Std XI

PHYSICS

Specimen Question Bank

(Numericals)

Chapter Number 1 to 13

CHAPTER 1 - MEASUREMENTS

S.A.I (2 Marks)

1. Determine the number of significant figures in the following measurements :

   (a) 0.002901 (b) 980 (c) 6.63×10^{-34} (D) 98.00

2. State the order of magnitude of the following :

   (a) 8.85×10^{-12} Wb / Am (b) 1.6×10^{-19} C

   (c) 6400 km (d) 0.00927

3. What is the order of magnitude of one light year expressed in metre ?

4. Two carbon resistances are given by $R_1 = (4 + 0.4)$ ohm and $R_2 = (12 + 0.6)$ ohm. Calculate the percentage error , if they are connected in series.

5. If the velocity (v) , time (t) and force (f) were chosen as fundamental quantities then obtain the dimensional formula of mass.

S.A.II (3 Marks)

1. In the following equation , x, t, and f represent displacement , time and force respectively .
   $f = a + bt + A\sin (\omega + \phi) + 1 / (c + xd)$. What is the dimensional formula for A.c ?

2. A metal wire has a mass (0.5 + 0.005) g , radius (4 + 0.004) mm and length (5 + 0.05) cm. Calculate the percentage error in the measurement of its density.

3. A student performing an experiment to find the period of second's pendulum obtained the following results :
   1.96 s , 2.00 s , 1.94 s , 2.04 s and 2.06 s . Find an absolute error , relative error and percentage error in the measurement.

CHAPTER 2 - SCALARS AND VECTORS

S.A.I (2 Marks)

1. Two equal forces (P each) act at a point inclined to each other at an angle of 120° . Calculate the magnitude of their resultant.

2. Find ' m ' if $\bar{A} = 4\hat{i} + 5\hat{j} + 2\hat{k}$ and $\bar{B} = m\hat{i} + 2\hat{j} + \hat{k}$ are perpendicular to each other .

3. A force $\bar{F} = (\hat{i} + 2\hat{j} - \hat{k})$ N displaces a body through $\bar{S} = (\hat{i} + \hat{j} - 2\hat{k})$ m in 10 s. What is the power developed ?

4. A force $\bar{F} = (4\hat{i} + 5\hat{j})$ N , acts on a particle whose position with respect to the origin '0 of an inertial frame of reference is given by $\bar{r} = (5\hat{i} + 4\hat{j})$. Determine the torque acting on the particle.

S.A.II (3 Marks)

1. If the vectors $\bar{P} = \hat{i} + 2\hat{j}$ and $\bar{Q} = 2\hat{i} - m\hat{j}$ are parallel to each other, then find the magnitude of vector $\bar{Q}$.

2. If magnitude of $|\bar{A} \times \bar{B}| = \sqrt{3}\,\bar{A}.\bar{B}$, then find the value of magnitude of $|\bar{A} + \bar{B}|$

3. The linear velocity of a particle on a rotating body is given by $\bar{v} = \bar{\omega} \times \bar{r}$ where $\bar{\omega}$ is angular velocity and $\bar{r}$ is radius vector . Find value of magnitude of '$\bar{v}$' , if, $\bar{\omega} = \hat{i} + \hat{j}$ and $\bar{r} = \hat{i} - \hat{j}$

CHAPTER 3 - PROJECTILE MOTION

S.A.I (2 Marks)

1. Calculate the time of flight of the projectile if it is projected with a velocity of 80 m/s by making an angle of 30^0 with the horizontal. ($g = 9.8\ m/s^2$)

2. A man throws a ball to maximum horizontal distance of 100m. Calculate the maximum height reached.

3. A shell fired from a canon can cover maximum horizontal distance of 10 km. Calculate velocity of projectile. ($g = 9.8\ m/s^2$)

S.A.II (3 Marks)

1. A body is projected with the velocity of 50 m/s at an angle of 30^0 with the vertical. Calculate (i) height (ii) time of flight (iii) horizontal range of projectile. ($g = 10\ m/s^2$)

2. The speed of car is reduced from 144 km/hr to 72 km/hr in 5.0 s. What is the distance travelled by car during this time interval?

3. A particle starts from rest accelerates at 2 m/s^2 for 10 s and then goes for constant speed for 30 s and then decelerates at 4 m/s till stops. Find the total distance travelled.

CHAPTER 4 - FORCE

S.A.I (2 Marks)

1. A cricket ball of mass 0.5 kg strikes a cricket bat normally with a velocity of 20 ms^{-1} and rebounds with velocity of 10 ms^{-1}. Then find the impulse of the force exerted by the ball on the bat.

