SAMPLE PAPER-05
PHYSICS (Theory)
(Questions)
Class – XII

Time allowed: 3 hours Maximum Marks: 70

General Instructions:

a) All the questions are compulsory.
b) There are **26** questions in total.
c) Questions **1** to **5** are very short answer type questions and carry **one** mark each.
d) Questions **6**to **10** carry **two** marks each.
e) Questions **11** to **22** carry **three** marks each.
f) Questions **23** to **26** carry **five** marks each.
g) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions in five marks each. You have to attempt only one of the choices in such questions.
h) Use of calculators is **not** permitted. However, you may use log tables if necessary.
i) You may use the following values of physical constants wherever necessary:

$c = 3x10^{8} m/s$

$h = 6.63x10^{-34} Js$

$e = 1.6x10^{-19} C$

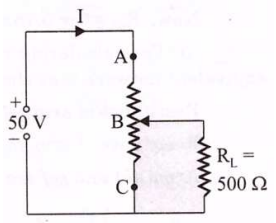
$\mu_o = 4\pi x10^{-7} TmA^{-1}$

$\frac{1}{4\pi\varepsilon_0} = 9x10^{9} Nm^2C^{-2}$

$m_e = 9.1x10^{-31} kg$

1. What is the cause of charging?
2. A wire is carrying a current. Is it charged?
3. Why is a neutron most effective as a bullet in nuclear reactions?
4. Define forbidden gap.
5. Name two elementary particles which have almost infinite life time.
6. What do you mean by an ideal dipole and what is the nature of electric field symmetry of the dipole?
7. What is the magnetic moment of an electron orbiting in a circular orbit of radius r with a speed v?
8. Velocity of light in a liquid is 1.5 × 10^8 m/s and in air it is 3 × 10^8 m/s. If a ray of light passes from liquid into the air, calculate the value of critical angle.

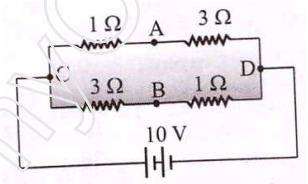
9. Name a device that converts the change in intensity of illumination into changes in electric current. Give three applications of this device.
10. Define Hertz antenna and Marconi antenna.
11. A number of identical cells, n each of emf E, internal resistance r connected in series are charged by a. d.c source of emf E', using a resistor R.
    a. Draw circuit arrangement
    b. Deduce the expression for (i) the charging current and (ii) the potential difference across the combination of the cells.
12. As shown in the below figure a variable rheostat of $2k\Omega$ is used to control the potential difference across a 500 ohm load.



    (i) If the resistance AB is $500\,\Omega$. What is the potential difference across the load?
    (ii) If the load is removed, what should be the resistance of BC to get 40 volt between B and C?

Or

A battery of emf 10 V is connected to resistance as shown in the below figure. Determine the potential difference between A and B.



13. In Yong's double slit experiment, the two slits 0.15 mm apart are illuminated by monochromatic light of wavelength 450 nm. The screen is 1.0 m away from the slits.
    a. Find the distance of the second (i) bright fringe(ii) dark fringe from the central maximum
    b. How will the fringe pattern change if the screen is moved away from the slits?
14. Write the expression for the force acting on a charged particle of charge q moving with velocity $\vec{v}$ in the presence of magnetic field $\vec{B}$. Show that in the presence of this force:

a. The kinetic energy of the particle does not change.

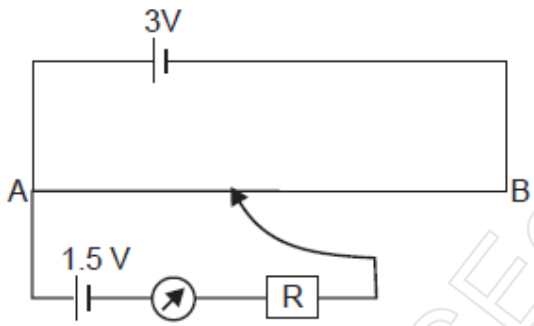
b. Its instantaneous power is zero.

15. The vertical component of the earth's magnetic field at a given place is $\sqrt{3}$ times its horizontal component. If total intensity of Earth's magnetic field at the place is 0.4 G find the value of:

a. Angle of dip.

b. The horizontal component of Earth' magnetic fleld.

16. A potentiometer wire of length 1 m is connected to a driver cell of emf 3 V as shown in the below diagram. When cell of 1.5 V emf is used in the secondary circuit, the balance point is found to be 60 cm. on replacing this cell and using a cell of unknown emf, the balance point shifts to 80 cm



a. Calculate unknown emf of the cell.

b. Explain with reason, whether the circuit works, if the driver cell is replaced with a cell of emf 1 V.

c. Does the high resistance R, used in the secondary circuit affect the balance point? Justify our answer.

