**5 SETS of 2074**

**Physics XI**

**SET – I**

**Group A**

1. **Answer, in brief, any *six* questions. [6×2=12]**
2. Prove that the maximum horizontal range is four times the maximum height attained by a projectile which is fired along the required oblique direction.
3. Two balls have the same size but one is denser than the other. Assuming the air resistance to be the same on each ball, explain why the heavier ball reaches the ground first when both are released simultaneously from the same height?
4. Why is it easier to pull a body than to push it?
5. Why the antiseptics used for cuts and wounds in human flesh have low surface tension?
6. An artificial satellite revolves round the earth without fuel but an aero plane requires fuel to fly, why?
7. A hollow bob of simple pendulum is filled with water. A small hole is made at its bottom. As the water slowly flows out, how does time period vary?
8. You are given a hard-boiled egg and a raw egg. How will you distinguish between the two?
9. **Answer, in brief, any *TWO* questions. [2×2 = 4]**
10. Why is a baby wrapped more tightly with warm clothes than an adult man in winter?
11. Under what condition do real gases follow ideal gas equation?
12. Why is the molar heat capacity of a gas at constant pressure always greater than that at constant volume?
13. **Answer, in brief, any *ONE* question. [1x2 = 2]**
14. Can you ever have situation in which a light ray goes undeviated through a prism?
15. Can you think of a situation in which a convex lens would behave like a concave lens?
16. **Answer, in brief, any *ONE* question. [1x2 = 2]**
17. Nothing will happen to a bird sitting on a naked high power line but a man gets fatal shock when he touches the same line, why?
18. Define equipotential surface. What will be the work done on a unit positive charge when it is moved from one point to another over an equipotential surface?

**Group B**

1. **Answer any *THREE* questions. [3x4 = 12]**
2. Derive the expression for energy store in a stretched wire. Also obtain the expression for energy density.
3. Why should a road be banked at turning? Derive an expression for the reasonable speed of a vehicle moving along a banked circular road.
4. What is meant by gravitational potential energy? Derive an expression for the gravitational potential energy of a body at a given point within the gravitational field.
5. What do you mean by angular momentum? State the principle of conservation of angular momentum and prove it.
6. **Answer any *TWO* questions. [2x4 = 8]**
7. Define latent heat of fusion of ice .How do you determine the latent heat of fusion of ice by the method of mixture in lab?
8. Derive ideal gas equation and calculate the value of the universal gas constant.
9. What do you mean by isothermal process? Obtain an expression for the work done by an ideal gas in the isothermal process.
10. **Answer any *ONE* question. [1x4 = 4]**
11. What is lateral shift? Deduce lateral shift in terms of thickness of a slab and the angle of incidence of the light.
12. Derive the formula relating object distance, image distance and the focal length for a convex lens.
13. **Answer any *ONE* question. [1x4 = 4]**
14. State and explain Gauss’ theorem and hence use it to determine the field outside a charged sphere.
15. Define the term potential gradient. Also derive a relation between the potential gradient and electric field strength.

**Group C**

1. **Solve any *THREE* numerical problems. [3x4 = 12]**
2. A coin placed on a disc rotates with a speed of 33 1/3 rev /min provided that the coin is not more than 10 cm from the axis. Calculate the coefficient of static friction between the coin and the disc.
3. Calculate the period of revolution of a satellite revolving at a distance of 20 km above the earth’s surface. (Radius of the earth = 6400km,acceleration due to gravity = 10m/s2)
4. A simple pendulum 4m long swings with an amplitude of 0.2m. Compute (a) the velocity of the pendulum at its lowest point, (b) its acceleration at the end of its path.
5. A constant torque of 200 Nm turns a wheel about its centre. The M.I. about this axis is 100 kgm2. Find the angular velocity gained in 4 s and the K.E. gained after 20 revolutions.
6. **Solve any *TWO* numerical problems. [2x4 = 8]**
7. 50 gram of ice at –6oC is dropped into water at 0oC. How many grams of water freeze? Given sp. heat capacity of ice = 2000J /kg oC , latent heat of fusion of ice = 80 cal/gm, latent heat of vaporization = 540 cal/gm.)
8. Calculate the root mean square speed of thermal agitation of the molecules of Helium in a vessel at 30o C. (Density of helium at STP = 0.1785 kg/m3 )
9. Estimate the rate at which ice would melt in a wooden box 2.5 cm thick of inside measurement 100cm x 60cm x 40cm, assuming that the external temperature is 35oC and thermal conductivity of wood 0.169 Wm-1K-1
10. A thin equiconvex lens of glass of refractive index 1.5 whose surface has a radius of curvature 24 cm, is placed on a horizontal plane mirror. When the space between the lens and mirror is filled with a liquid, a pin held 40cm vertically above the lens is found to coincide with its own image. Calculate the refractive index of the liquid.
11. A charged oil drop remains stationary when situated between two parallel horizontal plates 30mm apart and a p.d of 1000 V is applied to the plates. Find the charge on the oil drop if the mass of drop is 6x10-15 kg. Assume g = 9.8m/s2

