

Page No. 1/7

Subject Code **J-229**

Seat No.

--	--	--	--	--	--	--

DATE : 19/06/2026

SUBJECT : PHYSICS (54)

E

Time : 11.00 - 2.00

DURATION : 3 Hours

TOTAL PAGES : 7

TOTAL MARKS : 70

General Instructions :

The question paper is divided into four sections :

- (i) 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.
- (ii) Section B : Q. No. 3 to Q. No. 14 contain Twelve short answer type of questions carrying Two marks each. (Attempt any Eight).
- (iii) Section C : Q. No. 15 to Q. No. 26 contain Twelve short answer type of questions carrying Three marks each. (Attempt any Eight).
- (iv) Section D : Q. No. 27 to Q. No. 31 contain Five long answer type of questions carrying Four marks each.(Attempt any Three).
- (v) Use of the log table is allowed. Use of the calculator is NOT allowed.
- (vi) Figures to the right indicate full marks.
- (vii) For multiple choice type of questions, only the first attempt will be considered for evaluation.
- (viii) Physical constants : –
 - (1) Velocity of light in air = 3×10^8 m/s
 - (2) Planck's constant = 6.63×10^{-34} Js
 - (3) $\pi = 3.142$
 - (4) $\mu_0 = 4\pi \times 10^{-7}$ Wb/Am
 - (5) $1 \text{ eV} = 1.6 \times 10^{-19}$ J
 - (6) $\epsilon_0 = 8.85 \times 10^{-12}$ C²/Nm²
 - (7) Rydberg's constant = 1.097×10^7 per meter.

End of Page 1 (P.T.O.)

SECTION – A

Q. 1. Select and write the correct answers for the following multiple choice type of questions :

10

(i) The MI of ring of radius ' R ' and mass ' M ' about its central axis is _____

(a) $2 MR^2$

(b) $\frac{MR^2}{2}$

(c) MR^2

(d) $\frac{3}{2}MR^2$

(ii) For a monoatomic gas enclosed in a container at a constant temperature has degrees of freedom

(a) 5

(b) 3

(c) 7

(d) 4

(iii) The equation of the first law of thermodynamics for isochoric process is

(a) $Q = \Delta U$

(b) $Q = 0$

(c) $Q = \Delta U + W$

(d) $Q = \Delta U - W$

(iv) Cyclotron can not accelerate _____

(a) protons

(b) α -particles

(c) neutrons

(d) deuterons

(v) In a purely inductive and capacitive circuit, power factor is, _____

(a) one

(b) zero

(c) infinity

(d) 10

(vi) The Boolean equation for NOR gate is

(a) $Y = A \cdot B$

(b) $Y = A + B$

(c) $Y = \overline{A}$

(d) $Y = \overline{A + B}$

--	--	--	--	--	--	--

- (vii) When n number of capacitors having each of capacity ' C ' are connected in series, their equivalent capacity is
- (a) $\frac{1}{C}$ (b) nC
- (c) $\frac{C}{n}$ (d) $\frac{1}{nC}$
- (viii) A polarising angle for an optical material is 35° . Then refractive index of the material is
- (a) 0.647 (b) 0.7002
- (c) 0.7265 (d) 0.7133
- (ix) For a streamline flow, the relative velocity between the two liquid layers is 10 cm/s. The distance between them is 5 cm. The velocity gradient is
- (a) 3 S^{-1} (b) 5 S^{-1}
- (c) 4 S^{-1} (d) 2 S^{-1}
- (x) The wavelength of a stationary wave on a string is 0.75 m with frequency of 64 Hz. Then, the velocity of wave is
- (a) 48 m/s (b) 50 m/s
- (c) 64 m/s (d) 60 m/s

Q. 2. Answer the following questions :

8

- (i) Absorption of ink by a blotting paper is an example of which phenomenon of fluids?
- (ii) State Kirchhoff's first law for electrical network.
- (iii) Define 'photoelectric work function.'
- (iv) Which series of spectral lines belongs to the ultraviolet region of the hydrogen spectrum?

