First Preliminary Exam - 2022 Time : **3.00** Hrs.

Std. : **XII (Sci.)** Sub. : **Physics** Marks : **70**

General Instructions :

(1) The question paper is divided into four sections.

(i) **Section A :** Q.No. 1 contains 10 multiple choice questions carrying 1 mark each.
Q.No. 2 contains 8 very short answer type of questions carrying 1 mark each.

(ii) **Section B :** Q.No. 3 to 14 contains 12 short answer type questions carrying 2 marks each.

(iii) **Section C :** Q.No. 15 to 26 contains 12 short answer type questions carrying 3 marks each.

(iv) **Section D :** Q.No.27 to 31 contains 5 long answer type questions carrying 4 marks each.

(2) Use of log table is allowed. Use of calculator is not allowed.

(3) Figures to the right indicate full marks.

(4) For each MCQ's correct answer must be written along with its alphabets. i.e. (a) ..... / (b) ..... / (c) ..... / (d) ..... etc. only first attempt will be considered for evaluation.

Section - A

Q. 1 Select and write the correct answer. **(10)**

(1) As the electron revolves in the second Bohr orbit of the hydrogen atom, the corresponding current is (about) 1.3×10^{-4}A. If the area of the orbit is (about) 1.4×10^{-19} m^2, what is the (approximate) equivalent magnetic moment ?

(a) 1.82×10^{-23} Am^2 (b) 1.82×10^{-15} A–m^2

(c) 2.82×10^{-23} Am^2 (d) 2.82×10^{-15} A–m^2

(2) In a common-base configuration the transistor has an emitter current of 10 mA and collector current of 9.8 mA; the value of the base current is

(a) 0.1 mA (b) 0.2 mA

(c) 0.3 mA (d) 0.4 mA

(1) .....

(3) The relation between relative permeability and magnetic susceptibility is given by

(a) $\chi_m = \mu_r + 1$ (b) $\chi_m = -\mu_r + 1$

(c) $\mu_r = 1 - \chi_m$ (d) $\mu_r = 1 + \chi_m$

(4) The internal energy of one mole of argon at 300 K is ..... . (R = 8.314 J/mol.K)

(a) 3541 J (b) 3741 J (c) 3941 J (d) 4041 J

(5) The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom is ..... .

(a) 1:1 (b) 1:−1 (c) 2:−1 (d) 1:−2

(6) In series LCR circuit, at resonance, phase difference between current and emf of source is ..... .

(a) πrad (b) $\frac{\pi}{2}$rad (c) $\frac{\pi}{4}$rad (d) zero rad

(7) Henry is equivalent to

(a) ampere/second (b) ampere-second

(c) ohm/second (d) ohm-second

(8) For polyatomic molecule having 'F' vibrational modes, the ratio of two specific heats, $\frac{C_p}{C_v}$ is,

(a) $\frac{1+F}{2+F}$ (b) $\frac{2+F}{3+F}$ (c) $\frac{4+F}{3+F}$ (d) $\frac{5+F}{4+F}$

(9) The magnitude of centripetal force cannot be expressed as ..... .

(a) $mr\omega^2$ (b) $\frac{4\pi^2 mr}{T^2}$ (c) $mv\omega$ (d) mv/ω

(10) In which of the following substance, surface tension increases with increase in temperature?

(a) Copper (b) Molton copper

(c) Iron (d) Molton iron

Q.2 Answer the following. (8)

(i) A metal rod of resistance of 15Ω is moved to the right at a constant speed of 60 cm/s along two parallel conducting rails 2 cm apart and shorted at one end. A magnetic field of magnitude 0.35 T points into the page. Calculate the induced emf.

(ii) The maximum velocity of a particle performing SHM is 6.28 cm/s. If the length of its path is 8 cm, calculate the period.

(iii) A gate has following truth table. State the name of the gate.

P	Q	Y
0	0	0
1	0	0
0	1	0
1	1	1

(iv) What is Lorentz force ?

(v) What is meant by fluid ?

(vi) How is the heat defined ?

(vii) Define the diathermanous substance.

(viii) In relation $I = MK^2$, K stands for what ?

Section - B

Attempt any EIGHT of the following. (16)

Q. 3 Explain Thomson's model of atom.

Q. 4 State Faraday's law of electromagnetic induction.

Q. 5 A drop of water of radius 6 mm breaks into number of droplets each of radius 1 mm. How many droplets will be formed ?

Q. 6 The peak value of AC through a registor of 100Ω is 2A. If the frequency of AC is 50 Hz, find the heat produced in the resistor in one cycle.

Q. 7 Define end correction. State any two limitations of end correction.

Q. 8 If the total energy of radiation of frequency 10^{14} Hz is 6.63 J, calculate the number of photons in the radiation.

Q. 9 Compare the rate of emission of heat by a black body at 327°C with the rate of emission of heat of same body at 27°C.