2. Three blocks of mass 3 kg, 2kg and 1 kg are placed side by side on smooth surface. If a horizontal force of 24 N is applied on 3 kg block then find the net force on the block of mass 2 kg.

3. A 12 kg bomb at rest explodes into two pieces of 4 kg and 8 kg. If the momentem of 4 kg piece is 20 kg m/s, then determine the kinetic energy of 8 kg piece.

S.A.II (3 Marks)

1. A 10 g bullet is fired from a gun of certain mass with a speed of 2000 m/s. Find the mass of gun if a recoil velocity of gun is 5 m/s.

2. Two spherical bodies of respective masses 2 kg & 4 kg having their speed 5m/s & 2 m/s approaching one another. Determine their speeds after collision if the coefficient of restitution is 0.5.

CHAPTER 5 - FRICTION IN SOLIDS AND LIQUIDS

S.A.I (2 Marks)

1. A car is moving on a straight road with a speed of 72 km/ hr. If coefficient of kinetic friction (μ_k) = 0.5 then find the distance in which the car can be stopped .

2. Two thin circular plates P and Q of radii 3 cm and 5 cm are kept in water at depth of 40 cm and 120 cm respectively below the free surface of water. If F_P and F_Q are the thrust on respective plates P and Q then find ratio $F_p : F_Q$.

3. Water is flowing through a pipe of uniform cross section of diameter 1.6 m. What is the maximum velocity of water to avoid a turbulent flow ?
[coefficient of viscosity of water = 80 Ns / m^2 , density (p) = 1000 kg /m^3 and Reynold's number (R) = 1600]

4. The reading of pressure gauge attached to a closed pipe was 3.5 X 10^5 Pa . When a valve of the pipe was opened , the pressure reduced to 3 X 10^5 Pa. What was the speed of water flowing out of the pipe ?
(density of water = 10^3 kg /m^3)

S.A.II (3 Marks)

1. A metal ball of radius 10^{-4}m and density 10^4 kg /m^3 falls freely under gravity through a distance ' h ' and enters a tank of water. It is found that after entering the water , the velocity of a ball does not change. What is the value of ' h ?
[η = 10^{-5} Pa , g = 10 m/s^2 and density (p) = 10^3 kg /m^3]

2. A block is at rest at the top of a rough inclined plane at an angle of 30° with horizontal. What is the coefficient of kinetic friction between the block and plane , if the block slides down with an acceleration of g / 5 ?

3. Water is flowing steadily in river. P and Q are two layers of water at heights of 20 cm and 30 cm from the bottom . The velocity of the layer P is 12 cm /s . Calculate the velocity of layer Q.

CHAPTER 6 - SOUND WAVES

S.A.I. (2 Marks)

1. The wavelength of a sound note is 1 m in air and 2.5 m in a liquid. Find the speed of sound in the liquid, if the speed of the sound in air is 330 m/s

2. Assuming the speed of sound in air at NTP to be 330 m/s, find the speed at 20^0C.

3. The speed of sound in air at 0^0C is 331 m/s. At what temperature will the speed be greater by 10%?

4. At what temperature will the speed of sound in oxygen be the same as the speed of sound in carbon-dioxide at 0^0C?
(molecular weight of oxygen is 32 and γ for oxygen is 1.4, molecular wight of carbon-dixode is 44 and γ for carbon dioxide is 1.4)

5. The wavelength of a sound note in air is 20 m at 21^0C. Find the wavelength of the same sound note in air at 37^0C.

S.A.II (3 Marks)

1. A stone is released into a well 44.1 m deep. If the splash is heard 3.127 second after the stone is released, calculate the speed of sound in air. (9=9.8 m/s^2)

2. The speed of sound in air at 0^0C is 331 m/s. Find the increase in the speed of sound as the temperature changes from -10^0C to 37^0C.

3. Twenty ripples are produced in one second when a stone is thrown in a pond. Distance between a crest and trough is 15 cm, find i) frequency ii) wavelength iii) velocity of ripple produced.

4. A man stands between two parallel buildings and shouts. He bears the first echo of this sound in 0.6 s and the second echo after 0.9 s. If the buildings are at a distance of 255 m, find the velocity of sound in air.

5. Two vibrating tuning forks emit sound waves of frequncies 280 Hz and 300 Hz respectivety. If the wavelengths of these sound waves differ in air by 8 cm, find the velocity of sound in air.

