Sub: Physics

Standard: 12th (Science) **Date: 16 / 11 /18**

Time : 3 Hours **Total Marks: 70**

General Instructions:

1) All questions are compulsory.
2) Section-A contains Q.No.1 to 4 of multiple choice type of questions carrying one mark each. Q.No.5 to 8 are very short answer type of questions carrying one mark each.
3) Section –B contains Q.No.9 to 15 of short answer type of questions carrying two marks each. Internal choice is provided to only one question.
4) Section-C contains Q.No.16 to 26 of short answer type of questions carrying three marks each. Internal choice is provided to only one question.
5) Section-D contains Q.No.27 to 29 of long answer type of questions carrying five marks each. Internal choice is provided to each question.
6) Use Log-table if necessary. Use of calculator is not allowed.

Physical constants:

(1) $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{ N}.m^2/C^2$ (2) Density of helium at NTP= $0.1785\ kg/m^3$

(3) One atmosphere $= 1.013 \times 10^5\ N/m^2$ (4) $e = 1.6 \times 10^{-19} C$

(5) $m_{electron} = 9.1 \times 10^{-31} kg$

SECTION-A

Q.1 A particle moving in a circular path with a constant angular velocity $\underset{\omega}{\rightarrow}$ has a linear speed v. The magnitude of its acceleration is

(A) ωv (B) $\frac{\omega}{v}$ (C) $\frac{v}{\omega}$ (D) $\omega^2 v$.

Q.2 A square plate of glass, of side 7 cm and thickness 2 mm, is placed with its square face flat on a liquid surface. If the surface tension of the liquid is 20 dyn/cm, the force of surface tension on the glass plate is

(A) 298 dynes (B) 140 dynes (C) 560 dynes (D) 576 dynes

Q.3 Two resistors R_1 *and* R, are connected in the left gap and right gap of a metre bridge,and the null point is obtained at 20 cm from the left. On interchanging the resistors in the two gaps, the null point shifts by

(A) 20 cm (B) 40 cm (C) 60 cm (D) 80 cm.

Q.4 Which of the following would permit finer detail to be examined using a microscope of given numerical aperture?

(A) Yellow light (B) Ultraviolet radiation (C) Violet light (D) Blue light

Q.5 Obtain the dimensions of electric susceptibility.

Q.6 What is the significance of binding energy per nuclear?

Q.7 What is the adiabatic constant for a gas if each molecule of the gas has five degrees of freedom?

Q.8 State the principle of superposition of waves.

SECTION-B

Q.9 A wheel is rotating at 80 rpm. If $24\pi^2$ J of energy is needed to double its angular speed, calculate the moment of inertia of the wheel.

Q.10 Explain the reflection of sound waves from a curved surface.

OR

Explain the reflection of sound waves at the surface of a denser medium.

Q.11 Explain and define the self-inductance of a coil.

Q.12 Derive the relationship $\frac{V_p}{V_s} = \frac{I_s}{I_p}$ for a transformer.

Q.13 A long cylindrical conductor of radius 4 cm carries a charge of $10\,\mu C/m$ and is kept in a medium of dielectric constant 1. Find the electric field intensity at a point 10 m from the axis of the cylinder.

Q.14 Explain the physical significance of moment of inertia.

Q.15 The resistance of a 20 m long potentiometer wire is 20Ω. If the current through it is 0.8 A, what is the balancing length when two cells of emfs 1.3 V and 1.1 V are connected so as to oppose each other?

SECTION-C

Q.16 Explain the construction and working of a photodiode with a neat diagram.

Q.17 Defineescape speed. Obtain an expression for the escape speed of a body from the surface of a planet.

Q.18 Derive an expression for the linear acceleration of a particle performing UCM.

Q.19 Explain the origin of diamagnetism on the basis of atomic structure.

Q.20 Explain the phenomenon of surface tension on the basis of molecular theory.

Q.21 Obtain an expression for the frequency of revolution of an electron in the nth Bohr orbit.

Q.22 Calculate the rms speed of helium atoms at 27^0C.

Q.23 The rectangular coil in a moving-coil galvanometer has 200 turns, each of length 5 cm and breadth 3 cm, and is suspended in a radial magnetic field of induction 0.05 Wb/m^2. The twist constant of the suspension fibre is $3 \times 10^{-9}\, N.m/degree$. Calculate the deflecting torque and the current through the coil which will deflect it through 40^0.

Q.24 Explain the phenomenon of reflection on the basis of Huygens' wave theory of light.

Q.25 Describe the biprisms experiment to determine the wavelength of monochromatic light.

OR

Describe Young's experiment to observe the interference of light.

Q.26 The work function of tungsten is 5.50 eV. Calculate the speed of the fastest electron ejected from tungsten surface when electromagnetic radiation of energy 6eV is incident on the surface.

SECTION-D

Q.27 Obtain an expression for the period of a simple pendulum.

A particle performs SHM of amplitude 10 cm. Its maximum velocity during oscillations is 100 cm/s. What is its displacement when the velocity is 100 cm/s?

OR

Show that linear SHM is the projection of UCM on a diameter of the circle.

The equation of linear SHM is $x = 20 \sin\left(4\pi t + \frac{\pi}{3}\right)$cm, Find the period and epoch of the motion.

Q.28 State and explain the laws of vibrating strings.

Two simple harmonic progressive waves are represented by

$y_1 = 2 \sin 2\pi \left(100t - \frac{x}{50}\right) cm$ and $y_2 = 2 \sin 2\pi \left(100t + \frac{x}{50}\right) cm$. The waves combine to form a stationary wave. Find the amplitude at an antinode and the loop length.

OR

With neat labelled diagrams, explain the three lowest modes of vibration of a string stretched between rigid supports.

Find the fundamental frequency of an air column in a pipe closed at one end. The length of the pipe is 30 cm and the inner diameter of the pipe is 4 cm. The speed of sound in air at room temperature is 750 m/s.

Q.29 Explain the behavior of a metal wire under increasing load.

Write a note on bandwidth of signals.

OR

Describe a method to determine Young's modulus of the material of a thin wire.

Explain the two basic modes of long distance communication.