KATHMANDU

DON BOSCO COLLEGE

1st Terminal Examinations - 2061

Class: XII **Subject: Physics** **F.M: 75**
Time: 3 Hrs **P.M: 30**

(Answers to the numerical problems should be in SI units.)

1. ***Answer all the questions in short:*** **[8×2 = 16]**

(a) It is said that an elastic body becomes plastic when a large deforming force is applied, how?
(b) Interference is not possible with two independent sources, why?
(c) What is the reason behind the phenomenon of objects appearing to be smaller and smaller when they get far away from an observer?
(d) Distinguish between a wavefront and wavelet?
(e) Name the process in which cooling of a gas is possible even if no heat energy has been extracted from it, also explain why does it happen?
(f) Why do the passengers inside a train operated by a steam engine seem to sway to and fro?
(g) What are the differences between photoelectric emission and thermionic emission?
(h) Why is a magnetic field used to deflect electron beam and not an electric field in a television picture tube?

2. ***Answer any four in short:*** **[4×2 = 8]**

(a) Why is it considered that steel is more elastic than copper?
(b) How can two circular coils be used to produce uniform magnetic field?
(c) Give the reason behind the bright glow of the gas in the tube to demonstrate electric discharge. Why is the glow absent when there is near perfect vacuum in the tube?
(d) Why do gases have multiple values of heat capacities, whereas solids and liquids have one?
(e) What will happen when the objective and eyepiece of a telescope is reversed, and why?

3. a. Derive an expression for the energy stored in an elastic wire stretched by a certain given length. **[4]**

b. A cylindrical copper wire and a cylindrical steel wire, each of length 1.5 m and diameter 2 mm, are joined at one end to form a composite wire 3 m long. The wire is loaded, until its length becomes 3.003 m. Calculate the strains in the copper and the steel wires and, the force applied to the wire. [Young's Modulus of copper = 12.3×10^{10} N/m^2, Young's Modulus of steel = 2.0×10^{11} N/m^2]. **[3]**

4. a. Define path difference and use its concept to derive the conditions for the existence of bright or dark fringe at a certain location, according to Young's theory of Interference. **[4]**

b. A compound microscope is designed in such a way that the final image coincides with the object and is at the least distance of distinct vision (25 cm) when the object is 4 cm from the objective. Calculate the focal lengths of the objective and the eyepiece, provided the magnifying power of the microscope is 14. **[3]**

5. a. Define molar heat capacities at constant pressure and volume. Hence derive an expression showing their relationship for 'n' mole of an ideal gas. **[4]**

b. Given that the volume of a gas at STP is 2.24×10^{-2} m^3/mole and that standard pressure is 1.0×10^5 N/m^2, calculate the value for the Molar Gas Constant 'R' and use it to find the difference between the quantities of heat required to raise the temperature of 0.01 kg of oxygen from 0 ^{0}C to 10 ^{0}C when

i) The pressure is allowed to remain constant, and

ii) The volume is allowed to remain constant. [Relative molecular mass of oxygen = 32] [3]

6. a. Use Biot Savart Law to derive a relationship for the magnetic field experienced by a straight conductor carrying a current of magnitude 'I'. [4]

   b. Find the value of the magnetic field intensity at a distance of 20 cm from and on the axis of a circular coil of diameter 2 cm and carrying a uniform current of magnitude 4 A. Also draw a diagram to show the direction of the resultant field. [$\mu_o = 4\pi \times 10^{-7}$ H/m.] [3]

7. a. Describe an experiment to determine the ratio of charge to the mass (e/m) of an electron. [5]

   b. When light of frequency 5.4×10^{14} Hz is shone on a metal surface, the maximum energy of the electrons emitted is 1.2×10^{-19} J. If the same surface is illuminated with light of frequency 6.6×10^{14} Hz, the maximum energy of the electrons emitted is 2×10^{-19} J. Use the data to calculate value for the Planck's constant. [4]

8. a. From Bohr's postulates, determine an expression for the energy of an electron in the first orbit of a hydrogen atom. [4]

   b. In one experiment, a singly charged drop was found to fall under gravity at a terminal velocity of 0.0040 cm per second and to raise at 0.0120 cm per second when a field of 2×10^5 V/m was suitably applied. Calculate the value of the electronic charge given that the radius 'r' of the drop was 6.0×10^{-7} m and the viscosity 'η', of the gas under the conditions of the experiment was 1.80×10^{-5} Nsec/m^2. [3]

9. An electron is confined to a box of size 100 Å Calculate the uncertainty introduced in the velocity of the electron. [Given, mass of electron = 9.1×10^{-31} kg, h = 6.62×10^{-34} Jsec.] [3]

10. What are cathode rays? Write some properties of cathode rays. [4]

The only difference between something ordinary and something extraordinary is that 'extra'.