D.A.V SR. SEC. PUBLIC SCHOOL, RIHAND NAGAR

PHYSICS XII

Assignment - 3

1.Two wires of equal legth, one of copper and the other of manganin have same resistance. Which wire is thicker?

2. What are the directions of electric and magnetic field vectors relative to each other and relative to the direction of propagation of electromagnetic waves?

3. How does the angular separation between fringes in single-slit diffraction experiment change when the distance of separation between the slit and screen is doubled?

4. A bar magnet is moved in the direction indicated by the arrow between two coils *PQ* and *CD*. Predict the directions of induced current in each coil

5. For the same value of angle incidence, the angles of refraction in three media *A*, *B* and C are 15°, 25° and 35° respectively. In which medium would the velocity of light be minimum?

6. A proton and an electron have same kinetic energy. Which one has greater de-Broglie wavelength and why?

7. Mention the two characteristic properties of the material suitable for making core of a transformer.

8. A charge'*q*' is placed at the centre of a cube of side *l*. What is electric flux passing through each face of cube?

9. A test charge '*q*' is moved without acceleration from *A* to *C* along the path from *A* to *B* and then from *B* to *C* in electric field *E* as shown in the figure. (*i*) Calculate the potential difference between *A* and *C*. (*ii*) At which point (of the two) is the electric potential more and why?

10. An electric dipole is held in a uniform electric field.(*i*) Show that the net force acting on it is zero.(*ii*) The dipole is aligned parallel to the field. Find the work done in rotating it through the angle of 180°

11. State the underlying principle of a transformer. How is the large scale transmission of electric energy over long distances done with the use of transformers?

12. A capacitor of capacitance of 'C' is being charged by connecting it across a dc source along with an ammeter. Will the ammeter show a momentary deflection during the process of charging? If so, how would you explain this momentary deflection and the resulting continuity of current in the circuit? Write the expression for the current inside the capacitor.

13. An object *AB* is kept in front of a concave mirror as shown in the figure.(*i*) Complete the ray diagram showing the image formation of the object. (*ii*) How will the position and intensity of the image be affected if the lower half of the mirror's reflecting surface is painted black?

14. Draw a labelled ray diagram of a reflecting telescope. Mention its two advantages over the refracting telescope.

15. Describe briefly with the help of a circuit diagram, how the flow of current carries in a p-n-p transistor is regulated with emitter-base junction forward biased and base-collector junction reverse biased.

16. In the given block diagram of a receiver, identify the boxes labelled as X and Y and write their functions.

17. A light bulb is rated 100 W for 220 V ac supply of 50 Hz. Calculate (*i*) the resistance of the bulb; (*ii*) the rms current through the bulb

OR

An alternating voltage given by $V = 140 \sin 314\ t$ is connected across a pure resistor of 50 Ω. Find (*i*) the frequency of the source. (*ii*) the rms current through the resistor.

18. A circular coil of N turns and radius R carries a current I. It is unwound and rewound to make another coil of radius R/2, current I remaining the same. Calculate the ratio of the magnetic moments of the new coil and the original coil.

19. Deduce the expression for the electrostatic energy stored in a capacitor of capacitance '*C*'& having charge '*Q*'. How will the (*i*) energy stored and (*ii*) the electric field inside the capacitor be affected when it is completely filled with a dielectric material of dielectric constant '*K*'?

20. Calculate the value of the resistance *R* in the circuit shown in the figure so that the current in the circuit is 0.2 A. What would be the potential difference between points *B* and *E*?

21. You are given three lenses *L*1, *L*2 and *L*3 each of focal length 20 cm. An object is kept at 40 cm in front of *L*1, as shown. The final real image is formed at the focus '*I*' of *L*3. Find the separations between *L*1, *L*2 and *L*3.

22. Define the terms (*i*) 'cut-off voltage' and (*ii*) 'threshold frequency' in relation to the phenomenon of photoelectric effect. Using Einstein's photoelectric equation show how the cut-off voltage and threshold frequency for a given photosensitive material can be determined with the help of a suitable plot/graph.

23. A series LCR circuit is connected to an ac source. Using the phasor diagram, derive the expression for the impedance of the circuit. Plot a graph to show the variation of current with frequency of the source, explaining the nature of its variation.

24. Mention three 'different modes of propagation used in communication system. Explain with the help of a diagram how long distance communication can be achieved by ionospheric reflection of radio waves.

