

1. A capacitor is a device to store charge.
- In what form is energy stored in a capacitor?
  - Derive an expression for the energy stored in a capacitor.
  - Two capacitors of equal capacitance when connected in series have net capacitance  $C_1$  and when connected in parallel have net capacitance  $C_2$ . What is the value of  $\frac{C_1}{C_2}$ ? { 1 + 3 + 2 = 6 }
2. S1 and S2 are two parallel concentric spheres enclosing charges Q and 2Q respectively as in fig. 
- What is the ratio of electric flux through S1 and S2?
  - How will electric flux through sphere S1 change if a medium of dielectric constant 5 is introduced in the space inside S1 in place of air? { 1 + 1 = 2 }
3. A potentiometer is preferred over a voltmeter to measure small potentials.
- Why potentiometer is more accurate than voltmeter?
  - A potentiometer wire is 10 m long and potential drop of 6V is maintained between its ends. Find emf of a cell which balances against a length of 180 cm of the potentiometer wire. (given pd/cm = 3/500V) { 2 + 3 = 5 }
4. Cyclotron is a device used to accelerate charged particles or ions to very high energies.
- What is the main function of electric field in a cyclotron?
  - What is the principle of working of a cyclotron?
  - Can we accelerate neutrons by a cyclotron? Give reason. { 2 + 1 + 1 = 4 }
5. A solenoid behaves like a bar magnet.
- What is a solenoid?
  - Which law help you to find magnetic field due to solenoid? State the law.
  - Obtain an expression for magnetic field due to solenoid using the above law. { 1 + 2 + 2 = 5 }
6. Self inductance is known as inertia in electricity. Do you agree with this statement? Justify. { 2 }
7. The instantaneous value of ac at any instant t is given by  $E = E_0 \sin \omega t$ , where  $E_0$  is the peak value of ac.
- What will be the instantaneous value of ac supply of 220V and 50 Hz.
  - The equation of an ac is given by  $I = 30 \sin 200 \pi t$ . Calculate the frequency and rms value of ac?
  - Which is more dangerous 220 V ac or 220 V dc. Explain. { 2 + 2 + 1 = 5 }
8. Name the electromagnetic waves used for the following applications.
- Imaging of bones in human body.
  - Mobile phone communication.
  - Remote control of TV sets.
  - For sterilizing surgical instrument. { 4 x 1/2 = 2 }
9. In total internal reflection, the angle of incidence for which the angle of refraction becomes  $90^\circ$  is called critical angle.
- Which one has greater critical angle, diamond or glass crystal?
  - Critical angle depends on the wavelength of light. Comment.
  - What is the refractive index of a medium if the critical angle is  $41^\circ$ ?
  - Find the value of light in a medium having critical angle  $30^\circ$ ? { 1 + 1 + 2 + 2 = 6 }
10. In Young's double slit experiment the two pin holes are illuminated by a red monochromatic source.
- What will happen if one hole is closed.
  - Establish the relation between bandwidth and wavelength of light uses.
  - What will happen to the interference pattern if all arrangement is shifted into water. { 1 + 2 + 2 = 5 }
11. A transistor has a current gain of 30. If the collector resistance is 6 kW, calculate the voltage gain. { 2 }

12. A Zener diode is a specially doped diode to operate in the reverse bias condition.
- What is meant by zener breakdown? {1 + 1 + 1 = 3}
  - Draw the characteristics of a zener diode and mark breakdown voltage.
  - Why is a zener diode used as a voltage regulator? {1 + 1 + 1 = 3}
13. (a) Draw a graph showing the variation of stopping potential with frequency of incident radiation.
- Find an expression for slope of the graph using Einstein's photoelectric equation. {1 + 2 = 3}
14. An electron is accelerated through 120 eV. Find the de-Broglie wavelength. {2}
15. Modulation is very essential in large distance communication.
- State two differences between amplitude modulation and frequency modulation.
  - Find the range of an antenna of height 15 m. Given radius of earth = 64 km. {1 + 2 = 3}
16. Binding energy is a measure of the stability of a nucleus.
- Draw the binding energy curve.
  - Which is the most stable nucleus? Mark it on the graph. {1 + 1 = 2}
17. Match the following {3}

Rutherford	$\Delta p \Delta x = h$	a particle scattering
Bohr	Angular momentum	Uncertainty principle.
Heisenberg	Distance of closest approach	$\frac{nh}{2p}$