Kaivalya
XII-A

APEEJAY SCHOOL SHEIKH SARAI

FIRST TERMINAL EXAMINATION, 2016-17 **SS-9**

CLASS-XII

PHYSICS

Time allowed : 3 Hrs. **M.M. : 70**

General Instructions :

(i) All questions are compulsory. There are 26 questions in all.

(ii) This question paper has five sections : Section A, Section B, Section C, Section D and Section E.

(iii) Section A contains five questions of one mark each, Section B contains five questions of two marks each, Section C contains twelve questions of three marks each, Section D contains one value based question of our marks and Section E contains three questions of five marks each.

(iv) 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 the three questions of five marks weightage. You have to attempt only one of the choices in such questions.

(v) You may use the following of physical constant wherever necessary :

$c = 3 \times 10^8$ *m/s*

$h = 6.63 \times 10^{-34}$ *Js*

$e = 1.6 \times 10^{-19}$ *C*

$\mu_0 = 4\pi \times 10^{-7}$ *Tm* A^{-1}

$\varepsilon_0 = 8.854 \times 10^{-12}\ C^2 N^{-1} m^{-2}$

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9\ Nm^2 C^{-2}$

Mass of electron $= 9.1 \times 10^{-31}$ *kg*

Mass of neutron $= 1.675 \times 10^{-27}$ *kg*

Mass of proton $= 1.673 \times 10^{-27}$ *kg*

Avogadro's number $= 6.023 \times 10^{23}$ *per gram mole*

Boltazmann constant $- = 1.38 \times 10^{-23}\ JK^{-1}$

(SECTION—A)

1. What will be the effect on interference fringes if red light is replaced by blue light.
2. A variable frequency a.c. source is connected to a capacitor. How will the displacement current change with decrease in frequency.

P.T.O.

3. Define the term 'Mobility' of charge carrier in a conductor. Write its S.I. unit and what is its relation with relaxation time.

4. Why does the electric field inside a dielectric decreases when it is placed in an external electric field ?

5. Why is choke coil needed while using fluorescent tubes with a.c. mains ? Why can we not use an ordinary resistor instead of choke coil ?

(SECTION—B)

6. Use mirror equation to show that convex mirror always produces a virtual image independent of the location of the object.

7. Define the term magnetic inclination. Deduce the relation connecting the horizontal component and inclination with the help of a diagram

8. Two charges 'q' and '$-3q$' are placed fixed on x-axis separated by distance 'd'. Where should a third charge '$2q$' be placed such that it will not experience any force ?

9. A power transmission line feeds input power at 2300 V to step down transformer with its primary windings having 4000 turns. What should be the number of turns in the secondary in order to get an output power at 230V ?

10. Define self-inductance of a coil. Show that magnetic energy required to build up the current 'I' in a coil of self-inductance 'L' is given by $\frac{1}{2} LI^2$.

OR

Derive an expression for impedance of an a.c. circuit consisting of an inductor and a resistor.

(SECTION—C)

11. (a) Draw a ray diagram depicting the formation of the image by an astronomical telescope in normal adjustment.

(b) You are given the following three lenses. Which two lenses will you use as an eyepiece and as an objective to construct an astronomical telescope ? Give reason.

Lenses	Power (D)	Aperture (cm)
L_1	3	8
L_2	6	1
L_3	10	1

12. (a) State Biot-Savart law and express this law in the vector form.

(b) Two identical circular coils 'P' and 'Q' each of radius 'R' carrying currents '$1A$' and '$\sqrt{3}A$' respectively, are placed concentrically and perpendicular to each other lying in

the XY and YZ planes. Find the magnitude and direction of the net magnetic field at the centre of the coils.

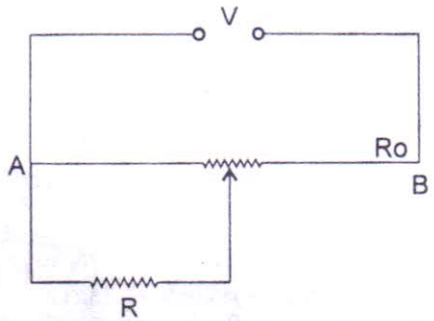
13. Describe the working principle of a moving coil galvanometer. Why is it necessary to use (i) A radial magnetic field (ii) a cylindrical soft iron core in a galvanometer ? Write the expression for current sensitivity of the galvanometer. Can a galvanometer as such be used for measuring the current ? Explain.