**SET – II**

**Group A**

* + - 1. **Answer, in brief, any *six* questions. [6×2 =12]**

1. Can a body have zero velocity but non zero acceleration?
2. Mountain roads are curved and not straight up the slope, why?
3. Why is the earth bulged out at the equator and flattened at the poles?
4. A person standing on single foot can easily be knocked down than a person standing on both feet, why?
5. How can one change time period of swing without changing its length?
6. Why is a rocket launched from west to east in the equatorial plane of the earth?
7. A fan with blades takes longer time to come to rest than a fan without blades. Why?
8. **Answer, in brief, any *TWO* questions. [2×2 = 4]**
9. Molecules of different gases have equal average kinetic energies provided their temperature is the same. Do these molecules have equal velocities also?
10. Why do birds puff up their feathers on a cold day?
11. Two identical spheres, one of them solid and another hollow are heated to the same temperature and allowed to cool, which one will cool faster?
12. **Answer, in brief, any *ONE* question. [1x2 = 2]**
13. Under what condition does a prism produce the angle of minimum deviation?
14. The image of a candle formed by a convex lens is obtained on a screen. Will the full size of the image be obtained if the lower half of the lens is painted black and completely opaque?
15. **Answer, in brief, any *ONE* question. [1x2 = 2]**
16. A man inside an insulated hollow metal cage does not receive a shock although it is connected to a high voltage supply. Explain, why?
17. Two conducting spheres of the same metal have the same radii. If one is hollow and the other is solid, which one will have more amount of charge if each is charged through the same potential?

**Group B**

1. **Answer any *THREE* questions. [3x4 = 12]**
2. State the principle of conservation of linear momentum. Explain how Newton’s third law of motion leads to this principle.
3. What is meant by angular velocity? Show that the acceleration of a body moving in a circular path of radius r with uniform angular velocity ω is rω2.
4. State the principle of conservation of energy and hence show that the total mechanical energy of a freely falling body remains conserved at any point of its path.
5. What is simple pendulum? Show that the motion of the bob of a simple pendulum is simple harmonic. Obtain an expression for its time period.
6. **Answer any *TWO* questions. [2x4 = 8]**
7. How can you determine the specific heat capacity of a liquid by the method of cooling? What is the principle used in this method?
8. Derive an expression for the pressure exerted by one mole of an ideal gas enclosed in a cube.
9. Describe a method to determine the coefficient of thermal conductivity of a good conductor.
10. **Answer any *ONE* question. [1x4 = 4]**
11. Discuss the phenomenon of refraction through prism and show that the deviation of incident ray produced by a small angled prism for small angle of incidence is independent of the angle of incidence.
12. Derive lens maker’s formula  = (μ-1)  where the symbols have their usual meaning.
13. **Answer any *ONE* question. [1x4 = 4]**
14. Define the term potential difference between any two points in an electrostatic field and hence derive an expression for it.
15. What do you mean by electric field intensity? Derive an expression for the electric field intensity due to an infinite plane sheet of uniform charge density.