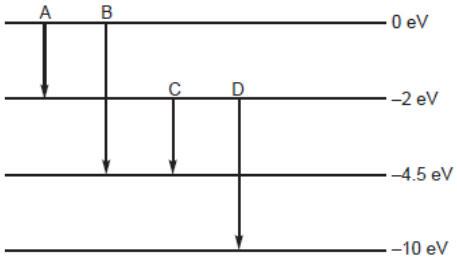
17. Prove that a convex lens produces an n times magnified image when the object distances from the lens have magnitude $\left(f \pm \frac{f}{n} \right)$. Here f is the magnitude of the focal length of the lens.

Hence find the two values of object distance for which a convex lens of power 2.5 D will produce an image that is four times as large as the object.

18. Calculate the de-Broglie wavelength of a beam of electrons, accelerated through a potential difference of 10 kV.

19.

a. The energy levels of a hypothetical hydrogen-like atom are shown below diagram. Find out the transition, from the ones shown in the diagram, which will result in the emission of a photon of wavelength 275 nm.



b. Which of these transitions corresponds to the emission of radiation of (i) maximum and (ii) minimum wavelength?

20. Draw plot of the variation of amplitude versus ω for an amplitude modulated wave. Define modulation index. State its importance for effective amplitude modulation.

21. Distinguish between nuclear fusion and fission

22. In a diode AM demodulation the output circuit consists of R = $1\,k\Omega$ and C= 10pF.a carrier signal of 100 kHz, is to be demodulated. Is the given set-up good for this purpose? If not suggest a value of C that would make the diode circuit good for demodulating this carrier signal.

23. Two students are situated in a room 10 m high, they are separated by 7 m partition wall. The students are unable to see each other even though they can converse easily. But they know that both light and sound waves can bend around the obstacles. So they were interested to know scientific cause of such phenomena. Then they went to their friend Sara who convinced them with basic facts.

a. What are the values shown by Sara

b. How did Sara convenience them such basic facts?

24.

a. Using Gauss law, derive an expression for the electric field intensity at any point outside a uniformly charged thin spherical shell of radius R and charge density $\sigma C/m^2$. Draw the field lines when the charge density of the sphere is positive and negative.

b. A uniformly charged conducting sphere of 2.5 m in diameter has a surface charge density of $100\mu C/m^2$. Calculate the

i) Charge on the sphere

ii) Total electric flux passing through the sphere.

Or

A spherical capacitor has an inner sphere of radius 12 cm and an outer sphere of radius 13 cm. the outer sphere is earthed and the inner sphere is given a charge of 2.5μC. the space between the concentric spheres is filled with liquid of dielectric constant 32.

a. Determine the capacitance of the capacitor

b. What is the potential of the inner sphere

c. Compare the capacitance of this capacitor with that of an isolated sphere of radius 12 cm. explains why the latter is much smaller.

25. Two charges 5×10^{-8} C and -3×10^{-8} C are located 16 cm 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.

Or

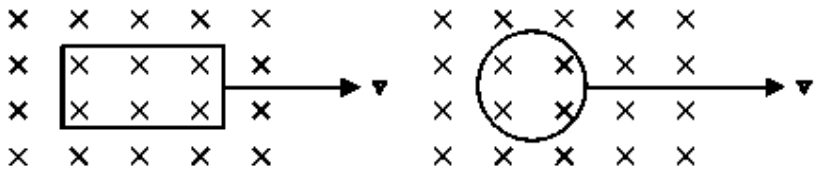
A parallel plate capacitor with air between the plates has a capacitance of 8 pF (1pF = 10^{-12}F). What will be the capacitance if the distance between the plates is reduced by half, and the space between them is filled with a substance of dielectric constant 6?

26.

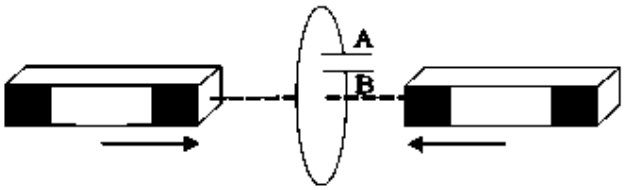
a) A closed loop is held stationary in the magnetic field between the north and south poles of two permanent magnets held fixed. Can we hope to generate current in the loop by using very strong magnets?

b) A closed loop moves normal to the constant electric field between the plates of a large capacitor. Is a current induced in the loop, (i) when it is wholly inside the region between the capacitor plates, (ii) when it is partially outside the plates of the capacitor? The electric field is normal to the plane of the loop.

c) A rectangular loop and a circular loop are moving out of a uniform magnetic field region in the figure given below to a field-free region with a constant velocity v. In which loop do you expect the induced emf to be constant during the passage out of the field region? The field is normal to the loops.



d) Predict the polarity of the capacitor in the situation described in the figure below:



Or

A metallic rod of 1 m length is rotated with a frequency of 50 rev/s, with one end hinged at the centre and the other end at the circumference of a circular metallic ring of radius 1 m, about an axis passing through the centre and perpendicular to the plane of the ring in the figure given below. A constant and uniform magnetic field of 1 T parallel to the axis is present everywhere. What is the emf between the centre and the metallic ring?