OR

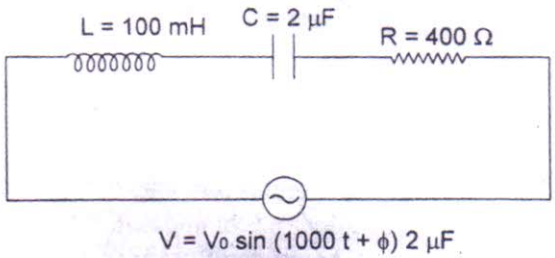
(a) Define the term mutual inductance and write its S.I. Unit.

(b) Obtain the expression for the mutual inductance of two long co-axial solenoids S_1 and S_2 wound one over the other each of length 'L' and radii 'r_1' and 'r_2' and 'n_1' and 'n_2' number of turns per unit length, when a current 'I' is set up in the outer solenoid S_2.

14. A resistance 'R' draws current from a potentiometer. The potentiometer wire AB, has a total resistance of Ro. A voltage 'V' is supplied to the potentiometer. Derive an expression for the voltage across 'R'. When the sliding contact is in the middle of the potentiometer wire.

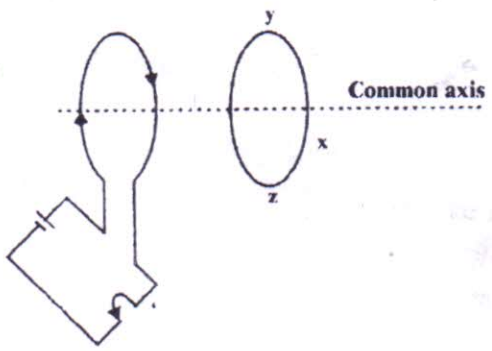


15. (i) Find the value of the phase difference between the current and the voltage in the series LCR circuit shown below. Which one leads in phase : current or voltage ?

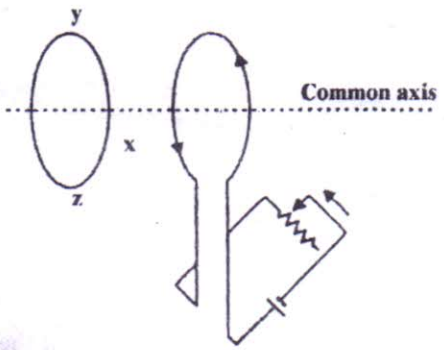


(ii) Without making any other change, find the value of the additional capacitor C_1, to be connected in parallel with the capacitor in order to made the power factor of the circuit unity.

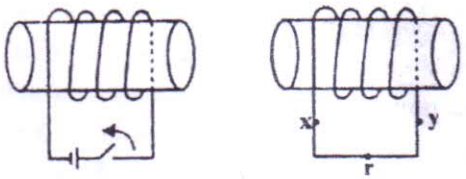
16. Predict the direction of induced current in the situations described in the following figs. Give reason also.



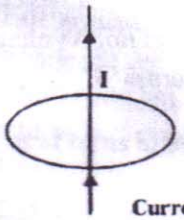
(a) Tapping key just closed



(b) Rheostat setting being changed

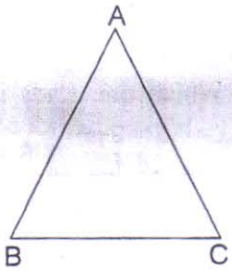


(c)
Tapping key just released



(d) Current (I) decreasing at a steady rate

17. (i) A ray of light incident on face AB of an equilateral glass prism, shows minimum deviation of 30°, calculate the speed of light through the prism.



(ii) Find the angle of incidence at face AB so that the emergent ray grazes along the face AC.

18. Two moving coil meters, M_1 and M_2 have the following particulars :

$R_1 = 10\Omega$, $N_1 = 30$, $A_1 = 3.6 \times 10^{-3}\ m^2$, $B_1 = 0.25\,T$,

$R_2 = 14\Omega$, $N_2 = 42$, $A_2 = 1.8 \times 10^{-3}\ m^2$, $B_2 = 0.50\,T$

The spring constants are identical for the two maters.

Determine the ratio of (a) current sensitivity and (b) voltage sensitivity of M_2 and M_1.

19. Answer the following questions :

(a) In a single-slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band ?

(b) In what way is diffraction from each slit related to the interference pattern in a double-slit experiment ?

(c) When a tiny circular obstacle is placed in the path of light from a distance source, a bright spat is seen at the centre of the shadow of the obstacle. Explain why ?