**Group C**

1. **Solve any *THREE* numerical problems. [3x4 = 12]**
2. A train of mass 2x105 kg moves at a constant sped of 72 km/hr up a straight incline against a frictional force of 1.28 x 104 N. The inclination is such that the train rises vertically 1 metre for every 100 m travelled along the incline. Calculate the necessary power developed by the engine of the train.
3. An object of mass 10 kg is whirled round a horizontal circle of radius 4m by a revolving string inclined to the vertical . If the uniform speed of the object is 5m/s. Calculate (i) the tension in the string (ii) the angle of inclination of the string to the vertical.
4. A body of mass 0.2 kg is executing simple harmonic motion with an amplitude of 20mm. The maximum force which acts upon it is 0.64 N. Calculate (i) its maximum velocity and (ii) its period of oscillation .
5. A recording disc rotates steadily at 45 rev/min on a table. When a small mass of 0.02 kg is dropped gently on the disc at a distance of 0.04 m from its axis and sticks to the disc, the rate of revolution falls to 36 rev/min, calculate the M.I. of the disc about its centre.
6. **Solve any *TWO* numerical problems. [2x4 = 8]**
7. Find the result of mixing 10g of ice at –8oC with 10g of water at 12oC Sp. heat of ice is 0.5 and latent heat of ice is 80cal/gram.
8. Air at 273 K and 1.01x105 N/m2 pressure contains 2.7 x 1025 molecules per cubic meter. How many molecules per m3 will be there at a place where the temperature is 223 K and pressure is 1.33 x 10-4 N m-2 ?
9. A bar of length 0.2 m and cross – sectional area 2.5 x10-4 m2 is ideally lagged. One end is maintained at 373K while the other is maintained at 273K by immersion in melting ice. Calculate the rate at which ice melts owing to the flow of heat along the bar .Thermal conductivity of the material of the bar = 4x102 Wm-1 K-1. Sp. latent heat of fusion of ice = 3.4x105 J/kg.
10. A glass prism of angle 72o and index of refraction 1.66 is immersed in a liquid of refractive index 1.33.What is the angle of minimum deviation for a parallel beam of light passing through the prism. [**4]**
11. Three equal charges 1.8x10-6 C each are located at the corners of an equilateral triangle ABC, whose sides are 6 cm. Calculate the electric potential at a point mid – way between the corners A and B. [**3]**

**SET – III**

**Group A**

* + - 1. **Answer, in brief, any *six* questions. [6x2 =12]**

1. Can an object with constant acceleration reverse its direction? Explain.
2. A man can throw a stone 50 m away. What is the maximum height to which he can throw the same stone?
3. When a large heavy truck collides with a passenger car, the occupants of the car are more likely to be hurt than the truck driver, why?
4. If the sun some how collapsed to form a black hole, what effect would this event have on the orbit of the earth?
5. A body is moving in a circular path with constant speed. Is this motion simple harmonic? Explain.
6. When a smooth flowing stream of water comes out of a faucet, it narrows as it falls, why?
7. Two wires A and B have equal lengths and are made of same material. If the diameter of wire A is twice that of wire B, which wire has the greater extension for a given load?
8. **Answer, in brief, any *TWO* questions. [2x2 = 4]**
9. Why are two thin blankets warmer than a single blanket of double the thickness?
10. When a metallic block with a hole in it is heated, why does not the material around the hole expand into the hole and make it smaller?
11. Explain why the temperature of a gas drops in an adiabatic process?
12. **Answer, in brief, any *ONE* question. [1x2 = 2]**
13. What is the cause of dispersion of light?
14. Why does the sun appear red during sun rise and sun set? Explain.
15. **Answer, in brief, any *ONE* question. [1x2 = 2]**
16. If the electric field is zero around a certain region of space, is the electric potential also zero in the region or not? Explain.
17. Is the dielectric constant the same as dielectric strength? Explain with examples.

