

Full Marks – 80

(Two Hours + 15 minutes reading time)

Answer to this Paper must be written on the paper provided separately.

You will not be allowed to write during the first 15 minutes.

This time is to be spent in reading the question paper.

The time given at the head of this Paper is the time allowed for writing the answers.

This paper is divided into sections

Attempt all questions from **Section A** and any four from **Section B**.

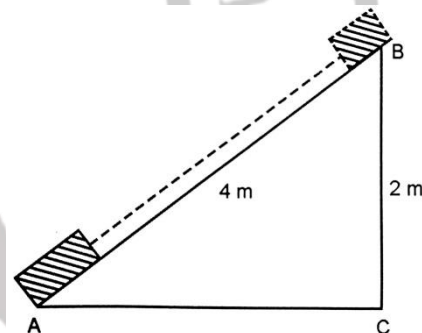
The intended marks for questions or parts of questions are given in brackets [ ].

## SECTION A (40 Marks)

Attempt *all* questions

### Question 1

- (a) What are Non-Contact Forces? Give two examples of Non-Contact forces. [2]
- (b)
- i) What is Moment of Force?
  - ii) What force will produce a moment of force of 6.5Nm, if the perpendicular distance from the point of application of force and turning point is 1.3m? [2]
- (c) A force of 100Kgf acts on a body of mass 1 ton. Calculate the acceleration produced in the body. [Take  $g=10\text{m/s}^2$ ] [2]
- (d) A body of mass 0.5kg is thrown vertically upward with a velocity of 20m/s. Calculate the maximum potential energy attained by the body. [2]
- (e) A block of mass 40 kg is pulled along a slope as shown in the diagram with a constant speed by applying a force of 250N, parallel to the slope. A and B are the initial and final positions of the body.
- i) Calculate the work done by the force in moving the block from A to B
  - ii) Calculate the potential energy gained by the block. [ $g=10\text{m/s}^2$ ] [2]



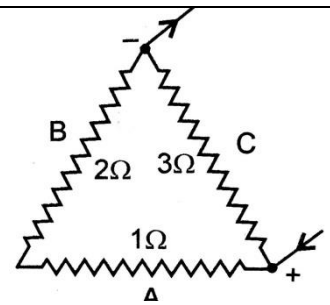
### Question 2

- (a) State one similarity and one difference between X-rays and  $\gamma$ -rays. [2]
- (b) State two ways by which E.M.F of an A.C. generator can be increased. [2]
- (c) Why does a crack in a window pane appear silvery at some particular angle? [2]
- (d) Why do soft drink bottles cool better in ice at  $0^\circ\text{C}$  than water at  $0^\circ\text{C}$  [2]
- (e) State the characteristics of an image formed when:
- i) An object is placed between  $2F_1$  and  $F_1$  of a convex lens. [2]
  - ii) An object is placed between  $2F_1$  and  $F_1$  of a concave lens. [2]

### Question 3

- (a) Complete the Nuclear equation:  ${}_{92}^{235}\text{X} \xrightarrow{-\beta} \dots \text{X}_1 \xrightarrow{-\alpha} \dots \text{X}_2$  [2]
- (b) Explain why wine glasses start rattling, when a note of some particular frequency is struck by a piano. [2]
- (c)
- i) What do you understand by the term quality of note?
  - ii) What happens to the pitch if the frequency of a note decreases? [2]
- (d) How is the internal resistance of a cell affected if:
- i) The surface area of the electrodes in contact with electrolyte increases?
  - ii) The distance between the electrodes increases. [2]

- (e) A, B and C are resistors of resistance  $1\Omega$ ,  $2\Omega$  and  $3\Omega$  respectively. Calculate their equivalent resistance. [2]



**Question 4**

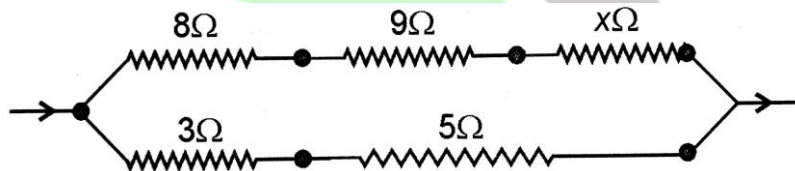
- (a) 20 g of ice melts in a closed copper vessel at  $20^\circ\text{C}$ , till the temperature attained is  $0^\circ\text{C}$ . If the specific latent heat of fusion of ice is  $340\text{J/g}$  and the specific heat capacity of copper is  $0.4\text{J/g}$ , calculate the mass of the copper vessel. [2]
- (b) A heater coil of resistance  $40\ \Omega$  carries a current  $I$ . If the power of the heater is  $1\text{kW}$ , calculate the magnitude of  $I$ . [2]
- (c) Draw a diagram for the magnetic lines of force around a straight conductor, showing clearly the direction of current and the direction of the magnetic lines of force. How can the intensity of the magnetic field around the conductor be increased? [2]
- (d)
- What is the principle of an a.c. generator? [2]
  - What energy changes take place in an a.c. generator? [2]
- (f) A radioactive substance is oxidised. What change, would you expect to take place in its radioactivity and why? [2]