(d) Two students are separated by a 7 m partition wall in a room 10 m high. If both light and sound waves can bend around obstacles, how is it that the students are unable to see each other even though they can converse easily ?

(e) Ray optics is based on the assumption that light travels in a straight line. Diffraction effects (observed when light propagates through small apertures/slits or around small obstacles) disprove this assumption. Yet the ray optics assumption is so commonly used in understanding location and several other properties of images in optical instruments. What is the justification ?

20. (i) Obtain the expression for the torque 'τ' experienced by an electric dipole of dipole moment $\vec{P}$ in a uniform electric field $\vec{E}$.

(ii) What will happen if the field were not uniform.

21. Two concentric spheres of radii 'R' and 'r' have similar charges with equal surface charge densities. What is the electric potential at their common centre ?

22. (a) A cell of emf 'E' and internal resistance 'r' is connected to a variable load resistor 'R'. Draw the plots of the terminal voltage 'V' versus (i) 'R' and (ii) the current 'I'.

(b) It is found that when $R = 4\Omega$, the current is $1A$ and when 'R' is increased to '9Ω' the current reduces to $0.5A$. Find the values of the emf 'E' and internal resistance 'r'.

(SECTION—D)

23. Mrs. Rashmi Singh broke reading glasses. When she went to the shopkeeper to order new spects, he suggested that she should get spectacles with plastic lenses instead of glass lenses. On getting the new spectacles, she found that the new ones were thicker than the earlier ones. She asked this question to the shopkeeper but he could not offer satisfactory explanation for this. At home, Mrs Singh raised the same question to her daughter Anuja who explained why plastic lenses were thicker.

(a) Write two qualities displayed each by Anuja and her mother.

(b) How do you explain this fact using lens maker's formula ?

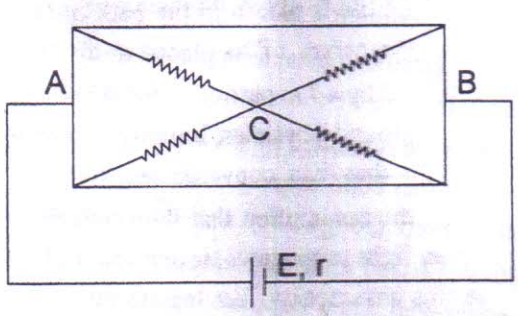
24. (i) On the basis of electron drift, derive an expression for resistivity of a conductor in terms of number density of free electrons and relaxation time. On what factors does resistivity of a conductor depend ?

(ii) Why alloys like constantan and manganin are used for making standard resistor ?

OR

(i) State the two Kirchhoff's laws. Explain briefly how these rules are justified.

(ii) The current is drawn from a cell of emf E and internal resistance r connected to the network of resistors each of resistance r as shown in the figure. Obtain the expression for (i) the current draw from the cell and (ii) the power consumed in the network.



25. Draw a labelled diagram of AC generator. Derive the expression for the instantaneous value of the emf induced in the coil.

(b) A circular coil of cross-sectional area 200 cm^2 and 20 turns is rotated about the vertical diameter with angular speed of 50 rad s^{-1} in a uniform magnetic field of magnitude 3.0×10^{-2} T. Calculate the maximum value of the current in the coil.

OR

(a) Draw a labelled diagram of a step-up transformer. Obtain the ratio of secondary to primary voltage in terms of number of turns and currents in the two coils.

(b) A solenoid of length 1.0 m radius 1 cm and total turns 1000 wound on it, carries a current of SA. Calculate the magnitude of the axial magnetic field inside the solenoid. If an electron was to move with a speed of 1.4 m/sec. along the axis of this current carrying solenoid, what would be the force experienced by this electron ?

26. (a) Distinguish between unpolarized light and linearly polarized light. How does one get linearly polarised light with the help of a polaroid ?

(b) A narrow beam of unpolarised light of intensity I_0 is incident on a polaroid P_1. The light transmitted by it is then incident on a second polaroid P_2 with its pass axis making angle of 60° relative to the pass axis of P_1. Find the intensity of the light transmitted by P_2.

OR

(a) Explain two features to distinguish between the interference pattern in Young's double slit experiment with the diffraction pattern obtained due to a single slit.

(b) A monochromatic light of wavelength 500 nm is incident normally on a single slit of width 0.2 mm to produce a diffraction pattern. Find the angular width of the central maximum obtained on the screen.

Estimate the number of fringes obtained in Young's double slit experiment with fringe width 0.5 mm, which can be accommodated within the region of total angular spread of the central maximum due to single slit.