SATISH SCIENCE ACADEMY

DHANORI PUNE-411015

PHYSICS

Class 12 - Physics

Time Allowed: 3 hours   **Maximum Marks: 70**

General Instructions:

The question paper is divided into **four sections**:

1. **Section A**

   - Q. No. 1 contains **Ten multiple choice type** of questions carrying **One mark** each.

   - Q. No. 2 contains **Eight very short answer type** of questions carrying **One mark** each.

2. **Section B**

   - Q. No. 3 to Q. No. 14 contain **Twelve short answer type** of questions carrying **Two marks** each. (Attempt any Eight).

3. **Section C**

   - Q. No. 15 to Q. No. 26 contain **Twelve short answer type** of questions carrying **Three marks** each. (Attempt any Eight).

4. **Section D**

   - Q. No. 27 to Q. No. 31 contain **Five long answer type** of questions carrying **Four marks** each. (Attempt any Three).

5. Use of the log table is allowed. Use of calculator is not allowed.

6. Figures to the right indicate full marks.

7. For each multiple choice type of question, it is mandatory to write the correct answer along with its alphabet. e.g., (a)....../(b)....../(c)....../(d) .... No marks(s) shall be given, if **<u>ONLY</u>** the correct answer or the alphabet of the correct answer is written. Only the first attempt will be considered for evaluation.

<div align="center">Section A</div>

1. **Select and write the correct answers for the following multiple choice type of questions:**   **[10]**

    (a)   The momentum of a photon of de Broglie wavelength $5000\overset{o}{A}$ is _____.   **[1]**
    [Planck's constant $= 6.63 \times 10^{-34} J.s$.]

        a) $1.326 \times 10^{-28} \ kg - m/s$ b) $7.54 \times 10^{-28} \ kg - m/s$

        c) $1.326 \times 10^{-27} \ kg - m/s$ d) $7.54 \times 10^{-27} \ kg - m/s$

    (b)   In a cyclic process, if $\Delta U =$ internal energy, W = work done, Q = Heat supplied then   **[1]**

        a) $Q = 0$ b) $W = 0$

c) $W = Q$ d) $\Delta U = Q$

(c) A pure semiconductor is known as _____. **[1]**

    a) extrinsic semiconductor   b) p-type semiconductor

    c) n-type semiconductor   d) intrinsic semiconductor

(d) A ray of light passes from vacuum to a medium of refractive index μ. Angle of incidence is found to be twice the angle of refraction. The angle of incidence is given by **[1]**

    a) $2\sin^{-1}\left(\frac{\mu}{2}\right)$ b) $\cos^{-1}\left(\frac{\mu}{2}\right)$

    c) $2\cos^{-1}\left(\frac{\mu}{2}\right)$ d) $\cos^{-1}(\mu)$

(e) Phase difference between a node and an adjacent antinode in a stationary wave is _____. **[1]**

    a) πrad b) $\frac{\pi}{2} rad$

    c) $\frac{\pi}{4} rad$ d) $\frac{3\pi}{4} rad$

(f) In which of the following substances, surface tension increases with increase in temperature? **[1]**

    a) Molten copper   b) Iron

    c) Copper   d) Molten iron

(g) The energy of an electron in nth Bohr orbit is proportional to _____. **[1]**

    a) n^2 b) $\frac{1}{n^2}$

    c) $\frac{1}{n}$ d) n

(h) If a watch-glass containing a small quantity of water is placed on two dissimilar magnetic poles, then water _____. **[1]**

    a) shows a depression in the middle.   b) shows an elevation in the middle.

    c) evaporates immediately.   d) surface remains horizontal.

(i) The specific heat capacity of water is **[1]**

    a) $8R$ b) $\frac{7}{8}R$

    c) $\frac{9}{7}R$ d) $9R$

(j) Avalanche breakdown in a zener diode takes place due to _____. **[1]**

    a) accelerated minority charge carrier   b) light energy

    c) thermal energy   d) magnetic field

2. **Answer the following questions:** **[8]**

(a) Is it always necessary to use red light to get photoelectric effect? **[1]**

(b) Define the term **damped oscillations**. **[1]**

(c) What is the average value of alternating current over a complete cycle? **[1]**

(d) Define potential gradient of the potentiometer wire. **[1]**

(e) Define U.C.M. **[1]**

Name the forces acting on a body executing nonuniform circular motion.

(f) Categorize the following into polar and non-polar dielectrics: **[1]**

    a. H_2O

b. CO_2

(g)   What is the value of force on a closed circuit in a magnetic field?   **[1]**

(h)   State the formula for the Bohr magneton.   **[1]**

Section B

Attempt any 8 questions

3.   Define surface tension and surface energy.   **[2]**

4.   Draw a neat and labelled diagram of suspended coil type moving coil galvanometer.   **[2]**

5.   Draw neat, labelled diagram showing different forces acting on a vehicle moving along a banked road.   **[2]**

6.   State Gauss' theorem in electrostatics. State the expression for electric field intensity at a point outside an   **[2]**
infinitely long charged conducting cylinder.