**Group B**

1. **Answer any *THREE* questions. [3x4 = 12]**
2. State triangle law of vector addition. Obtain an expression for the resultant of two vectors P and Q inclined at angle θ with each other.
3. Define work. Derive an expression to calculate work done by a variable force.
4. What do you mean by satellite? Derive an expression for the total energy of a satellite orbiting round the earth.
5. Derive an expression for the terminal velocity of a small spherical ball of radius r dropped gently in a viscous liquid of density ρ and coefficient of viscosity η.
6. **Answer any *TWO* questions. [2x4 = 8]**
7. Define linear and cubical expansion of solid and establish a relation between their coefficients.
8. Prove that the pressure exerted by a gas on the wall of a container is 2/3 times the kinetic energy per unit volume of the gas.
9. Describe the working of a petrol engine with the help of PV diagram.
10. **Answer any *ONE* question. [1x4 = 4]**
11. Describe the construction and working of a compound microscope and hence derive an expression for its magnifying power.
12. What do you mean by minimum deviation for a prism? Derive an expression for the refractive index of a prism in terms of the angle of minimum deviation.
13. **Answer any *ONE* question. [1x4 = 4]**
14. State and explain Gauss law in electrostatics. Apply it to obtain an expression for the electric field intensity of a linearly charged body.
15. What is meant by electric potential? Obtain an expression for the electric potential at a point near an electric charge.

**Group C**

1. **Solve any *THREE* numerical problems. [3x4 = 12]**
2. A projectile is fired from the ground level with a velocity of 500 m/s at 30o to the horizontal. Find its horizontal range, the greatest height attained and the time to reach the greatest height.
3. A disc of moment of inertia 5×10-4 kgm2 is rotating freely about the axis passing through its centre at 40 rpm. Calculate the new revolution per minute if some wax of mass 0.02kg is dropped gently on to the disc 0.08 m from the axis.
4. A car of mass 1000 kg moves at a constant speed of 25 m/s along a horizontal road where the frictional force is 200 N. Calculate the power developed by the engine.
5. What is the period of revolution of a satellite of mass m that orbits the earth in a circular path of radius 7880 km at a height of about 1500 km above the surface of the earth?
6. **Solve any *TWO* numerical problems. [2x4 = 8]**
7. An ideal gas initially at a pressure of 4 atmospheres and temperature 300 K is permitted to expand adiabatically twice its initial volume. Find the pressure and temperature if the gas is
   1. monatomic and (ii) diatomic with Cv = 5/2R.
8. What is the result of mixing 10 gm of ice at 0oC into 15 gm of water at 20o C in a vessel of mass 100 gm and specific heat 0.09?
9. A man, the surface area of whose skin is 2m2 is sitting in a room where the air temperature is 20oC. If his skin temperature is 37oC, find the rate at which his body loses heat. The emissivity of his skin is 0.97.
10. The real image obtained by a lens of power 5D is three times the length of the object. Calculate the object and image distances.
11. Charges of magnitude 100μC each are located in vacuum at the corners A, B, C, of an equilateral triangle of each side 4 m. If the charge at A and C are positive and the charge B negative, what is the magnitude and direction of the total force on the charge at C?

**SET – IV**

**Group A**

* + 1. **Answer, in brief, any *six* questions. [6x2 =12]**

1. Taking force, length and time as fundamental quantities, find the dimension of density.
2. When a horse pulls a cart, the cart also pulls the horse backwards. Explain how the motion takes place.
3. Under what condition does a body become weightless at the equator?
4. Is any energy consumed in planetary motion? Explain.
5. A man carrying a load on his back has to bend forward, why?
6. What will happen if a glass capillary tube of insufficient length is dipped in water?
7. Why are steel rods mixed with concrete while constructing building houses, etc?
   * 1. **Answer, in brief, any *TWO* questions. [2x2 = 4]**
8. Two bodies made of the same material have the same shape and size but one is hollow and the other is solid. If the same amount of heat is supplied to each of the bodies, is the overall volume expansion the same or not? Explain.
9. If the RMS speed of the atoms of an ideal gas is to be doubled, by what factor must the Kelvin temperature of the gas be increased?
10. "Food cooked in pressure cooker is well cooked than in open pot." Why?
    * 1. **Answer, in brief, any *ONE* question. [1x2 = 2]**
11. A lens made of glass is immersed in water. Will its power decrease or increase?
12. If a plane glass slab is placed on the letters of different colours, then violet colored letters appears more and more raised up, why?
    * 1. **Answer, in brief, any *ONE* question. [1x2 = 2]**
13. Why are sharp edges avoided in electrical machines?
14. Dielectric constant of water is 81. What does it mean?

