GEMS SCHOOL

Dhapakhel, Lalitpur

Model Question
SET –5

PHYSICS

Class: XI   Full Marks: 75
Time: 3:00 hours   Pass Marks: 27

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks.

Attempt all the questions.

You may use the following values of physics constants wherever necessary.
Acceleration due to gravity (g) $=10 m/s^2$
Specific heat capacity of copper $= 400J\ Kg^{-1}K^{-1}$
Specific heat capacity of water $= 4200\ J\ Kg^{-1}K^{-1}$
Latent heat of ice $= 80\ cal/gm$
Young's modulus of steel $= 2 \times 10^{11}\ Nm^{-2}$
Permittivity of free space ($\in_0$) $= 8.854 \times 10^{-12}C^2/Nm^2$

Group 'A'

1. **Answer, in brief, any SIX questions:**   **[6×2=12]**
   a. Name any two physical quantities which have the same dimensions. Can a quantity have unit but no dimension? Explain.
   b. If $\vec{i}, \vec{j}$ and $\vec{k}$ are unit vectors a long x, y and z-axis respectively, find $\vec{i}.(\ \vec{k} \times \vec{j}\ )$
   c. Rain drops hitting the side windows of a car in motion often leave diagonal streaks. Why?
   d. Does the centre of mass and centre of gravity lie at the same point? Explain with example.
   e. Soap bubbles are almost perfect spheres. Why?
   f. In still air, a helium filled balloon rises up to a certain height and then stops rising. Why?
   g. A fan with blades longer time to come to rest than without blades. Why?

2. **Answer, in brief, any TWO questions:**   **[2×2=4]**
   a. Why has a gas two values of molar heat capacities?
   b. What is the difference between saturated and unsaturated vapour?
   c. Under what conditions do the real gases obey more strictly the gas equation PV = RT?

3. **Answer, in brief, any ONE question:**   **[1x2=2]**
   a. Define luminous intensity of a source. What is its unit?
   b. Can total internal reflection be achieved if object originates in rarer medium? Explain with a diagram to justify your answer.

4. **Answer, in brief, any ONE question:**   **[1x2=2]**
   a. Can we give any desired quantity of charge to a capacitor? Explain.
   b. Can a charged body attract an uncharged body? Explain.

Group 'B'

5. **Answer any THREE questions:**   **[3×4=12]**
   a. Write expression for work done by a constant and a variable force. Show that the work done by the resultant force on a particle is equal to the change in kinetic energy of the particle.
   b. Obtain an expression for variation of g with rotation of earth.
   c. Derive a relation between torque applied and angular acceleration produced in a rigid body and hence define moment of inertia.
   d. Using dimensional consideration, deduce Poiseulle's formula for the rate of flow of a liquid through a capillary tube.

6. **Answer any TWO question:**   **[2×4=8]**
   a. Describe a method to determine the linear expansivity of a solid. Can the cubical expansively be derived from this value?
   b. What is specific latent heat of vaporization of a liquid? Develop an expression for the determination of the latent heat of vaporization.
   c. Derive an expression for the work done during the adiabatic expansion of an ideal gas. Does the internal energy of the system change during adiabatic expansion?

7. **Answer any ONE question:** [1x4=4]

a. What is prism? Show that the deviation product by a small angel prism is independent of the angle of incidence, provided the angle of incidence is small.
b. What is chromatic aberration? Show that for a lens, the chromatic aberration is the product of dispersive power and focal length of mean light.

8. **Answer any ONE question:** [1x4=4]

a. Define electric potential. Derive an expression for the electric potential due to a point charge a t a distance r from it.
b. State and explain gauss's law in electrostatics. Use this law to obtain electric field intensity due to a plane charged conductor.

Group 'C'

9. **Answer any THREE numerical questions:** [3×4=12]

a. A light is attached to a block with mass 4kg that rests on a frictionless, horizontal surface. The horizontal rope passes over a frictionless pulley and a block with mass m is suspended from the other end. When the blocks are released, the tension in the rope is 10 N. Draw free body diagrams and calculates the acceleration of either block and the mass m of the hanging block.
b. A mass of 1 kg is attached to the lower end of a string 1 m long whose upper end is fixed. The mass is made to rotate in a horizontal circle of radius 60 cm. If the circular speed of the mass is constant, find the tension in the string and the period of motion.
c. Calculate the work done in stretching a steel wire 100 cm in length and of cross-sectional area 0.03 cm^2 when a load of 100 N is slowly applied before the elastic limit is reached.
d. A simple pendulum 5 m long swings with an amplitude 25 cm. find the velocity of the pendulum at its lowest point and the acceleration at the end of its path.

10. **Answer any THREE numerical questions:** [3×4=12]

a. A cylinder of gas has a mass of 10kg and pressure of 8 atmospheres at 27^0c, when some gas is used in a cold room at -3^0c, the gas remaining in the cylinder at this temperature and a pressure of 6.4 atmospheres. Calculate the mass of gas used.
b. A slab of stone of area 0.36 m^2 and thickness 10 cm exposed on the lower surface to steam at 100^0 C. A block of ice at 0^0 C rests on the upper surface of the slab. In one hour, 4.8 kg of ice is melted. Calculate the thermal conductivity of stone.
c. A petrol engine consumes 25 Kg of petrol per hour. The calorific value of petrol is 11.4×10^6 cal/Kg. The power of the engine is 99.75 Kw. Calculate the efficiency of the engine.

11. A compound microscope has lenses of focal lengths 1 cm and 3 cm. An object is placed 1.2 cm from the object lens. If a virtual image is formed at 25 cm from the eye, calculate the separation of the lenses and the magnification of the instruments. [4]

12. Two charges -1 μ c , 2μc are placed at the corners A and B of an equilateral triangle ABC of side 2 cm. Calculate the electric field at C. [3]