

# Preliminary Examination (2021-2022)

Std. - XII

Sub. - Physics

Time - 3 hrs.

Marks - 70

Instructions:

The question paper is divided into 4 sections

- 1) Section A : Q. 1 contains 10 multiple choice type questions carrying one mark each. Q. 2 contains 8 very short answer type questions carrying one mark each
- 2) Section B : Q. no. 3 to Q. no. 14 contains twelve short answer type of questions carrying two marks each. (Attempt any eight)
- 3) Section C : Q. no. 15 to Q. no. 26 contains 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 shall be given if ONLY the correct answer or alphabet of correct answer is written. Only the first attempt will be considered for evaluation.
- 8) Physical constants : (i)  $R = 8.319$  SI units (ii)  $\mu_0 = 4\pi \times 10^{-7} \text{ Wb/Am}$   
(iii)  $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9$  SI units (iv)  $g = 9.8 \text{ m/s}^2$  (v)  $h = 6.626 \times 10^{-34} \text{ Js}$   
(vi)  $C = 3 \times 10^8 \text{ m/s}$  (vii)  $1 \text{ u} = 1.66 \times 10^{-27} \text{ kg}$  (viii)  $K_B = 1.38 \times 10^{-23} \text{ J/K}$

## Section A

Q.1 Select and write correct answer for the following multiple choice type questions.

- i) The coefficient of viscosity of liquid ---- (10)
  - a) increases with increase in temperature
  - b) decreases with increase in temperature
  - c) remains same at different temperatures
  - d) decreases with decrease in temperature
- ii) ---- is diathermanous substance.
  - a) Iron
  - b) Benzene
  - c) Wood
  - d) Oxygen
- iii) Mathematical equation for the first law of thermodynamics is ----
  - a)  $Q = \Delta U + W$
  - b)  $W = Q + \Delta U$
  - c)  $\Delta U = Q + W$
  - d)  $W = Pdv$
- iv) In the third harmonic of vibrations of air column in a pipe closed at one end, ---- nodes and ---- antinodes are formed.
  - a) 2, 3
  - b) 2, 2
  - c) 3, 2
  - d) 3, 3

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- v) ----- is the path difference for destructive interference of light.  
 a)  $n\lambda$                       b)  $n(\lambda + 1)$                       c)  $(2n + 1)\lambda/2$                       d)  $(n + 1)\lambda/2$
- vi) The rms value of current is related to peak value of current by the equation -----  
 a)  $I_{rms} = 0.707 I_0$                       b)  $I_{rms} = \sqrt{2} I_0$                       c)  $I_{rms} = \frac{I_0}{0.707}$                       d)  $I_0 = \frac{I_{rms}}{\sqrt{2}}$
- vii) De-Broglie wavelength of matter wave is -----  
 a)  $\lambda = hmV$                       b)  $\lambda = \frac{h}{mV}$                       c)  $\lambda = \frac{mV}{h}$                       d)  $\lambda = hv_0$
- viii) A spring has force constant 5 N/m. What is the period of oscillation of mass 0.2 kg is attached to the spring ?  
 a)  $0.04 \pi s$                       b)  $0.4 \pi s$                       c)  $4 \pi s$                       d)  $40 \pi s$
- ix) In Young's double slit experiment, if  $I_0$  is the maximum intensity, then the intensity at a point on the screen having path difference  $\lambda/6$  is -----  
 a)  $\frac{3}{4} I_0$                       b)  $\frac{1}{2} I_0$                       c)  $\frac{1}{\sqrt{2}} I_0$                       d)  $\frac{\sqrt{3}}{2} I_0$
- x) In a transistor  $\beta = 50$  and  $I_B = 20 \mu A$ , then  $I_E$  is -----  
 a)  $1.02 \mu A$                       b)  $1.02 mA$                       c)  $10.2 \mu A$                       d)  $10.2 mA$

Q.2 Answer the following questions.

(8)

- State the mathematical expression for theorem of parallel axes in case of moment of inertia and the terms involved in it.
- Define surface tension.
- What is meant by closed system in thermodynamics.
- If pendulum of clock is taken on mountain top, does it loose or gain in time ?
- Name any two domestic devices which run directly on AC.
- Why is a 'NOT' gate known as an inverter ?
- A circular coil of conducting wire has 500 turns and an area of  $1.2 \times 10^{-4} m^2$  is enclosed by coil. A current of  $100 \mu A$  is passed through coil. What is magnetic moment of coil ?
- In hydrogen atom the energy of electron in ground state is  $-13.6 eV$ . What is the energy of  $4^{th}$  excited state ?

**Section B**

Attempt any eight of the following questions

(16)

- Q.3 Show graphically distribution of radiant power of black body at different temperature.