CHAPTER 7 - THERMAL EXPANSION

S.A.I (2 Marks)

1. A room has a glass window of length 1.2 m, breadth 1.0 m and thickness 3 mm. The temperature inside the room is 23^0C and outside the room is 4^0C. If the thermal conductivity of glass is 0.75 J/m-sK, determine the amount of heat conducted through the glass per minute.

2. A certain mass of a gas at 27^0C is heated untill both its pressure and volume are doubled. Calculate its final temperature.

3. A lead bullet has a volume of 20 cm^3 at 0^0C and 20.20 cm^3 at 90^0C. Find the coefficient of cubical expansion of lead.

4. A steel ball of mass 8 gram is heated so that its temperature rises by 22^0C. If the heat supplied to it is 75 J, find its specific heat capacity.

5. Calculate the temperature in Fahrenheit if it is 30^0C.

S.A.II (3 Marks)

1. A certain mass of air at 63^0C occupies 175 cm^3. The pressure remaining unchanged, what volume will it occupy at i) the ice point ii) the steam point?

2. The radius of a wooden wheel is 0.505 m, a steel ring having radius 0.5m at 25^0C is to be just fitted on a wooden wheel. To what temperature the ring should be heated? (α for steel = $1.25 \times 10^{-5}/^0$C)

3. A metal rod has an area of cross section 10 cm^2 and its length is 25 cm. One end of the rod is maintained at 100^0C and the other end at 25^0C . Find
   i) temperature gradient along the rod.

   ii) The quantity of heat flowing through the rod in 10 minutes. (Thermal conductivity of a metal = 0.018 K cal/m-sK)

4. A liquid of ^{0}C is poured in a beaker of volume 500 c.c. to fill it completely. It is then heated to 95^0C. How much liquid will overflow?
   (γ liquid = $1.75 \times 10^{-5}/^0$C, γ glass= $2.75 \times 10^{-5}/^0$C)

5. A body cools from 62^0C to 54^0C in 10 minutes and to 48^0C in the next 10 minutes. Find the temperature of the surroundings.

CHAPTER 8 - REFRACTION OF LIGHT

S.A.I (2 Marks)

1. A ray of light falls on a glass plate of refractive index 1.62. If the reflected and refracted rays are perpendicular, find the angle of incidence.

2. The critical angles for a ray of light are 38°42' for glass and 42° for glycerine. Calculate the refractive index of glass with respect to glycerine,

3. A prism deviates violet ray' through 3.6°. If the refracting angle of the prism is 6° and. $\omega = 0.05$, find the deviation produced in the case of red ray.

S.A.II (3 Marks)

1. A glass prism of certain material produces a minimum deviation of 16° when its refracting angle is 30°.What will be the angle of minimum deviation produced by a prism of the same material having refracting angle of 60°?

2. A prism of refractive index 1.53 is placed in water of refractive index 1.33. If the angle of prism is 60°, calculate the angle of minimum deviation in water.

3. At what angle should a ray of light be incident on the face of a prism of refracting angle 60 °, so that it just suffers internal reflection at the other face? The refractive index of the prism is 1.524.

4. A ray of monochromatic light travelling in vacuum with speed c, wavelength λ and frequency υ, enters into a medium of refractive index 1.5. What will be its new speed, wavelength and frequency?

CHAPTER 9 - RAY OPTICS

S.A.I (2 Marks)

1. A double concave lens of refractive index 1.5 has surfaces with radii of curvature 10 cm and 12.5 cm. Find its focal length.

2. A double concave lens of refractive index 1.5 has surfaces with radii of curvatures10 cm and 12.5 cm. Find its focal power.

S.A.II (3 Marks)

1. An object is placed at a distance of 40 cm from a concave mirror of focal length 15 cm. If the object is displaced through a distance of 20 cm towards the mirror, by how much distance is the image displaced?

2. An object is kept in front of a concave mirror of focal length 15 cm. The image formed is three times the size of the object. Calculate two possible distances of the object from the mirror.

3. A double convex lens has radii of curvatures 30 cm and 45 cm and is made of refractive index 1.5. Find the focal length and the position of the image when object is 42 cm from it.

4. An object is placed at a distance of 1.5 m from a screen and a convex lens is interposed between them. The magnification produced is 4. Calculate the focal length of the lens.

5. The focal length of objective and eyepiece of compound microscope are 2 cm and 8 cm respectively. An object is placed at a distance of 2.4 cm from the objective. The final image is formed i) at DDV and ii) at infinity from the eyepiece. Find the magnifying power of microscope in both the cases.