7.   Define phase of S.H.M.   **[2]**
Show variation of displacement, velocity and acceleration with phase for a particle performing linear S.H.M.
graphically, when it starts from extreme position.

8.   Define: **[2]**

 a. Isothermal process

 b. Adiabatic process.

9.   Define and state formulae for: **[2]**

 i. Inductive reactance

 ii. Capacitive reactance

10.   Calculate the period of a particle performing linear S.H.M. with maximum speed of $0.08\ m/s$ and maximum   **[2]**
acceleration of $0.32\ m/s^2$.

11.   Explain the formation of stationary waves by analytical method. Show that nodes and antinodes are equally   **[2]**
spaced in a stationary wave.

12.   The kinetic energy of nitrogen per unit mass at 300 K is $2.5 \times 10^6\ J/Kg$. Find the kinetic energy of 4 kg   **[2]**
oxygen at 600 K. [Molecular weight of nitrogen = 28, Molecular weight of oxygen = 32]

13.   The combined resistance of a galvanometer of resistance 500Ω and its shunt is 21Ω. Calculate the value of   **[2]**
shunt.

14.   The velocity of electron in the first Bohr orbit of radius 0.5 A.U. is $2.24 \times 10^6\ m/s$. Calculate the period of   **[2]**
revolution of electron in the same orbit.

Section C

Attempt any 8 questions

15.   State the conditions necessary for obtaining sharp and steady interference pattern.   **[3]**

16.   Draw neat, labelled diagram of a parallel plate capacitor with a dielectric slab between the plates.   **[3]**

17.   What is gyromagnetic ratio? Write the necessary expression.   **[3]**

18.   What is photoelectric effect?   **[3]**
Define:

 i. Stopping potential

 ii. Photoelectric work function.

19.   Explain how a moving coil galvanometer can be converted into voltmeter.   **[3]**

20.   Express equation of one dimensional simple harmonic progressive wave travelling in the direction of positive X-   **[3]**
axis in 'two' different forms.

21.   Explain, why the equivalent inductance of two coils connected in parallel is less than the inductance of either of   **[3]**

the coils.

22. The equation of simple harmonic progressive wave is given by $y = 0.05 \sin \pi \left[20t - \frac{x}{6} \right]$, where all quantities are in S. I. units. Calculate the displacement of a particle at 5 m from origin and at the instant 0.1 second. **[3]**

23. In a biprism experiment the slit is illuminated by a light of wavelength 4800 A.U. The distance between slit and biprism is 20 cm and the distance between biprism and eye piece is 80 cm. If the distance between virtual sources is 3 mm, determine the distance between the 5th bright band on side of the central band and 5th dark band on other side. **[3]**

24. A coil has **n** turns, each of cross-sectional area $1.6 \ cm^2$. The axis of the coil is kept inclined at $30°$ with the direction of uniform magnetic field of induction $2 \ N/Am$. The torque of 0.02 Nm is experienced by the coil, when a current of 1.25 A flows through each turn. Calculate n. **[3]**

25. An alternating voltage is given by $e = 8 \sin 628.4t$. Find **[3]**
    i. peak value of e.m.f.
    ii. frequency of e.m.f.
    iii. instantaneous value of e.m.f. at time $t = 10 \ ms$.

26. Calculate the wavelength of the first two lines in Balmer series of hydrogen atom. **[3]**

Section D

Attempt any 3 questions

27. Define surface energy of the liquid. Obtain the relation between the surface energy and surface tension. **[4]**

28. **Answer the following questions:** **[4]**
    (a) Distinguish between step-up and step-down transformer. **[2]**
    (b) An aircraft of wing span of 60 m flies horizontally in earth's magnetic field of $6 \times 10^{-5} \ T$ at a speed of $500 \ m/s$. Calculate the e.m.f. induced between the tips of wings of aircraft. **[2]**

29. **Answer the following questions:** **[4]**
    (a) What is a thermodynamic process? Give any two types of it. **[2]**
    (b) 104 J of work is done on certain volume of a gas. If the gas releases 125 kJ of heat, calculate the change in internal energy of the gas. **[2]**

30. **Answer:** **[4]**
    (a) What is perfectly blackbody? Explain Ferry's blackbody. **[2]**
    (b) Calculate the kinetic energy of 10 grams of Argon molecules at $127°C$. **[2]**
    [Universal gas constant R = 8320 J/k mole K, Atomic weight of Argon = 40]

31. In a conical pendulum, a string of length 120 cm is fixed at rigid support and carries a mass of 150 g at its free end. If the mass is revolved in a horizontal circle of radius 0.2 m around a vertical axis, calculate tension in the string. $\left(g = 9.8 \ m/s^2 \right)$ **[4]**