**Group B**

* + 1. **Answer any *THREE* questions. [3x4 = 12]**

1. Define angle of friction and angle of repose. Find the relation between them.
2. Define conical pendulum. Find the expression for its time period.
3. What do you mean by escape velocity? Show that the escape velocity is independent of the mass of the escaping body.
4. State and prove Bernoulli’s theorem. How is the theorem valid for non-viscous and incompressible liquid?
   * 1. **Answer any *TWO* questions. [2x4 = 8]**
5. What is meant by the latent heat of substance? Derive an expression for the determination of the latent heat of vaporization of water.
6. Define molar heat capacity. Show that Cp = Cv + R where Cp and Cv stands for molar heat capacities at constant pressure and constant volume respectively.
7. Explain the working of diesel engine with the help of PV diagram.
   * 1. **Answer any *ONE* question. [1x4 = 4]**
8. What is chromatic aberration? Deduce the condition for achromatism.
9. Describe the construction and working of an astronomical telescope. Hence obtain an expression for its magnifying power when the final image is formed at the least distance of distinct vision.
   * 1. **Answer any *ONE* question. [1x4 = 4]**
10. Define electric field intensity. Obtain an expression for the electric field intensity at a point due to a point charge.
11. What do you mean by capacitance of a capacitor? Derive an expression for the capacitance of a parallel plate capacitor.

**Group C**

* + 1. **Solve any *THREE* numerical problems. [3x4 = 12]**

1. An iron block of mass 10 kg rests on a wooden plane inclined at 30o to the horizontal. It is found that the least force parallel to the plane which causes the block to slide up the plane is 100 N. Calculate the coefficient of sliding friction between wood and iron.
2. A uniform steel wire of density 7800 kgm–3 weighs 16 grams and is 250 cm long. It lengthens by 1.2 mm when a load of 8 kg is applied. Calculate the value of Young's modulus for the steel and the energy stored in the wire.
3. A string supports a solid iron object of mass 200 gm totally immersed in a liquid of density 800 kgm-3. The density of iron is 8000 kgm-3. Calculate the tension in the string.
4. A spherical ball contracts in volume by 0.1% at a depth of 10 m below the surface of water. Calculate the bulk modulus and compressibility of the material of the ball.
   * 1. **Solve any *TWO* numerical problems. [2x4 = 8]**
5. 10 gram of water is converted into steam at atmospheric pressure and 100oC. Calculate the increase in internal energy. Sp. latent heat of vaporization of water = 540 cal/gm and volume of 1 gram of water and steam are 1 cm3 and 1671 cm3.
6. Assuming the density of Nitrogen at STP to be 1.251 kg/m3, find the RMS velocity of Nitrogen molecules at 127oC. Atmospheric pressure = 1.01 ×105 N/m2.
7. In carnot engine, the temperature of sink is 7oC. If its efficiency is 50%, what is the temperature of the source?
   * 1. A compound microscope has lenses of focal length 1cm and 3 cm. An object is placed 1.2 cm from the object lens and its virtual image is formed 25 cm the eye. Calculate the separation of the lenses and the magnificent of the instrument**. [4]**

**12**. Two capacitors of capacitance 4 μF and 6 μF respectively are connected in series and the combination connected momentarily across a 100V battery. The charged capacitors are isolated and connected in parallel, similar charged plates being connected together. What would be the resulting p.d across the combination? [**3]**

