Maharashtra Board

Question Paper 2022

Class 12



HSC

QUESTION PAPER

Presented By

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DAY — 06 SEAT NUMBER

2022	III	10	1030	J-737	(E)

PHYSICS (54)

Time : 3 Hrs. (8 Pages) 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.

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(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 ONLY the correct answer or the alphabet of the correct answer is written. Only the first attempt will be considered for evaluation.*

(8) *Physical Constants :*

(i) mass of electron $m = 9.1 \times 10^{-31}$ kg

(ii) $\varepsilon_0 = 8.85 \times 10^{-12} \frac{C^2}{Nm^2}$

(iii) $\pi = 3.142$

(iv) charge on electron $e = 1.6 \times 10^{-19}$ C

(v) $\mu_0 = 4\pi \times 10^{-7}$ Wb / Am

(vi) $h = 6.63 \times 10^{-34}$ Js

(vii) $C = 3 \times 10^8$ m/s

SECTION – A

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

(i) The first law of thermodynamics is concerned with the conservation of _____.

(a) momentum (b) energy

(c) temperature (d) mass

(ii) The average value of alternating current over a full cycle is always _____.

[I_0 = Peak value of current]

(a) zero (b) $\frac{I_0}{2}$

(c) $\frac{I_0}{\sqrt{2}}$ (d) $2 I_0$

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(iii) The angle at which maximum torque is exerted by the external uniform electric field on the electric dipole is _____.

(a) 0^o
(b) 30^o
(c) 45^o
(d) 90^o

(iv) The property of light which does not change, when it travels from one medium to another is _____.

(a) velocity
(b) wavelength
(c) frequency
(d) amplitude

(v) The root mean square speed of the molecules of a gas is proportional to _____.
[T = Absolute temperature of gas]

(a) $\sqrt{T}$
(b) $\frac{1}{\sqrt{T}}$
(c) T
(d) $\frac{1}{T}$

(vi) The unit Wbm^{-2} is equal to _____.

(a) henry
(b) watt
(c) dyne
(d) tesla

(vii) When the bob performs a vertical circular motion and the string rotates in a vertical plane, the difference in the tension in the string at horizontal position and uppermost position is _____.

(a) mg
(b) 2 mg
(c) 3 mg
(d) 6 mg

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(viii) A liquid rises in glass capillary tube upto a height of 2.5 cm at room temperature. If another glass capillary tube having radius half that of the earlier tube is immersed in the same liquid, the rise of liquid in it will be _____.

(a) 1.25 cm (b) 2.5 cm

(c) 5 cm (d) 10 cm

(ix) In young's double slit experiment the two coherent sources have different amplitudes. If the ratio of maximum intensity to minimum intensity is 16:1, then the ratio of amplitudes of the two source will be _____.

(a) 4 : 1 (b) 5 : 3

(c) 1 : 4 (d) 1 : 16

(x) The equation of a simple harmonic progressive wave travelling on a string is $y = 8 \sin (0.02\ x - 4t)$ cm. The speed of the wave is _____.

(a) 10 cm/s (b) 20 cm/s

(c) 100 cm/s (d) 200 cm/s

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

(i) Define potential gradient of the potentiometer wire.

(ii) State the formula for critical velocity in terms of Reynold's number for a flow of a fluid.

(iii) Is it always necessary to use red light to get photoelectric effect?

(iv) Write the Boolean expression for Exclusive – OR (X – OR) gate.

(v) Write the differential equation for angular S.H.M.

(vi) What is the mathematical formula for third postulate of Bohr's atomic model?

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(vii) Two inductor coils with inductance 10 mH and 20 mH are connected in series. What is the resultant inductance of the combination of the two coils?

(viii) Calculate the moment of inertia of a uniform disc of mass 10 kg and radius 60 cm about an axis perpendicular to its length and passing through its centre.

