MONDAY, 21st JUNE – Morning, 9.30 to 12

1971 (LC)

B1

Any <u>six</u> questions to be answered

1. Answer <u>eleven</u> of the following fifteen items (a), (b), (c) ... etc. Each item carries six marks. <u>Keep your answers short.</u>

(a) What force is required to give a body of mass 4 kg (4,000 grams) an acceleration of 2 metres (200 cm) per second² ?

(b) What words are omitted from the statement: "When a body is falling freely under gravity the sum of the potential energy and the ___ ___ remains constant" ?

(c) If a body weighs 200 kg on the earth, what will it weigh at a height above the earth equal to the radius of the earth ?

(d) Two forces, of 3 units and 4 units, act at right angles to each other. What is the magnitude of their resultant ?

(e) What does the absolute zero of temperature read in °C ?

(f) Write down the relationship between the velocity of sound in air and the temperature of the air.

(g) Show by means of a ray diagram how a convex mirror forms a virtual image of an object.

(h) Write down the relationship between wave velocity, wavelength and frequency.

(i) What charge (positive, negative or neutral) is on a body when it has a deficiency of electrons ?

(j) A Daniell cell consists essentially of an zinc rod, sulphuric acid, a porous pot, a solution of copper sulphate and a copper vessel. Which is the depolariser (i.e. which reduces polarisation) ?

(k) What is the effective resistance when a resistance of 4 ohms is joined in parallel to a resistance of 2 ohms ?

(l) For comparing the e.m.f. of two cells, using a slidewire potentiometer, the circuit is arranged as shown in the diagram.
Explain why the potential difference between A and a point X on the wire is proportional to the length AX.
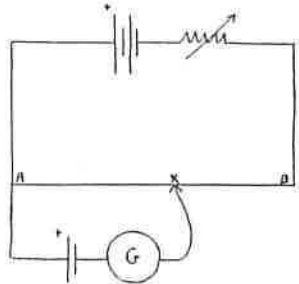
(m) In Einstein's photoelectric law $\frac{1}{2}mv^2 = h\nu - \phi$, what does $h\nu$ represent ?

(n) Why does the image in a television screen become distorted when a strong magnet is brought near to the screen ?

(o) Complete the nuclear reaction

$$_7N^{14} + _2He^4 \rightarrow _0O^{17} +$$
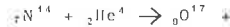
(66 marks)

2. What is meant by the statement: "the acceleration due to gravity is 9·8 metres (980 cm) per second²" ?
An object starting from rest falls freely from a height and strikes the ground in 5 seconds. Find the velocity of the object on striking the ground. Calculate also the distance travelled by the object in the last 2 seconds of its fall.
Outline an experiment by which the acceleration due to gravity may be measured.

(66 marks)

3. Distinguish between transverse and longitudinal waves.
Describe how interference, diffraction, polarisation, of light may be demonstrated.
What conclusions regarding the nature of light may be drawn from these phenomena ?

(66 marks)

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4. Show by means of a diagram the dispersion of light by a prism.
How may a reasonably pure spectrum of white light be produced ?
Define refractive index. A microscope is sharply focussed on a mark drawn on a sheet of paper. On covering the mark with a sheet of glass of thickness 0·5 cm the microscope has to be raised 0·17 cm in order to focus on the mark again. Calculate the refractive index of the glass.

(66 marks)

5. Describe how you would carry out any two of the following experiments: (i) the comparison of the magnetic moments of two bar magnets, (ii) the measurement of the resistance of a length of resistance wire, (iii) the measurement of the wavelength of sodium light.

(66 marks)

6. What is meant by (i) the photoelectric emission of electrons, (ii) the thermionic emission of electrons ?
Name a device in which a beam of electrons is utilised. Explain briefly how it operates and mention any one of its applications.

(66 marks)

7. Describe an experiment to show that a current-carrying conductor experiences a force in a magnetic field.
Draw a labelled diagram of a moving coil-meter, e.g. a galvanometer. What determines the sensitivity of the instrument ?

(66 marks)

8. State the laws of electromagnetic induction.
Describe with the aid of a diagram the construction and operation of a transformer or an induction coil.
A transformer is used to reduce the voltage of the A.C. mains – 220 volts – to operate an 11 volt device. If the current in the device is 2 amperes and the efficiency of the transformer is 80%, find the current in the primary circuit.

(67 marks)

9. What are cathode rays, X-rays ? List their principal properties.
Refer to the difference in origin of these rays in terms of atomic structure.
What effect has the voltage in an X-ray tube on (i) the wavelength, (ii) the penetrating power, of the X-rays ?

(67 marks)

10. "As a result of neutron bombardment, the atomic nucleus of many elements can capture a neutron thus forming a radioactive isotope of the target element, with an increase of one unit in the mass number". Explain the underlined terms.
What is nuclear fission ? How is the reaction initiated and what products are formed ?

(67 marks)

11. Answer any two of the following:

(a) Write down the assumptions on which the kinetic theory of gases is based.
Show how the kinetic theory equation $p = \frac{1}{3}\frac{nm\overline{v}^2}{v}$ is related to Boyle's law.

(b) Draw a labelled diagram of a gold-leaf electroscope. How would you show the identity between electrostatic charges and the carriers of electric current in metals ?

(c) How may ultraviolet light and infrared light be detected ?
Show the positions of ultraviolet light, infrared light, visible light in the electromagnetic spectrum, in increasing order of wavelengths.

(d) Show with a ray diagram the formation of the image in a telescope.

(67 marks)