GIRLS' HIGH SCHOOL AND COLLEGE

2020 – 2021

CLASS -12 A&B

PHYSICS

WORKSHEET- 07

Chapter- CAPACITORS AND DIELECTRICS

PLEASE NOTE : To start with this chapter you have to first revise Conductors and Insulators and also Electric Potential.

Refer your course book : ISC PHYSICS Class – XII (Part – 1)

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POTENTIAL AT A POINT measures the work done on a unit positive charge while bringing it from infinity to that point.

Also remember work is done on a charge when it moves in a force field. Consider an uncharged conductor. When the first charge is brought from infinity to it no work is done as no force field exists. But after that as the charges start accumulating on the surface of a conductor its field increases and so does the work done in bringing other charges. As the work done increases in bringing a new charge every time the potential on the surface of the conductor keeps increasing.

Thus we see that every conductor acquires a potential on acquiring charges. The amount of charge on a conductor depends upon the potential on it. Thus every conductor has a capacity of carrying charges at a certain potential. This is

called its capacitance.

We are going to do about capacitance of a conductor in this worksheet. Go through the subject matter carefully and keep answering the questions that follow.

Now refer to the topic

- CAPACITANCE OF A CONDUCTOR found on page 128 in your course book.
- CAPACITANCE OF AN ISOLATED SPHERICAL CONDUCTOR found on page 129 in your course book.

Q1) Define Capacitance of a conductor. Give its unit and dimensional formula. Why is capacitance measured in submultiples of its unit?

Q2) A spherical conductor of capacitance 30 μF is given a charge of 0.0002 C.

Calculate the potential.

Q3) Find the radius of a sphere so that it may have capacity of 0.1μF.

Q4) Calculate the capacitance of spherical conductor of radius 0.18 m, when placed in vacuum.

Q5) If we treat the earth as a conducting sphere of a radius 6400 Km , what will be the order of its capacitance?

PLEASE NOTE : Insulators are also called Dielectrics. They do not conduct electricity but charges get induced on their surface when placed in an electric field. Thus dielectrics transit electric effect but they themselves do not conduct electricity.

Now refer to

- NOTE found on page 129 in your course book.
- POTENTIAL ENERGY OF A CHARGED CONDUCTOR found on page 130 in your course book.

Q6) A conductor when charged to 1000 V, takes 2 μC of charge. Find the capacity of the conductor and the potential energy stored in it.

Q7) A sphere of radius 15 cm has a charge of +100 μC. What is the amount of energy stored in it?

Now refer to the topic

- CAPACITOR found on page 132 in your course book.
- CAPACITANCE OF A CAPACITOR found on page 132 in your course book.

Q8) What is a capacitor? How is it denoted in a circuit?

Q9) Define capacitance of a capacitor. Give its unit.

Q10) What do you mean by a parallel plate capacitor?

Now refer to the topic

- EXPRESSION FOR CAPACITANCE OF A PARALLEL PLATE CAPACITOR found on page 133 in your course book.
- DEPENDENCE OF THE CAPACITANCE OF A CAPACITOR found on page 134 in your course book.

Q11) Obtain an expression for capacitance of a parallel plate capacitor when its dimensions are known.

Q12) From the expression for capacitance obtained above state on what factors does capacitance of a parallel plate capacitor depend and how.

Q13) You are given two plane metal sheets of mica at a distance

2×10^{-5} m apart. Calculate the area of the metal required to construct a capacitor of capacity 0.02 μF. Given $\varepsilon_0 = 8.85 \times 10^{-12}$ F m^{-1}.

Q14) A parallel plate capacitor of plate area A = 600 cm^2 and plate separation d = 2.0 mm is connected to a DC source of 200 V. Calculate in SI unit :

(i) the magnitude of the uniform electric field $\vec{E}$ between the plates,

(ii) the charge density σ on any plate. Given $\varepsilon_0 = 8.85 \times 10^{-12}$ F m^{-1}.

Q15) Do Num-4 found on page 174 in your course book.

Now refer to the topic

- ELECTRIC POLARISATION OF MATTER found on page 141 in your course book.
- CHARGE INDUCED ON THE SURFACE OF A DIELECTRIC SLAB and
- DIELECTRICS found on page 140 in your course book.
- CAPACITANCE OF A PARALLEL PLATE CAPACITOR WITH DIELECTRIC SLAB BETWEEN PLATES found on page 134 in your course book.
- EFFECT OF INTRODUCING DIELECTRIC BETWEEN THE

PLATES OF A CHARGED CAPACITOR found on page 143 in your course book.

Q16) Do Q9 found on page 169 in your course book.

Q17) Do Q6 found on page 169 in your course book.

Q18) Do Q7 found on page 169 in your course book.

Q19) Do Q24 found on page 169 in your course book.

Q20) Show that effect of introducing a dielectric slab of thickness 't' and dielectric constant 'K' is same as reducing the plate separation by 'd_k'

where $d_k = t\left(1 - \frac{1}{k}\right)$.

Q21) A capacitor is formed of two plates 2 mm apart . The plates are totally immersed in an insulating oil having K = 4. A potential of 2.828 kV is applied across the plate. Calculate the surface charge density.

Q22) In a parallel-plate capacitor of capacitance C, a metal sheet is inserted between the plates, parallel to them. The thickness of the sheet is half of the separation between the plates. What is the new capacitance?

Now refer to the topic

- COMBINATION OF CAPACITORS found on page 136 in your course book.

Q23) Two capacitors of capacitances 8F and 2F are connected in series across 220 V mains. Calculate the potential drop across each.

Q24) Do Num-21 found on page 175 in your course book.

Q25) Two capacitors of capacitance 2 μF and 4 μF are connected in parallel. This group is connected in series with a 3 μF capacitor across an 800 V line. Find the potential difference across each capacitor.

Q26) A capacitor of capacitance C_1 = 1 μF withstands maximum voltage of V_1 = 6 kV, while another capacitor of capacitance C_2 = 2 μF stasnds a maximum voltage of V_2 = 4 kV. What maximum voltage will the system of these two capacitors withstand if they are connected in series?

Q27) Do Num-41 found on page 176 in your course book.

Q28) Do Num-43 found on page 176 in your course book.

Q29) Do Num-42 found on page 176 in your course book.

Now refer to the topic

- ENERGY STORED IN A CHARGED CAPACITROR found on page 138 in your course book.
- FORCE BETWEEN THE PLATES OF A CHARGED PARALLEL PLATE CAPACITOR found on page 139 in your course book.

Q29) Do Q-38 found on page 173 in your course book.

Q30) Do Q-8 found on page 173 in your course book.

Q31) Do Num-13 found on page 175 in your course book.

Also find the force acting between the plates.

Q32) Do Num-14 found on page 175 in your course book.

Q33) Do Num-15 found on page 175 in your course book.

How will the force acting between plates change?

Q34) Do Num-16 found on page 175 in your course book.

Q35) Do Num-17 found on page 175 in your course book.

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