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- Q.4 With P-V diagram explain cyclic process in thermodynamics.
- Q.5 What is magnetization ? What is gyromagnetic ratio ?
- Q.6 Draw schematic diagram of moving coil galvanometer.
- Q.7 What are coherent sources ? State methods to obtain coherent sources.
- Q.8 State Lenz's law. Write mathematical expression for Faraday's law of electromagnetic induction incorporate with Lenz's law.
- Q.9 In AC circuit, with pure capacitor only, show that alternating current leads the alternating emf.
- Q.10 The radius of racing track is designed to radius of 72 m. The outer surface of track is inclined to an angle of  $78^\circ$  with the horizontal. What is the maximum limit of speed of vehicle on the track ?
- Q.11 What is the excess pressure inside a soap bubble of radius 3 cm, if surface tension of soap solution is 30 dyne/cm ? Write your answer in SI units.
- Q.12 The displacements of two sinusoidal waves travelling through the string are  $y_1 = 10^{-6}(50t + \frac{x}{20} + 0.5)$  and  $y_2 = 10^{-6}(50t + \frac{x}{20} + \frac{\pi}{2})$  x and y are in meter and t is in second. Calculate phase difference between these two waves.
- Q.13 What shunt resistance is required to convert 20  $\Omega$  galvanometer into an ammeter with range 0 to 50 mA, if 1.0 mA is full scale deflection current of galvanometer.
- Q.14 Calculate threshold wavelength for metal, if its work function is 5 eV.

Section C

Attempt any eight of the following questions

(24)

- Q.15 State Einstein's photoelectric equation. Explain characteristics of photoelectric effect, on the basis of Einstein's equation, regarding  
(i) dependency of photocurrent  
(ii) dependency of kinetic energy of photoelectrons.
- Q.16 Explain half wave rectifier with neat circuit diagram.
- Q.17 Derive an expression for capacitance of parallel plate capacitor without dielectric.
- Q.18 Derive an expression for terminal velocity of a small spherical body falling through a viscous fluid.
- Q.19 Explain composition of two S.H.M.s having same period, along the same path, and hence derive an expression for amplitude of resultant S.H.M.
- Q.20 Obtain an expression for path difference between the two waves reaching at a point on the screen in double slit experiment.

100 cm = 1m



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- Q.21 Show that orbital magnetic moment of electron is  $\frac{eVr}{2}$  and also state its relation with angular momentum of electron
- Q.22 Two tuning forks having frequencies 320 Hz and 340 Hz are sounded together to produce sound waves, of wavelengths differ by 6 cm in a medium. Find velocity of sound waves in that medium.
- Q.23 A solenoid of length 25 cm has inner radius of 1 cm and is made up of 200 turns of copper wire. For a current of 3 A in it, find magnitude of magnetic field inside the solenoid.
- Q.24 One mole of an ideal gas is initially kept in a cylinder with movable, frictionless and massless piston at a pressure  $2 \times 10^6$  Pa and temperature  $47^\circ\text{C}$ . It is then expanded till its volume becomes 3 times initial volume. How much work is done, if expansion is isobaric?
- Q.25 An inductor of inductance of 100 mH is connected to an AC source of peak emf 200 V and frequency 50 Hz. Calculate peak current and instantaneous voltage when the current is peak.
- Q.26
- A horizontal line with three points labeled O, P, and Q from left to right. Below the line, a double-headed arrow spans the distance from O to P, labeled '10 m'. Another double-headed arrow spans the distance from P to Q, labeled '6 m'.
- The charges are  $9 \mu\text{C}$ ,  $2 \mu\text{C}$  and  $2 \mu\text{C}$  at the points O, P and Q respectively. Calculate the electrostatic potential energy of this system of charges.

Section D

Attempt any three of the following questions

(12)

- Q.27 Obtain the relation between torque and moment of inertia.
- Q.28 Define (i) Coefficient of reflection (ii) coefficient of emission  
Find rms speed of helium atom at  $27^\circ\text{C}$ , if the mass of the atom is 4 u.
- Q.29 Obtain the balanced condition for Wheatstone's network, by using Kirchhoff's laws.  
State any two advantages of potentiometer over voltmeter.
- Q.30 Explain transformer and obtain its turn ratio.  
The primary and secondary coil of transformer, each having inductance 200 mH. The mutual inductance between windings is  $4 \times 10^{-6}$  H. What percentage of the flux from one coil reaches the other coil?
- Q.31 Derive Rydberg's formula for wavelength of spectral line in hydrogen spectrum.  
Calculate wavelength of 'second line' in Paschen series of hydrogen atom.  
[ $R = 1.097 \times 10^7 \text{ m}^{-1}$ ]