of the energy supplied by the battery is lost as heat while charging the capacitor.

Additional problem

105. The electric potential as a function of a distance x as shown in figure. Construct a graph of the electric field strength E versus x. Fig ☞



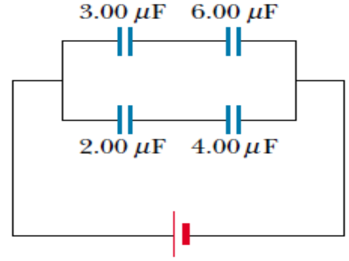
106. The electric field outside a charged long straight wire is given by E = $\frac{1000}{r}\ V/m$ and is directed outwards. What is the sign of charge on the wire? If two points A and B are situated such that r_A = 0.2 m and r_B = 0.4 m find the value of (V_B-V_A).
Ans: - 693.1 V

107. The insulated plates of a parallel plate capacitor have a charge density σ. Show that the work done in changing the distance, between plates of capacitor from d_1 to d_2 is **W =** $\frac{\sigma^2 A}{2K\varepsilon o}$ **(d_1 - d_2).**

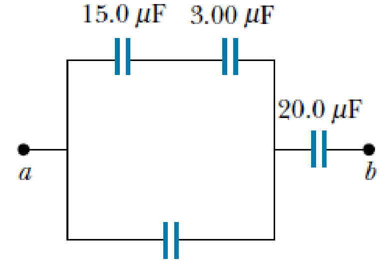
108. When a potential difference of 150 V is applied to the plates of a parallel-plate capacitor, the plates carry a surface charge density of 30.0 nC/cm^2.What is the spacing between the plates?

109. Show that just outside a conductor, the electric field is $\frac{\sigma}{\varepsilon o}\ \hat{n}$.

110. Four capacitors are connected as shown in Figure (a) Find the equivalent capacitance between points *a* and *b*. (b) Calculate the charge on each capacitor if ΔV_{ab} = 15.0 V.



111. For the system of capacitors shown in Figure. Find (a) the equivalent capacitance of the system, (b) the potential difference across each capacitor, (c) the charge on each capacitor, and (d) the total energy stored by the group.



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