**SECTION B (40 Marks)**

Answer *any four* questions from this Section

**Question 5**

- (a) Some amount of heat is given out to  $120\text{g}$  of water and its temperature rises by  $10\text{K}$ . When the same amount of heat is given to  $60\text{g}$  of oil, its temperature rises by  $40\text{K}$ . If sp.heat capacity for water is  $4200\text{J/g}$ . Calculate
- amount of oil absorbed by oil [4]
  - specific heat capacity of oil [4]
- (b) How can you bend a ray of light through  $90^\circ$ , without using a plane mirror? Support your answer by a diagram. [2]
- (c) The equivalent of a circuit diagram is  $6\Omega$ . Calculate the value of  $x$ . [4]



**Question 6**

- (a)
- In a gear, number of rotations of the driven wheel is more than the driving wheel. Does this increase the speed or the load capacity of the gear? [1]
  - A driving wheel of a gear has 48 teeth and the driven wheel 16 teeth along their circumference. Calculate the number of rotations made by the driven wheel for 20 rotations of the driving wheel. [2]
- (b)
- Draw a neat diagram for a pulley system of velocity ratio 4. [2]
  - If the above pulley system is used to lift a load of  $1000\text{N}$  by an effort of  $320\text{N}$ , Calculate:
    - Mechanical advantage [2]
    - Percentage efficiency of the system [2]
- (c)
- Name a class of lever which always has a mechanical advantage less than 1. Support your answer by a simplified diagram and explain why the mechanical advantage is less than 1. [3]
  - What is the use of lever which always has a mechanical advantage less than 1. Support your answer by a simplified diagram and explain why the mechanical advantage is less than 1. [3]

**Question 7**

- (a)
- Draw a properly labelled diagram to show that the apparent depth of a tank filled with water is less than its real depth. [3]

- ii) A stamp placed under a glass block of refractive index 1.5 appears raised by 0.8cm. Calculate thickness of the glass block. [4]
- (d) By drawing a neat diagram, show the refraction of two parallel incident rays by a concave lens, by treating the lens as a combination of a glass block and two prisms. [3]
- (e) How can you detect infrared radiation? State one use of Infrared radiation. [3]

### Question 8

- (a)
- i) Explain why it becomes pleasantly warm when the water in the rivers and lakes starts freezing in cold countries.
- ii) 0.8kg of ice at 0°C melts, when water at 100°C is poured into it, till the final temperature is zero. Calculate the mass of water required to achieve it. [4]  
[Specific latent heat of fusion of ice=336J/g and specific heat capacity of water is 4.2J/g/°C]
- (b) A man stands in between two parallel cliffs and fires a gun. He hears the first echo after 0.8s and second echo after 2.5s. Calculate the distance between the cliffs. [Take the speed of sound=320m/s] [3]
- (c) Name an electromagnetic wave which is used for:
- detecting fake currency
  - for night vision devices
  - for the cure of cancer
- [3]

### Question 9

- (a)
- i) By giving two examples each, define :
- Ohmic resistance
  - Non-ohmic resistance
- ii) A metal wire has a resistance of 3 Ω/m, find the total resistance of three lengths of such wires, each of length 2m, when connected in parallel. [4]
- (d)
- i) Rewrite the following sentence, using correct alternative.  
“A fuse wire is connected in parallel/series to the earth/neutral/live wire.”
- ii) Which of the two cables, one of 2A and other of 10A will be thicker and why? [3]
- (e) Calculate the resistance of a nichrome wire which will bring 200g of water at 25°C to its boiling point in 10 minutes, when the current flowing through it is 5A. [3]

### Question 10

- (a)
- i) Draw a neat diagram of an A.C. generator.
- ii) When the plane of the coil of an A.C. generator becomes parallel to the magnetic field of radial magnets, what is the magnitude of induced current? Explain your answer. [3]
- (b)
- i) State two characteristics of a thermion emitter.
- ii) Name two commonly used thermion emitters. Which amongst them is better? [3]
- (f)
- i) What is the background radiation?
- ii) How will you detect background radiation?
- iii) What is the change in atomic weight of an element after a  $\beta$  emission? Explain your answer. [4]

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*All the best*