25. Draw a plot of potential energy of a pair of nucleons as a function of their separations. Mark the regions where the nuclear force is (*i*) attractive and (*ii*) repulsive. Write any two characteristic features of nuclear forces.

26. In a Geiger–Marsden experiment, calculate the distance of closest approach to the nucleus of *Z*=80, when an □-particle of 8 MeV energy impinges on it before it comes momentarily to rest and reverses its direction.

How will the distance of closest approach be affected when the kinetic energy of the □-particle is doubled?

OR

The ground state energy of hydrogen atom is – 13.6 eV. If an electron makes a transition from an energy level – 0.85 eV to –3.4 eV, calculate the wavelength of the spectral line emitted. To which series of hydrogen spectrum does this wavelength belong?

27. Define relaxation time of the free electrons drifting in a conductor. How is it related to the drift velocity of free electrons? Use this relation to deduce the expression for the electrical resistivity of the material.

28. (*a*) In Young's double slit experiment, derive the condition for (*i*) constructive interference and (*ii*) destructive interference at a point on the screen. (*b*) A beam of light consisting of two wavelengths, 800 nm and 600 nm is used to obtain the interference fringes in a Young's double slit experiment on a screen placed 1.4 m away. If the two slits are separated by 0.28 mm, calculate the least distance from the central bright maximum where the bright fringes of the two wavelengths coincide.

OR

(*a*) How does an unpolarised light incident on a polaroid get polarised? Describe briefly, with the help of a necessary diagram, the polarisation of light by reflection from a transparent medium.

(*b*) Two polaroids '*A*' and '*B*' are kept in crossed position. How should a third polaroid '*C*' be placed between them so that the intensity of polarised light transmitted by polaroid B reduces to 1/8th of the intensity of unpolarised light incident on *A*?

29. (*a*) Describe briefly, with the help of a diagram, the role of the two important processes involved in the formation of a *p*-*n* junction. (*b*) Name the device which is used as a voltage-regulator. Draw the necessary circuit diagram and explain its working.

OR

(*a*) Explain briefly the principle on which a transistor-amplifier works as an oscillator. Draw the necessary circuit diagram and explain its working. (*b*) Identify the equivalent gate for the following circuit and write its truth table.

30. (*a*) Write the expression for the force, *F*, acting on a charged particle of charge '*q*', moving with a velocity *v* in the presence of both electric field *E* and magnetic field *B* Obtain the condition under which the particle moves undeflected through the fields. (*b*) A rectangular loop of size *l* × *b* carrying a steady current I is placed in a uniform magnetic field B. Prove that the torqueτ acting on the loop is given by τ = m× B, where m is the magnetic moment of the loop.

OR

(*a*) Explain, giving reasons, the basic difference in converting a galvanometer into (*i*)a voltmeter &(*ii*)an ammeter.

(*b*) Two long straight parallel conductors carrying steady current I1 and I2 are separated by a distance 'd'. Explain briefly, with the help of a suitable diagram, how the magnetic field due to one conductor acts on the other. Hence deduce the expression for force acting between the conductors. Mention the nature of this force.

ASSIGNMENT-4

1. Define electric dipole moment. Write its S.I. unit.
2. Where on the surface of Earth is the angle of dip 90°?
3. A hollow metal sphere of radius 5 cm is charged such that the potential on its surface is 10 V. What is the potential at the centre of the sphere?
4. How are radio waves produced?
5. Write any two characteristic properties of nuclear force.
6. Two bar magnets are quickly moved towards a metallic loop connected across a capacitor 'C' as shown in the figure. Predict the polarity of the capacitor.
7. What happens to the width of depletion layer of a *p-n* junction when it is (*i*) forward biased, (*ii*) reverse biased?
8. Define the term 'stopping potential' in relation to photoelectric effect.
9. A thin straight infinitely long conducting wire having charge density λ is enclosed by a cylindrical surface of radius r and length *l*, its axis coinciding with the length of the wire. Find the expression for the electric flux through the surface of the cylinder.
10. Plot a graph showing the variation of coulomb force (*F*) versus$(1/r^2)$,where *r* is the distance between the two charges of each pair of charges: (1μ C, 2μ C) and (2μ C – 3μ C). Interpret the graphs obtained.
11. Write the expression for Lorentz magnetic force on a particle of charge '*q*' moving with velocity *v* in a magnetic field *B* Show that no work is done by this force on the charged particle.

