PVG's
Muktangan English School & Jr. College, Pune - 9
Preliminary Examination (2024-25)
STD XII

Subject : Physics   Marks - 70
Date : 08.01.2025   Time : - 8.15 - 11.15 am

General Instructions :

The question paper is divided into four sections.

1)   Section A : Q.1 contains 10 multiple choice type questions carrying 1 mark each.

Q.2 contains 8 very short answer type questions carrying 1 mark each.

2)   Section B : Q.3 and Q.14 contains twelve short answer type questions carrying 2 marks each (attempt any eight)

3)   Section C : Q.15 to Q.26 contains twelve short answer type questions carrying 3 marks each (Attempt any eight)

4)   Section D : Q.27 to Q.31 contains five long answer type questions carrying 4 marks each (Attempt any three)

5)   For multiple choice type of question, only first attempt will be considered for evaluation.

6)   Symbols have usual meaning unless and otherwise stated.

7)   Draw the diagrams wherever necessary.

8)   Figures to the right indicate full marks.

9)   Use of log table is allowed. Used of calculator is not allowed.

10) Physical constants:

    i) $g = 9.8$ m/s^2

    ii) $\pi = 3.142$

    iii) $\mu_0 = 4\pi \times 10^{-7}$ wb/Am

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

Section A

Q.1   Select and write the most appropriate answer from the given alternatives for each sub-question.   (10)

   i)   Surface tension of a liquid is numerically equal to _____

         a) surface energy   b) surface energy per unit length

         c) surface energy per unit area   d) surface energy per unit volume

   ii)   Total dgrees of freedom of one rigid molecule of a diatomic gas at normal temperature is _____

         a) 5   b) 3

         c) 7   d) 4

iii) The superposition takes place between two waves of frequency f and amplitude A. The total intensity is directly proportional to _____

    a) A   b) 2A

    c) $2A^2$ d) $4A^2$

iv) Electric field of an isolated charged metallic sphere at any interior point is _____

    a) zero   b) one

    c) proportional to field   d) infinite

v) The law of conservation of energy holds for _____

    a) Ohm's Law   b) Kirchhoff's Current Law

    c) Wien's Law   d) Kirchhoff's Voltage Law

vi) Soft iron is used to make the core of transformer because of its _____

    a) low coercivity & low retentivity   b) low coercitvity & high retentivity

    c) high coercitvity & high retentivity   d) high coercitvity & low retentivity

vii) _____of a nucleus does not depend on its atomic number.

    a) radius   b) mass

    c) volume   d) density

viii) For a rolling hollow sphere, ratio of translational KE : rotational KE : total KE is _____

    a) 3: 2:5   b) 1: 2:5

    c) zero   d) 5: 3: 2

ix) Two capillary tubes of radii 0.3 cm and 0.6 cm are dipped in the same liquid. The ratio of heights through which the liquid will rise in the tubes is _____

    a) 1: 2   b) 2:1

    c) 1:4   d) 4:1

x) A gas in a closed container is heated with 10J of energy causing the liquid of the container to rise 2m with 3 N of force. Then total change in the internal energy of the system will be _____.

    a) -4J   b) -10J

    c) 4J   d) 10 J

Q.2   Answer the following questions.   **(8)**

i) Write equation for the Lorentz' force.

ii) Draw a symbol of light emitting diode.

iii) State Faraday's first law of electromagnetic induction.p

iv) What is the value of average power over one complete cycle of AC through an ideal inductor.

v) Right Boolen equation of NOR gate.

vi) Write the formula for efficiency of Carnot engine.

vii) A motor cyclist (to be treated as point mass) is to undertake horizontal circles inside the cylindrical wall of a well of inner radius 4 m. Coefficient of static friction between the tyres and the wall is 0.4. Calculate the minimum speed to perform this stunt.

viii) A circular coil of conducting wire has 500 turns and an area 1.26×10^{-4} m^2 is enclosed by the coil : A current 100 μA is passed through the coil. Calculate the magnetic moment of the coil.

