Sub Code: 210

HISSAN KASKI-Grade XII

Pre- Board Examination – 2071

Physics

Programme: Science **Full Marks: 75**
Time: 3hrs **Pass Marks: 27**

Shift : Day

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

(Group 'A')

1. Attempt any four questions. 4 × 2 = 8

a. Why is the terminal p.d. less than the emf when a current is drawn from it?
b. Two electric bulbs marked 60 W, 220 V and 100 W, 220 V are joined in series. Which one will be brighter?
c. What are the factors on which the thermo-emf produced in a thermocouple depends?
d. Why are the pole-pieces of a permanent magnet of a moving coil galvanometer made curved?
e. A current was sent through a helical coil spring. The spring contracted, as though it had been compressed. Why?
f. Why do you prefer soft iron to steel for making the core of a transformer or generator?

2. Attempt any four questions. 4 × 2 = 8

a. Explain why a discharge tube appears dark when evacuated to very low pressure.
b. What do you mean by de Broglie's wavelength? Can you expect to have such a wavelength for a massive object?
c. How are β-particles emitted from a nucleus even though it doesn't contain electrons?
d. A student asserts that silicon and germanium become good insulators at very low temperatures and good conductors at very high temperatures. Do you agree? Explain your reasoning.
e. Write down the quark combination of a neutron and an antiproton.
f. What do you mean by carbon dating?

3. Attempt any one question. 1 × 2 = 2

a. The hero of a western movie listens for an oncoming train by putting his ear to the track. Why does the method give an earlier warning of the approach of a train than just listening in the usual way?
b. By what factor must the pressure amplitude of a sound wave be increased in order to increase the intensity by a factor of 16? Explain.

4. Attempt any one question. 1 × 2 = 2

a. What is an optical path? Explain.
b. Does the polarizing angle depend on the wavelength of incident light? Explain.

(Group 'B')

5. Attempt any three questions. 3 × 4 = 12

a. Discuss the mechanism of conduction of electricity in a metal conductor. Establish an expression for the electric current in terms of the drift velocity of the electrons.
b. State the principle of potentiometer. Use this principle to compare the emfs of two cells. How do you determine the emf of one of the cells accurately?
c. Obtain an expression for magnetic field intensity at a point on the axis of a current carrying circular coil using Biot-Savart law. What is the value of the field at the center of the coil?
d. State Faraday's laws of electromagnetic induction. Derive an expression for the induced emf in a rectangular coil rotating in a magnetic field.

6. Attempt any three questions. **3 × 4 = 12**

a. Describe Millikan's experiment to verify Einstein's photo-electric equation.

b. What are Bohr's postulates? Derive an expression for the total energy of an electron in the n^{th} orbit of the hydrogen atom.

c. Show that the number of atoms of a given radioactive substance decreases exponentially with time. Derive a relation between decay constant and half life of the radioactive substance.

d. Draw a circuit diagram of an npn transistor in common-emitter (CE) configuration and discuss its input and output characteristics.

7. Attempt any one question. **1 × 4 = 4**

a. What do you mean by end correction? Discuss the different modes of vibrations of an air column in a closed pipe without considering the end correction.

b. What is the Doppler's effect? Deduce an expression for the apparent frequency heard by a stationary observer when a source recedes from him.

8. Attempt any one question. **1 × 4 = 4**

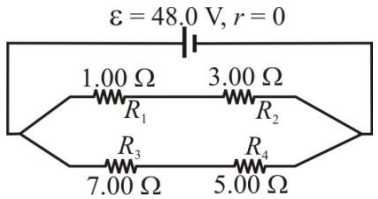
a. Describe Michelson's method for measuring the velocity of light in air. What are the advantages of this method over Foucault's method?

b. Describe Young's double slit experiment and show analytically that bright and dark fringes in this experiment are equally spaced.

(Group 'C')

9. Attempt any two questions. **2 × 4 = 8**

a. Compute the equivalent resistance of the network in the figure and find the current in each resistor. The battery has negligible internal resistance.



b. The resistance of the coil of a pivoted-coil galvanometer is 9.36 Ω and a current of 0.0224 A causes it to deflect full scale. We want to convert this galvanometer to an ammeter reading 20.0 A full scale. The only shunt available has a resistance of 0.0250 Ω. What resistance R must be connected in series with the coil?

c. A circuit consists of a capacitor of 2 μF and a resistor of 1000 Ω. An alternating e.m.f. of 12 V (r.m.s.) and frequency 50 Hz is applied. Find (i) the current flowing, (ii) the voltage across the capacitor, (iii) the phase angle between the applied e.m.f. and current (iv) the average power supplied.

10. Attempt any two questions. **2 × 4 = 8**

a. Calculate the radius of a drop of oil, density 900 kg/m^3, which falls with a terminal velocity 2.9×10^{-4} m/s through air of viscosity 1.8×10^{-5} Ns/m^2. Ignore the density of air. If the charge on the drop is $-3e$, what p.d. must be applied between two plates 5 mm apart? ($e = 1.6 \times 10^{-19}$ C; $g = 9.8$ m/s^2.)

b. An x-ray tube works at a dc potential difference of 50 kV. Only 0.4% of the energy of the cathode rays is converted into x-radiation and heat is generated in the target at the rate of 600 W. Estimate (i) the current passed into the tube (ii) the velocity of the electrons striking the target. (electron mass = 9.00×10^{-31} kg; electron charge = -1.60×10^{-19} C.)

c. Calculate in MeV the energy liberated when a helium nucleus ($_2He_e^4$) is produced (i) by fusing two neutrons and two protons, and (ii) by fusing two deuteriums ($_1H^2$). (The neutron mass is 1.00898 u, the proton mass is 1.00759 u; the nuclear masses of deuterium and helium are 2.01419 u and 4.00277 u respectively. u is equivalent to 931 MeV.)

11. The wavelength of the note emitted by a tuning-fork, frequency 512 Hz, in air at 17ºC is 66.5 cm. If the density of air at s.t.p. is 1.293 kg/m^3, calculate the ratio of the molar heat capacities of air. Assume that the density of mercury is 13600 kg/m^3 and g = 9.8 m/s^2. 4

12. Monochromatic light from a distant source is incident on a slit 0.750 mm wide. On a screen 2.00 m away, the distance from the central maximum of the diffraction pattern to the first minimum is measured to be 1.35 mm. Calculate the wavelength of the light.

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The End