OR

A steady current (*I*1) flows through a long straight wire. Another wire carrying steady current (*I*2in the same direction is kept close and parallel to the first wire. Show with the help of a diagram how the magnetic field due to the current *I*1 exerts a magnetic force on the second wire. Write the expression for this force.
12. What are eddy currents? Write any two applications of eddy currents.
13. What is sky wave communication? Why is this mode of propagation restricted to the frequencies only up to few MHz?
14. In the given circuit, assuming point *A* to be at zero potential, use Kirchhoff's rules to determine the potential at point *B*.
15. A parallel plate capacitor is being charged by a time varying current. Explain briefly how Ampere's circuital law is generalized to incorporate the effect due to the displacement current.
16. Net capacitance of three identical capacitors in series is 1μF. What will be their net capacitance if connected in parallel? Find the ratio of energy stored in the two configurations if they are both connected to same source.
17. Using the curve for the binding energy per nucleon as a function of mass number A, state clearly how the release in energy in the processes of nuclear fission and nuclear fusion can be explained.
18. In the meter bridge experiment, balance point was observed at *J* with *AJ* = *l*. (*i*) The values of *R* and *X* were doubled and then interchanged. What would be the new position of balance point?
(*ii*) If the galvanometer and battery are interchanged at the balance position, how will the balance point get affected?
19. A convex lens made up of glass of refractive index 1.5 is dipped, in turn, in (*i*) a medium of refractive index 1.65, (*ii*) a medium of refractive index 1.33. (*a*) Will it behave as a converging or a diverging lens in the two cases? (*b*) How will its focal length change in the two media?
20. Draw a plot showing the variation of photoelectric current with collector plate potential for two different frequencies, *v*1 >*v*2 , of incident radiation having the same intensity. In which case will the stopping potential be higher? Justify your answer.

21. Write briefly any two factors which demonstrate the need for modulating a signal. Draw a suitable diagram to show amplitude modulation using a sinusoidal signal as the modulating signal.

22. Use the mirror equation to show that (*a*) an object placed between *f* and 2*f* of a concave mirror produces a real image beyond 2*f*. (*b*) a convex mirror always produces a virtual image independent of the location of the object. (*c*) an object placed between the pole and focus of a concave mirror produces a virtual and enlarged image.

23. Draw a labelled diagram of a full wave rectifier circuit. State its working principle. Show the input-output waveforms.

24. (*a*) Using de Broglie's hypothesis, explain with the help of a suitable diagram, Bohr's second postulate of quantization of energy levels in a hydrogen atom.

(*b*) The ground state energy of hydrogen atom is –13.6 eV. What are the kinetic and potential energies of the electron in this state?

25. You are given a circuit below. Write its truth table. Hence, identify the logic operation carried out by this circuit. Draw the logic symbol of the gate it corresponds to.

26. A compound microscope uses an objective lens of focal length 4 cm and eyepiece lens of focal length 10 cm. An object is placed at 6 cm from the objective lens. Calculate the magnifying power of the compound microscope. Also calculate the length of the microscope.

OR

A giant refracting telescope at an observatory has an objective lens of focal length 15 m. If an eyepiece lens of focal length 1.0 cm is used, find the angular magnification of the telescope. If this telescope is used to view the moon, what is the diameter of the image of the moon formed by the objective lens? The diameter of the moon is 3.42 × 106 m and the radius of the lunar orbit is 3.8×10^8 m.

27. Two heating elements of resistance *R*1 and *R*2 when operated at a constant supply of voltage, *V*, consume powers *P*1 and *P*2 respectively. Deduce the expressions for the power of their combination when they are, in turn, connected in (*i*) series and (*ii*) parallel across the same voltage supply.

28. (*a*) State the principle of the working of a moving coil galvanometer, giving its labelled diagram.

(*b*) "Increasing the current sensitivity of a galvanometer may not necessarily increase its voltage sensitivity." Justify this statement. (*c*) Outline the necessary steps to convert a galvanometer of resistance *RG* into an ammeter of a given range.

OR

(*a*) Using Ampere's circuital law, obtain the expression for the magnetic field due to a long solenoid at a point inside the solenoid on its axis. (*b*) In what respect is a toroid different from a solenoid? Draw & compare the pattern of the magnetic field lines in the two cases. (*c*) How is the magnetic field inside a given solenoid made strong?