CHAPTER 10 - ELECTROSTATICS

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

2. Permittivity of free space (ε_0)

   $\varepsilon_0 = 8.85 \times 10^{-12} \ \frac{C^2}{N - m^2}$

3. $1eV = 1.6 \times 10^{-19} J$

4. Mass of electron (m) = 9.1×10^{-31} kg

5. Charge on electron (e) = $1.6 \times 10^{-19} C$

CHAPTER 10 - ELECTROSTATICS

S.A.I (2 Marks)

1. Two small identical metal spheres carrying charges 3×10^{-9} C and -2×10^{-9} C are brought in contact with each other and then separated by 1 m in a medium of relative permittivity 10. Find the electrostatic force between them.

2. Determine the electric potential at the midpoint of the line joining two charges 2×10^{-6} C and -1×10^{-6}C placed in vaccum 10 cm apart.

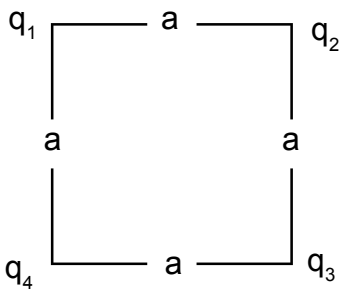
3. The electric field and electric potential at a certain point due to a point charge in vaccum are 9000 V/m and 18000 V, respectively. Find the distance of the point from the charge and the magnitude of the charge.

4. What is the electric potential energy of the following charge configuration ? Take

   $q_1 = +1 \times 10^{-8}$C, $q_2 = -2 \times 10^{-8}$C, $q_3 = +3 \times 10^{-8}$C,

   $q_4 = 2 \times 10^{-8}$C, and a = 1m

   Assume the charges to be in vacuum.



S.A.II (3 Marks)

5. An electric dipole has two point charges of 1.6×10^{-19}C and -1.6×10^{-19}C separated by $2\overset{0}{A}$. If the dipole is placed in a uniform electric field of 10N/C, making an angle of 30^{o} with the dipole moment, find

   i) The magnitude of the torque acting on the dipole due to the field and

   ii) The potential energy of the dipole.

2. PQRS is a square with each side $\sqrt{4.5}$ m. Point charges 2×10^{-9} C, -4×10^{-9} C, 6×10^{-9} C, are situated at corners P, Q and S respectively. Determine the wok done in moving a charge of +20 μC from point R to the centre of the square.

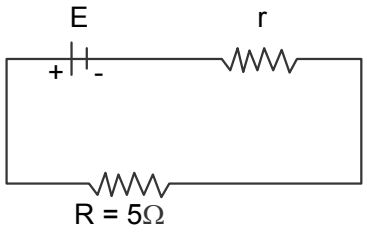
3. The electric potential is 800V at a point which is at a distance of r from a point charge q. If the electric field intensity at the point is 400 N/C, find q and r.

4. An electron initially at rest, is accelerated through a potential difference of 300 V. Find the energy acquired by the electron in eV and J. Also calculate the velocity of the electron.

CHAPTER 11 - CURRENT ELECTRICITY

S.A.I (2 Marks)

1. A wire of resistance 20Ω is stretched uniformly until its new length becomes three times the original length. Find its new resistance.
2. A uniform wire of length 1.5 m and has a resistance of 18Ω. The diameter of the wire is 0.032 cm. Find the specific resistance of the material of wire.
3. Two resistances when connected in series its effective resistance is 25Ω and when connected in parallel effective resistance is 6Ω. Determine value of two resistances.
4. Find the internal resistance in the following circuit, where E = 10V, terminal potential difference = 8V, load resistance R = 5Ω.



5. The following colour bands in a given order appear on a carbon resistor. Write the indicated value of the resistance.

   Orange, Brown, Voilet, Gold

S.A.II (3 Marks)

1. An electric heater draws 6A current from a 220 V supply. Calculate the power of the heater and the electric energy consumed by it in 2 hours.
2. A current of 5A is passed through a conductor of resistance 84 Ω. Calculate the heat given out by it in one minute. [J = 4.2 J/cal.]
3. Find the cost of using five bulbs of 60W each and three fans of 100 W each for 6 hours at the rate of Rs. 2 per unit.
4. A wire has resistance of 10Ω. If its length is halved by folding, find its resistance after the free ends are connected to each other.

CHAPTER 12 - MAGNETIC EFFECT OF ELECTRIC CURRENT

S.A.I (2 Marks)

1. A long straight wire in the horizontal plane carries a current of 50 A in north-south direction. What is the magnitude and direction of magnetic field at a point 2.5 m east of the wire ?