**SET – V**

**Group A**

* + 1. **Answer, in brief, any *six* questions. [6x2 =12]**

1. Differentiate between accurate and precise measurement.
2. What are the conditions under which the resultant of three coplanar forces is zero?
3. Why a wrench of longer arm is preferred in comparison to a wrench of the shorter arm?
4. A person in an artificial satellite revolving around the earth feels weightlessness, why?
5. A person standing on single foot can easily be knocked down than a person standing on both feet, why?
6. Why is suction effect is experienced by a person standing close to a platform at a station when a fast train passes?
7. Why do small particles of camphor dance on the surface of water?
   * 1. **Answer, in brief, any *TWO* questions. [2x2 = 4]**
8. Why is an adiabatic curve steeper than an isothermal curve?
9. Why is dew formed on the grass but not on the leaves of a tree?
10. If air is a bad conductor of heat, why do we not feel warm without clothes?
    * 1. **Answer, in brief, any *ONE* question. [1x2 = 2]**
11. Two identical metallic spheres of exactly equal masses are taken one is given a positive charge and the other negative charge. Are their masses different after charging? Explain.
12. Electric lines of force do not intersect each other, why?
    * 1. **Answer, in brief, any *ONE* question. [1x2 = 2]**
13. The vehicles carrying inflammable fluid drag a long metal chain over the ground, why?
14. A man inside an insulated hollow metal cage does not receive a shock although it is connected to a high voltage, explain why?

**Group B**

* + 1. **Answer any *THREE* questions. [3x4 = 12]**

1. What is projectile? Obtain an expression for the time of flight, horizontal range and maximum height attained by a projectile.
2. How does the acceleration due to gravity vary with the altitude and depth? Show where will the value of g maximum.
3. Define SHM. Obtain an expression for the time period of a mass attached with suspended helical spring.
4. Derive the expression for height of liquid rise in capillary.
   * 1. **Answer any *TWO* questions. [2x4 = 8]**
5. Define real expansivity of liquid. Describe balance column method to measure it.
6. Define specific heat capacity of substance. Describe method of mixture to determine it.
7. Show that PVγ = constant for a gas undergoing adiabatic change.
   * 1. **Answer any *ONE* question. [1x4 = 4]**
8. Define focal length of a lens. Obtain an expression for the equivalent focal length of two lenses in contact.
9. Derive the mirror formula = for a concave mirror.
   * 1. **Answer any *ONE* question. [1x4 = 4]**
10. Define capacitance of a capacitor. Obtain the expression for energy store in a charged capacitor.
11. State and prove Gauss theorem in electrostatics. Use it to obtain the expression for electric field intensity at a point inside a charged spherical conductor.

**Group C**

* + 1. **Solve any *THREE* numerical problems. [3x4 = 12]**

1. A stone is projected horizontally with 20 m/s from top of a tall building. Calculate its position and velocity after 3 sec, neglecting the air resistance.
2. A 25 cm thick block of ice floating on fresh water can support 80 kg man standing on it, what is the smallest area of the ice block? (sp. gr. of ice = 0.917)
3. A rectangular plate of dimensions 6 cm. by 4 cm and thickness 2 mm is placed vertical so that its longest side just touches the surface of the water. Calculate the downward force on the plate due to surface tension. (surface tension of water = 7.0 × 10–2 Nm–1)
4. In a test experiment on a model air plane in a wind tunnel, the flow speeds on the upper and lower surfaces of the wings are 70 m/s and 63 m/s respectively. What is the dynamic lift on the wing if its area is 2.5m2 ? Take the density of air to be 1.3 kg/m3.
   * 1. **Solve any *TWO* numerical problems. [2x4 = 8]**
5. A diatomic gas (γ = 1.4) absorbs 500 J of heat and expands isobarically. Calculate the increase in internal energy and external work done by the gas.
6. A silica cylinder of a radiant wall heater is 0.6 m long and has a radius of 6 mm. It is rated at 1.5 KW, estimate the temperature when operating. (Stefan’s constant = 6 × 10-8 W m-2k-4).
7. A brass pendulum clock keeps correct time at 30°C. How many seconds will it gain or lose per day when the temperature of the room falls to 10°C? [α for brass = 0.000018°C–1]
   * 1. Light travelling in air is incident on the surface of a block of plastic at an angle of 62.7o to the normal and is bent so that it makes an angle of 48.1o with the normal to the surface. Find the speed of light. [**4]**
     2. An alpha particle is a nucleus of doubly ionized helium. It has mass of   
        6.68 × 10–27 kg and charge of 3.2 × 10–19 C. Compare the force of electrostatic repulsion between the two alpha particles with the force of gravitational attraction between them. **[3]**