29. State the working of a.c. generator with the help of a labelled diagram. The coil of an a.c. generator having N turns, each of area A, is rotated with a constant angular velocity ω Deduce the expression for the alternating e.m.f. generated in the coil. What is the source of energy generation in this device?

OR

(*a*) Show that in an a.c. circuit containing a pure inductor, the voltage is ahead of current by π /2 in phase.

(*b*) A horizontal straight wire of length L extending from east to west is falling with speed v at right angles to the horizontal component of Earth's magnetic field B.

(*i*) Write the expression for the instantaneous value of the e.m.f. induced in the wire. (*ii*) What is the direction of the e.m.f.? (*iii*) Which end of the wire is at the higher potential?

30. State the importance of coherent sources in the phenomenon of interference. In Young's double slit experiment to produce interference pattern, obtain the conditions for constructive and destructive interference. Hence, deduce the expression for the fringe width. How does the fringe width get affected, if the entire experimental apparatus of Young is immersed in water?

OR

(*a*) State Huygen's principle. Using this principle explain how a diffraction pattern is obtained on a screen due to a narrow slit on which a narrow beam coming from a monochromatic source of light is incident normally.

(*b*) Show that the angular width of the first diffraction fringe is half of that of the central fringe.

(*c*) If a monochromatic source of light is replaced by white light, what change would youobserve in the diffraction pattern?

ASSIGNMENT-5

1. Name the physical quantity whose S.I. unit is JC -1. Is it a scalar or a vector quantity?

2. A beam of α particles projected along +*x*-axis, experiences a force due to a magnetic field along the +*y*-axis. What is the direction of the magnetic field?

3. Define self-inductance of a coil. Write its SI units.

4. A converging lens is kept co-axially in contact with a diverging lens – both the lenses being of equal focal lengths. What is the focal length of the combination?

5. Define ionisation energy. What is its value for a hydrogen atom?

6. Two conducting wires *X* and *Y* of same diameter but different materials are joined in series across a battery. If the number density of electrons in *X* is twice that in *Y,* find the ratio of drift velocity of electrons in two wires.

7. Name the part of electromagnetic spectrum whose wavelength lies in the range of 10-10 m. Give its one use.

8. When light travels from a rarer to a denser medium, the speed decreases. Does this decrease in speed imply a decrease in the energy carried by the light wave? Justify your answer.

9. Deduce the expression for the magnetic dipole moment of an electron orbiting around the central nucleus.

10. A spherical conducting shell of inner radius *r*1 and outer radius *r*2 has a charge '*Q*'. A charge '*q*' is placed at the centre of the shell. (*a*) What is the surface charge density on the (*i*) inner surface, (*ii*) outer surface of the shell? (*b*) Write the expression for the electric field at a point $x > r_2$ from the centre of the shell.

11. Draw a sketch of a plane electromagnetic wave propagating along the *z*-direction. Depict clearly the directions of electric and magnetic fields varying sinusoidally with *z.*

12. Show that the electric field at the surface of a charged conductor is given by $E = \sigma/\varepsilon 0 \quad n$ where is the surface charge density and *n* is a unit vector normal to the surface in the outward direction.

13. Two identical loops, one of copper and other of aluminium, are rotated with the same angular speed in the same magnetic field. Compare (i) the induced emf and (ii) the current produced in the two coils. Justify your answer.

14. An α -particle and a proton are accelerated from rest by the same potential. Find the ratio of their de-Broglie wavelengths.

15. Write two factors justifying the need of modulating a signal. A carrier wave of peak voltage 12 V is used to transmit a message signal. What should be the peak voltage of the modulating signal in order to have a modulation index of 75%?

16. Write Einstein's photoelectric equation. State clearly the three salient features observed in photoelectric effect, which can be explained on the basis of the above equation.

17. Draw a plot of potential energy of a pair of nucleons as a function of their separation. Write two important conclusions which you can draw regarding the nature of nuclear forces.

OR

Draw a plot of the binding energy per nucleon as a function of mass number for a large number of nuclei, $2 \leq A \leq 240$. How do you explain the constancy of binding energy per nucleon in the range $30 < A < 170$ using the property that nuclear force is short-ranged? Nuclear forces are short ranged, so every nucleon interacts with their neighbours only; so binding energy per nucleon remains constant.]

18. (*i*) Identify the logic gates marked *P* and *Q* in the given logic circuit.