- (v) Which semiconductor device converts solar energy into electrical energy?
- (vi) Define the term wavefront.
- (vii) A motorcyclist performs horizontal circular motion inside a well of inner radius 3 m. Calculate the minimum speed to perform the stunt if coefficient of static friction is 0.3.
[$g = 10 \text{ m/s}^2$].
- (viii) Calculate the maximum velocity of a particle having amplitude of oscillation 4 cm and period 4 seconds.
-

SECTION – B

Attempt any EIGHT questions from the following :

16

- Q. 3.** Obtain an expression for the maximum speed of a vehicle along horizontal circular curved road.
- Q. 4.** For a thermodynamic system :
- Define : (a) Mechanical equilibrium
(b) Chemical equilibrium
- Q. 5.** What are polar molecules and non polar molecules?
- Q. 6.** Explain how will you convert moving coil galvanometer into voltmeter?
- Q. 7.** Distinguish between free and forced vibrations.
- Q. 8.** State any two postulates of Bohr's theory of hydrogen atom.
- Q. 9.** Explain the cyclic process with the help of a neat $p - V$ diagram.
- Q. 10.** A star is emitting light at the wavelength of $4000\text{\AA}$. Determine the limit of angular resolution of a telescope having an objective of diameter of 400 cm.

--	--	--	--	--	--	--

- Q. 11.** Calculate the value of $\lambda_{\max}$ for solar radiation assuming the temperature on the surface of the sun is 5800 K.
[Wien's constant = 2.897×10^{-3} m.k.]
- Q. 12.** Calculate the radius of water drop, so that the excess pressure inside it is 24 N/m².
[Surface tension of water = 7.2×10^{-2} N/m]
- Q. 13.** The susceptibility of magnetic material is χ at 27°C. At what temperature its susceptibility will be $\chi/3$?
- Q. 14.** An alternating voltage source given by $e = 140 \sin (314.2 t)$ is connected across a pure resistor of 50 Ω . Determine :
(i) Frequency of the source.
(ii) RMS value of emf.
-

SECTION – C

Attempt any EIGHT questions of the following :

24

- Q. 15.** State and prove perpendicular axes theorem.
- Q. 16.** On the basis of molecular theory, explain the phenomenon of surface tension.
- Q. 17.** Show that all harmonics are present in the case of an air column vibrating in a pipe open at both the ends.
- Q. 18.** What is interference of light? State any four conditions for obtaining well defined and steady interference pattern.
- Q. 19.** With the help of a neat circuit diagram, explain the working of a half wave rectifier. Draw input and output waveforms.

- Q. 20.** Obtain an expression for orbital magnetic moment of an electron revolving around the nucleus of an atom.
- Q. 21.** Define the terms :
- (a) Inductive reactance
 - (b) Capacitive reactance
 - (c) Impedance
- Q. 22.** A parallel plate capacitor filled with air has an area 6 cm^2 and the plate separation is 2 mm. Calculate its capacity.
- Q. 23.** Two resistances X and Y in the two gaps of a meterbridge give a null point dividing the wire in the ratio 4 : 6. If both resistances are increased by 30Ω , the null point divides the wire in the ratio 5 : 6. Calculate the value of X and Y .
- Q. 24.** Calculate the shortest wavelength of Paschen series and the longest wavelength of Balmer series for hydrogen atom.
- Q. 25.** Calculate the current flowing through two long parallel wires carrying equal currents and separated by a distance of 1.35 cm experiencing a force per unit length of $4.76 \times 10^{-2} \text{ N/m}$.
- Q. 26.** An emf of 90 mV is induced in the winding of a coil, when current in a nearby coil is increasing at the rate of 4.5 A/s. What is the mutual inductance of the two coils?

SECTION – D

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

12

- Q. 27.** Derive an expression for pressure exerted by a gas on the basis of kinetic theory of gases.

--	--	--	--	--	--	--

- Q. 28.** State differential equation of linear S.H.M. hence obtain an expression for acceleration, velocity and displacement of a particle performing S.H.M.
- Q. 29.** With the help of neat diagram explain construction of a transformer. Calculate energy required to build up current of 1A in an inductor of inductance 20 mH.
- Q. 30.** Draw a neat schematic diagram of a photo cell.
The photoelectric work function for a metal is 4.2 eV. Find threshold wavelength.
- Q. 31.** Obtain an expression for magnetic induction of a toroid of N no. of turns about an axis passing through its centre and perpendicular to plane.
A Carnot refrigerator operates between 150 K and 200 K, calculate its coefficient of performance.