Q. 10 Find the angular speed of revolution of earth required so that the body on its surface, at equator would feel no weight. (R = 6400 km, g = 9.8 m/s^2)

Q. 11 Draw a neat labelled diagram to determine the resistance of a galvanometer by using a meter bridge.

Q. 12 Magnetic fields lines can be entirely confined within the core of a toroid, but not within a straight solenoid. Why ?

Q. 13 When water boils, why does its temperature remains constant ?

Q. 14 State Gauss's law what is a Guassian surface ?

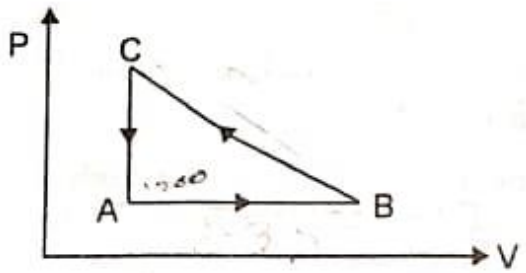
Section - C

Attempt any EIGHT of the following. (24)

Q. 15 What is transformer ? Explain step up and step down transformer.

Q. 16 Find the shortest wavelength in Paschen series if the longest wavelength in Balmer series is 6563 Å.

Q. 17 Consider the cyclic process ABCA on a sample of 2.0 mol of an ideal gas as shown in following figure, the temperatures of the gas at A and B are 300 K and 500 K respectively. A total of 1200 J heat is withdrawn from the sample in the process. Find the workdone by the gas in part BC. Take R = 8.3 J/mol-K.



Q. 18 A circular loop of radius 9.7 cm carries a current 2.3 A. Obtain the magnetic field

(a) at the centre of the loop and

(b) at a distance of 9.7 cm from the centre of the loop but on the axis.

Q. 19 Explain the phenomenon of surface tension on the basis of molecular theory.

Q. 20 In an interference experiment with the distance between the slit and the screen is 1 m and the separation between the two virtual images of the slit as 0.5 cm, an

interference pattern is obtained with a light of wavelength 3500 Å. Find the distance between 5th and 10th bright bands on the same side of central bright band.

Q. 21 When a plate of magnetic material of size 10 cm × 0.5 cm × 0.2 cm (length, breadth and thickness respectively) is located in 'magnetising field of 0.5×10^4 Am^{-1} then magnetic moment of 5 Am^2 is induced in it. Find out magnetic induction in rod.

Q. 22 What is a junction transistor ? What are its two types ? Draw circuit symbols of each transistors.

Q. 23 Obtain an expression relating the torque with angular acceleration for a rigid body.

Q. 24 Show that in an AC circuit containing a pure inductor the voltage is ahead of current by $\frac{\pi}{2}$ rad in phase.

Q. 25 With a neat labelled diagram describe the apparatus to study the characteristics of photoelectric effect.

Q. 26 Prove the relation between pressure of the gas and speed of its molecules.

Section - D

Attempt any THREE of the following. (12)

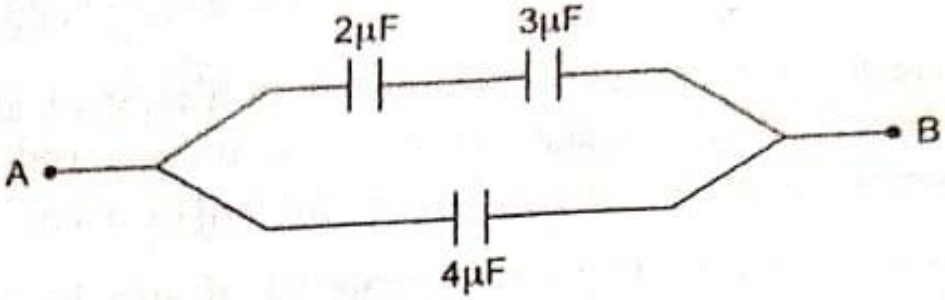
Q. 27 What are harmonics and overtones ?

A steel wire has a length of 12.0 m and a mass of 2.10 kg. What should be the tension in the wire so that speed of a transverse wave on the wire equals the speed of sound in dry air ? *(Speed of sound at 20°C = 343 m/s)*

Q. 28 Define ideal simple pendulum. Deduce an expression for period of simple pendulum. Hence state the factors on which its period depends.

Q. 29 What is a dielectric ? State its two types. Give two examples in each case.

Three capacitors are connected as shown in the figure below.



Calculate the effective capacitance between A and B.

Q. 30 What is meant by coherent sources ? Explain the two methods for obtaining coherent sources in the laboratory.

Q. 31 How do you calculate the shunt required to increase the range and times ?

A galvanometer carries as maximum current of 15 mA, when a voltage of 75 mV is applied to it. How to convert this into a voltmeter to read upto 150 volt and into an ammeter to read upto 25 A ?

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