(*ii*) Write down the output at *X* for the inputs $A = 0, B = 0$ and $A = 1, B = 1$.

19. Which mode of propagation is used by short wave broadcast services having frequencies range from a few MHz upto 30 MHz? Explain diagrammatically how long distance communication can be achieved by this mode. Why is there an upper limit to frequency of waves used in this mode?

20. Write any two factors on which internal resistance of a cell depends. The reading on a high resistance voltmeter, when a cell is connected across it, is 2.2 V. When the terminals of the cell are also connected to a
resistance of 5Ω as shown in the circuit, the voltmeter reading drops to 1-8 V. Find internal resistance of cell.

21. A network of four capacitors each of 1μ2 F capacitance is connected to a 500 V supply as shown in the figure. Determine (a) equivalent capacitance of the network and (b) charge on each capacitor.

22. (*i*) Draw a neat labelled ray diagram of an astronomical telescope in normal adjustment. Explain briefly its working. (*ii*) An astronomical telescope uses two lenses of powers 10 D and 1 D. What is its magnifying power in normal adjustment?

OR

(*i*) Draw a neat labelled ray diagram of a compound microscope. Explain briefly its working.
(*ii*) Why must both the objective and the eye-piece of a compound microscope have short focal lengths?

23. In Young'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?

24. State Kirchhoff's rules. Use these rules to write the expressions for the currents *I*1, *I* 2 and *I* 3 in the circuit diagram shown.

25. (*a*) Write symbolically the$\beta-$ decay process of 15 p 32.
(*b*) Derive an expression for the average life of a radionuclide. Give its relationship with the half-life.

26. How does an unpolarised light get polarised when passed through polaroid? Two polaroids are set in crossed positions. A third polaroid is placed between the two making an angle θ with the pass axis of the first polaroid. Write the expression of the intensity of light transmitted from the second polaroid. In what orientations will the transmitted intensity be (*i*) minimum and (*ii*) maximum?

27. An illuminated object and a screen are placed 90 cm apart. Determine the focal length and nature of the lens required to produce a clear image on the screen, twice the size of the object.

28. (*a*) With the help of a diagram, explain the principle and working of a moving coil galvanometer. (*b*) What is the importance of a radial magnetic field and how is it produced (*c*) Why is it that while using a moving coil galvanometer as a voltmeter a high resistance in series is required whereas in an ammeter a shunt is used?

OR

(*a*) Derive an expression for the force between two long parallel current carrying conductors .(*b*) Use this expression to define S. I. unit of current. (*c*) A long straight wire *AB* carries a current *I.* A proton *P* travels with a speed *v*, parallel to the wire, at a distance *d* from it in a direction opposite to the current as shown in the figure. What is the force experienced by the proton and what is its direction?

29. State Faraday's law of electromagnetic induction. Figure shows a rectangular conductor *PQRS* in which the conductor *PQ* is free to move in a uniform magnetic field *B* perpendicular to the plane of the paper. The field extends from $= x$ 0 to *x= b* and is zero for *x >b*. Assume that only the arm *PQ* possesses resistance *r.* When the arm *PQ* is pulled outward from $x =$ 0 to *x =*2*b* and is then moved backward to $= x$ 0 with constant speed *v*, obtain the expressions for the flux and the induced emf. Sketch the variations of these quantities with distance $0 \leq x \leq 2b.$

OR

Draw a schematic diagram of a step-up transformer. Explain its working principle. Deduce the expression for the secondary to primary voltage in terms of the number of turns in the two coils. In an ideal transformer, how is this ratio related to the currents in the two coils? How is the transformer used in large scale transmission and distribution of electrical energy over long distances?

30. (*a*) Draw the circuit diagrams of a *p-n* junction diode in (*i*) forward bias, (*ii*) reverse bias. How are these circuits used to study the *V-I* characteristics of a silicon diode? Draw the typical *V-I* characteristics?
(*b*) What is a light emitting diode (LED)? Mention two important advantages of LEDs over conventional lamps.

OR

(*a*) Draw the circuit arrangement for studying the input and output characteristics of an *n-p-n* transistor in *CE* configuration. With the help of these characteristics define (*i*) input resistance, (*ii*) current amplification factor. (*b*) Describe briefly with the help of a circuit diagram how an *n-p-n* transistor is used to produce self-sustained oscillations.

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