SECTION – B

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

Q. 3. Define moment of inertia of a rotating rigid body. State its SI unit and dimensions.

Q. 4. What are polar dielectrics and non polar dielectrics?

Q. 5. What is a thermodynamic process? Give any two types of it.

Q. 6. Derive an expression for the radius of the n^{th} Bohr orbit of the electron in hydrogen atom.

Q. 7. What are harmonics and overtones (Two points)?

Q. 8. Distinguish between potentiometer and voltmeter.

Q. 9. What are mechanical equilibrium and thermal equilibrium?

Q. 10. An electron in an atom is revolving round the nucleus in a circular orbit of radius 5.3×10^{-11}m with a speed of 3×10^{6} m/s. Find the angular momentum of electron.

Q. 11. Plane wavefront of light of wavelength 6000Å is incident on two slits on a screen perpendicular to the direction of light rays. If the total separation of 10 bright fringes on a screen 2 m away is 2 cm, find the distance between the slits.

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Q. 12. Eight droplets of water each of radius 0.2 mm coalesce into a single drop. Find the decrease in the surface area.

Q. 13. A 0.1 H inductor, a 25×10^{-6} F capacitor and a 15Ω resistor are connected in series to a 120 V, 50 Hz AC source. Calculate the resonant frequency.

Q. 14. The difference between the two molar specific heats of a gas is 9000 J / kg K. If the ratio of the two specific heats is 1.5, calculate the two molar specific heats.

SECTION – C

Attempt any EIGHT questions of the following : **[24]**

Q. 15. With the help of a neat diagram, explain the reflection of light on a plane reflecting surface.

Q. 16. What is magnetization, magnetic intensity and magnetic susceptibility?

Q. 17. Prove that the frequency of beats is equal to the difference between the frequencies of the two sound notes giving rise to beats.

Q. 18. Define :

(a) Inductive reactance

(b) Capacitive reactance

(c) Impedance

Q. 19. Derive an expression for the kinetic energy of a body rotating with a uniform angular speed.

Q. 20. Derive an expression for emf (e) generated in a conductor of length (l) moving in uniform magnetic field (B) with uniform velocity (v) along x-axis.

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Q. 21. Derive an expression for terminal velocity of a spherical object falling under gravity through a viscous medium.

Q. 22. Determine the shortest wavelengths of Balmer and Paschen series. Given the limit for Lyman series is 912 Å.

Q. 23. Calculate the value of magnetic field at a distance of 3 cm from a very long, straight wire carrying a current of 6A.

Q. 24. A parallel plate capacitor filled with air has an area of 6 cm^2 and plate separation of 3 mm. Calculate its capacitance.

Q. 25. An emf of 91 mV is induced in the windings of a coil, when the current in a nearby coil is increasing at the rate of 1.3 A/s, what is the mutual inductance (M) of the two coils in mH?

Q. 26. Two cells of emf 4V and 2V having respective internal resistance of 1Ω and 2Ω are connected in parallel, so as to send current in the same direction through an external resistance of 5Ω. Find the current through the external resistance.

SECTION – D

Attempt any THREE questions of the following : [12]

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

Q. 28. What is a rectifier? With the help of a neat circuit diagram, explain the working of a half wave rectifier.

Q. 29. Draw a neat, labelled diagram of a suspended coil type moving coil galvanometer.

The initial pressure and volume of a gas enclosed in a cylinder are 2×10^5 N/m^2 and 6×10^{-3} m^3 respectively. If the work done in compressing the gas at constant pressure is 150 J, find the final volume of the gas.

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Q. 30. Define second's pendulum. Derive a formula for the length of second's pendulum.

A particle performing linear S.H.M. has maximum velocity 25 cm/s and maximum acceleration 100 cm/s^2. Find period of oscillations.

Q. 31. Explain de Broglie wavelength. Obtain an expression for de Broglie wavelength of wave associated with material particles.

The photoelectric work function for a metal is 4.2 eV. Find the threshold wavelength.

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