



BOARD QUESTION PAPER : JULY 2024

PHYSICS

Time: 3 Hrs.

Max. 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 multiple choice type questions, only the first attempt will be consider for evaluation.
- (8) **Physical Constants:**
 - (i) $g = 9.8 \text{ m/s}^2$
 - (ii) $\pi = 3.142$
 - (iii) $\mu_0 = 4\pi \times 10^{-7} \text{ Wb/Am}$
 - (iv) $e = 1.6 \times 10^{-19} \text{ C}$

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

- i. Atoms having the same number of protons but different number of neutrons are called _____.
(A) isotopes (B) isobars
(C) isotones (D) isomers
- ii. The molecules on the surface of liquid have _____.
(A) minimum kinetic energy. (B) minimum potential energy.
(C) maximum kinetic energy. (D) maximum potential energy.
- iii. If coefficient of emission is 'e' for a perfectly black body and coefficient of transmission is 't' then _____.
(A) $e = 0, t = 1$ (B) $e = 1, t = 1$
(C) $e = 0, t = 0$ (D) $e = 1, t = 0$
- iv. An LED emits light when its _____.
(A) junction is reverse biased. (B) depletion region widens.
(C) holes and electrons recombine. (D) junction becomes hot.
- v. An electron, a proton, an α -particle and a hydrogen atom are moving with the same kinetic energy. The associated de Broglie wavelength will be the longest for _____.
(A) electron (B) proton
(C) α -particle (D) hydrogen atom
- vi. Cyclotron is used to accelerate _____.
(A) neutral particles (B) negatively charged particles
(C) positively charged particles (D) all types of particles
- vii. The unit henry is equal to _____.
(A) watt (B) ohm-second
(C) dyne (D) Wb/m^2



- viii. The ratio of emissive power of a perfect black body at 927°C and 327°C is _____.
(A) 2 : 1 (B) 4 : 1
(C) 8 : 1 (D) 16 : 1
- ix. In a series LCR circuit the phase difference between the voltage and the current is 45° . Then the power factor will be _____.
(A) 0.6071 (B) 0.7071
(C) 0.8081 (D) 1.0
- x. When an air column in a pipe closed at one end vibrates such that two nodes are formed in it, the frequency of its vibration is _____.
(A) two times the fundamental frequency
(B) three times the fundamental frequency
(C) four times the fundamental frequency
(D) five times the fundamental frequency

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

- i. What is the radius of gyration of a solid sphere of radius R about its diameter?
- ii. Write the differential equation for linear S.H.M.
- iii. State any one method of polarization of light.
- iv. What is the resistance of an ideal voltmeter?
- v. What are eddy currents?
- vi. What do you mean by logic gate?
- vii. A body of mass 0.2 kg performs linear S.H.M. It experiences a restoring force of 0.4 N when its displacement from the mean position is 8 cm . Determine force constant.
- viii. Determine the work done in bringing a charge of $5\text{ }\mu\text{C}$ from infinity to the point A. The potential at point A is 400 kV .

SECTION – B**Attempt any EIGHT questions of the following:****[16]**

- Q.3.** Show that average energy per molecule is directly proportional to the absolute temperature ' T ' of the gas.
- Q.4.** Explain cyclic process with the help of neat and labelled p-V diagram.
- Q.5.** Distinguish between progressive waves and stationary waves.
- Q.6.** Explain Biot and Savart's law with suitable diagram.
- Q.7.** Draw a neat and labelled diagram of van de Graaf generator.
- Q.8.** State the formula for the following:
(i) Average power in LCR circuit
(ii) Q-factor
- Q.9.** Explain the working of a transformer with a neat, labelled diagram.
- Q.10.** A galvanometer has a resistance of $100\text{ }\Omega$ and its full scale deflection current is 0.2 mA , what resistance should be added to it to have a range of $0\text{--}10\text{ V}$?
- Q.11.** An electron in hydrogen atom-stays in its second orbit for 10^{-8} s . How many revolutions will it make around the nucleus in that time?
[Velocity of electron in second orbit = $1.07 \times 10^6\text{ m/s}$, radius of electron in second orbit = $2.14 \times 10^{-10}\text{ m}$]



- Q.12.** A torque of magnitude 400 Nm acting on a body of mass 40 kg produces an angular acceleration of 20 rad/s^2 . Calculate the moment of inertia of the body.
- Q.13.** A bar magnet of moment of inertia of 500 gcm^2 oscillates with a time period of 3.142 seconds in a horizontal plane. What is its magnetic moment if the horizontal component of earth's magnetic field is $4 \times 10^{-5} \text{ T}$?
- Q.14.** A telescope has an objective of diameter 2.5 m. What is its angular resolution when observed at 7500 Å ?

SECTION – C

Attempt any **EIGHT** questions of the following:

[24]

- Q.15.** Define surface tension. Obtain the relation between surface tension and surface energy.
- Q.16.** Show that all harmonics are present in case of a stretched string.
- Q.17.** Derive an expression for the impedance of a series LCR circuit connected to an AC power supply.
- Q.18.** What is Curie temperature? Distinguish between diamagnetic and paramagnetic substances.
- Q.19.** Obtain the balancing conditions in case of Wheatstone's bridge.
- Q.20.** What is ionization energy? Assuming expression for energy of electron, derive an expression for wavelength of spectral lines in hydrogen atom.
- Q.21.** What is voltage regulation? Explain the working of Zener diode as a voltage regulator.
- Q.22.** A spherical drop of oil falls at a constant speed of 9.8 cm/s in steady air. Calculate the radius of the drop. The density of oil is 0.9013 g/cm^3 , density of air is 0.0013 g/cm^3 and the coefficient of viscosity of air is $1.8 \times 10^{-4} \text{ poise}$.
- Q.23.** A search coil having 2000 turns with area 1.5 cm^2 is placed in a magnetic field of 0.6 T . The coil is moved rapidly out of the field in a time of 0.2 second . Calculate the induced emf across the search coil.
- Q.24.** At what distance from the mean position is the kinetic energy of a particle performing S.H.M. of amplitude 10 cm , three times its potential energy?
- Q.25.** When 2×10^{10} electrons are transferred from one conductor to another, a potential difference of 20 V appears between the conductors. Find the capacitance of the two conductors.
- Q.26.** The magnetic field at the centre of a circular current carrying loop of radius 12 cm is $6 \times 10^{-6} \text{ T}$. What will be the magnetic moment of the loop?

SECTION – D

Attempt any **THREE** questions of the following:

[12]

- Q.27.** Derive an expression for minimum speed to perform stunts in well of death.
Part of a racing track is to be designed for a radius of curvature of 288 m . We are not recommending the vehicles to drive faster than 216 km/hr . With what angle should the road be tilted?
- Q.28.** Explain the concept of positive and negative work with varying pressure. Draw corresponding p-V diagrams.
- Q.29.** Deduce an expression for molar specific heat of a monoatomic gas at constant volume.
Find kinetic energy of 4000 cc of a gas at S.T.P.
[Given: Standard pressure is $1.013 \times 10^5 \text{ N/m}^2$]
- Q.30.** What is photoelectric effect?
Describe with neat circuit diagrams an experimental setup of photoelectric effect.
- Q.31.** Derive the formula for Brewster's angle.
Green light of wavelength 5100 Å from a narrow slit is incident on a double slit. If the overall separation of 10 fringes on a screen 2 m away is 2 cm . Find the slit separation.