2. A coil 'P' having 50 turns and 30 cm radius and another coil 'Q' having 150 turns and 10 cm radius are connected in series. Compare the magnetic induction at their centres when a current is passed through them.

3. What is the magnitude of magnetic force per unit length on a wire carrying a current of 8 A and making an angle of 30^0 with the direction of a uniform magnetic field of 0.15 T ?

4. What is the maximum torque on a rectangular coil of area 5 cm x 12 cm of 600 turns, when carrying a current of 10^{-5}A in a magnetic field of 0.1 T ?

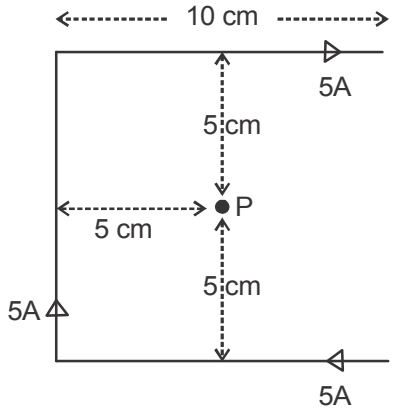
5. A long straight conductor carries a current of 100 A. At what distance from the conductor is the magnetic field caused by the current equal to 0.5×10^{-4} T?

S.A.II (3 Marks)

1. A long straight conductor carrying current of 4A is kept in air, tangential to the circular coil in same plane. The radius of circular coil is 2 cm and carrying current of 4A in clockwise direction. Calculate the magnetic induction at the centre of circular coil.
   ($\frac{\mu_0}{4\pi} = 10^{-7}$ S.I. Unit)

2. Two long straight parallel conductors 'A' and 'B' are carrying like currents 5A and 10A respectively. They are separated by distance 10 cm in air. The long straight conductor 'C' carrying current 5A is kept parallel midway between the two conductors 'A' and 'B'. Calculate the magnitude of force per unit lenght acting on conductor 'C'.

3. Three straight conductors each of legnth 10 cm and carrying current of 5A each are arranged as shown in following fig. The point 'P' is at distance 5 cm from each conductor. Calculate the magnitude and direction of resultant magnetic induction at a point 'P'. ($\mu_0 = 4\pi \times 10^{-7}$ SI Unit)



4. A horizontal straight wire of mass 1.2 gram is placed perpendicular to uniform magnetic field of 6×10^{-3} T. If resistance of wire is 2 Ωm^{-1}, calculate the potential difference that has to be applied between the ends of the wire to make it just self-supporting.

5. Two flat circular coils have a common centre but their planes are at right angles to each other. The inner coil has 300 turns and radius 3.14 cm. The outer coil has 800 turns and a radius of 6.28 cm. Find the magnitude of magnetic field at the common centre of the coils when a current of 200 mA is sent through each of them.

CHAPTER 13 - MAGNETISM

S.A.I (2 Marks)

1. A bar magnet has magnetic moment 3.6 Am^2 and pole strength 12 Am. Determine it's magnetic length and geometric length.

2. A flat circular coil has 500 turns, each of radius 20 cm. Find the value of the magnetic moment of the coil, when a current of 50 mA is passed through it.

3. A bar magnet has magnetic length of 0.2 cm. Compare the values of magnetic induction at two points on its axis at a distance of 20 cm and 30 cm from it's centre on same side.

4. At equator, assuming earth's magnetic field 0.5×10^{-4} tesla, estimate earth's dipole moment. (Radius of earth = 6.4×10^6m)

5. The vertical component of earth's magnetic field at a place is $\sqrt{3}$ times the horizontal component of earth's magnetic induction. What is the value of angle of dip at this place?

S.A.II (3 Marks)

1. A short bar magnet placed with its axis at 30^0 with a uniform external magnetic field of 0.25 T experiences a torque of magnitude 4.5×10^{-2} J. What is the magnitude of magnetic. moment of the magnet ?

2. The magnetic length of the magnet is 6 cm and it's magnetic moment is 0.5 Am^2. Calculate the magnetic induction on it's axis at a distance of 17 cm from the nearest pole.

3. A short bar magnet has a magnetic moment 0.48 JT^{-1}. Find the direction and magnitude of the magnetic field produced by the magnet at a distance of 10 cm from the centre of magnet on i) the axis ii) the equatorial line of the magnet.

4 Two magnets of magnetic moment 'M' and '$M\sqrt{3}$ ' are joined at their centres in such way that their lengths are perpendicular to each other. If this combination is suspended freely in a uniform magnetic field, what will be it's orientation in the field?