Section B

Attempt any eight questions **(16)**

Q.3 Write uses of potentiometer (Any 2)

Q.4 State two applications of Bernoulli's equations.

Q.5 Differentiate between centripetal force and centrifugal force (Any 2 points)

Q.6 Define mechanical equillibrium and chemical equillibrium

Q.7 Draw and label Vande Graff generator.

Q.8 Using cyclotron formula derive equation of frequency of Cyclotron.

Q.9 Derive an expression for radius of Bohr's orbit.

Q.10 Calculate the vale of λmax for solar radiation assuming that surface temperature of the sun is 5800 K (b = 2.897×10^{-3} mK).In which part of the electromagnetic spectrum, does this value lie?

Q.11 The total energy of a particle of mass 200 g, performing SHM is 10^{-2} J. Find its maximum velocity.

Q.12 Write the equation of a simple harmonic progressive wave of amplitude 0.02m and period 0.04 s travelling along the positive X-axis with velocity 12.5 m/s.

Q.13 A capcitor of capacitance 0.5 μF is connected to a source of alternating emf of frequency 100 Hz . What is the capacitive reactance? (π = 3.142)

Q.14 What is the de Broglie wavelength of an electron accelarated through 2500 volt?

Section C

Attempt any eight questions: **(24)**

Q.15 Derive an expression for time period of a conical pendulum.

Q.16 Show that all harmonics are present as overtones in the modes of vibrations of air column open at both ends (Draw diagrams)

Q.17 With the help of a neat ray diagram, explain laws of reflection on the basis of Huygen's wave theory of light.

Q.18 What are i) isotopes ii) isobars and iii) isotones.

Q.19 Draw a neat labelled circuit diagram of transistor in common emitter configuration. And write the relation (equation) between α & β.

Q.20 Explain thermodynamics of Isothermal process. (Draw necessary P-V diagram)

Q.21 Show that electrical potential energy (U) of the capacitor is, $U = (1/2)(Q^2/C)$

Q.22 A capillary tube of radius 0.5 mm is dipped vertically in a liquid of surface tension 0.04 N/m and relative density 0.8 g/cc. Calculate the height of capillary rise if the angle of contact is 10. (g= 9.8m/s^2)

Q.23 At what distance (x) from the mean position is the K.E of a particle performing SHM of amplitute 8 cm, three times its PE ?

Q.24 A galvanometer with a coil of resistance 40 Ω gives a full scale deflection for a current of 5 mA. How will you convert it into an ammeter of range 0-5 A?

Q.25 A coil of self inductance 5H is connected in series with a switch and a battery. After the switch is closed the steady state value of the current is 5A. The switch is then suddenly opened, causing the current to drop to zero in 0.2s. Find the emf developed across the inductance as the switch is opened.

Q.26 In nuclear reactor neutrons travel with energies of 5 x 10^{-21}J. Find their speed and wavelength. (given : m_n=1.67x 10^{-27}kg)

Section D

Attempt any three questions (12)

Q.27 What is transformer? Explain its construction and working. Derive transformer equation.

Q.28 With the help of a neat ray diagram, derive an expression for path difference in case of a double slit experiment.

Q.29 i) State the formulae for the following.

    a) average power in LCR circuit

    b) Q- Factor

    ii) A 100 mH inductor, a 25 μF capacitor and 15 Ω resistor are connected in series to 120 V, 50 Hz AC source. Calculate impedance of the circuit at resonance.

Q.30 i) Draw a neat labelled diagram of Ferry's Black Body.

    ii) At 300 K what is the rms speed of He-atom?
(Given : mass of He-atom = 6.64x10^{-27} kg, K_B = 1.38 x 10^{-23} J/K)

Q.31) i) Derive the expression for time period of angular oscillations of the bar magnet.

    ii) Calculate the gyromagnetic ratio of electron.
(Given : e=1.6x10^{-19}C, M_e=9.1x10^{-31}kg)

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