Sample Paper 4

ICSE Class X 2023-24
Physics
Science Paper - 1

Time: 2 Hours   **Max. Marks: 80**

General Instructions:
1.   Answer to this Paper must be written on the paper provided separately.
2.   You will not be allowed to write during first 15 minutes.
3.   This time is to be spent in reading the question paper.
4.   The time given at the head of this Paper is the time allowed for writing the answers.
5.   Section A is compulsory. Attempt any four questions from Section B.
6.   The intended marks for questions or parts of questions are given in brackets [ ].

SECTION - A

(Attempt all questions from this Section.)

QUESTION 1.

Choose the correct answers to the questions from the given options.   [15]

(Do not copy the questions, write the correct answer only.)

(i)   Clockwise moments are considered to be ....
   (a) zero
   (b) positive
   (c) negative
   (d) all of these

(ii) Work done is positive when ....
   (a) displacement is in direction of force applied
   (b) distance is positive
   (c) distance is negative
   (d) maximum distance travelled along direction of force applied

(iii) The heart of a normal person beats 72 times in a minute and does a work of 1 joule per beat. What is power of the heart ?
   (a) 1.5 W
   (b) 1.2 W
   (c) 2.2 W
   (d) 1.7 W

(iv) During α-emission :
   (a) the mass number and atomic number of an atom decrease by 2amu.
   (b) the mass number decreases by 4 amu and atomic number remains unchanged
   (c) the mass number decreases by 4 amu and atomic number decreases by 2 amu.
   (d) the mass number remains unchanged, but atomic number decreases by 2 amu.

(v) **Assertion :** Heater wire must have high resistance will be melting point.
   Reason : If resistance is high, the electric conductivity will be less.
   (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
   (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
   (c) Assertion (A) is true but reason (R) is false.
   (d) Assertion (A) is false but reason (R) is true.

(vi) Violet, green, red and yellow are the four colours formed on a white screen when a polychromatic light is dispersed. The arrangement of colours in the decreasing order of wave lengths is :
   (a) red, yellow, green and violet
   (b) violet, green, yellow and red
   (c) green, red, yellow and violet
   (d) violet, green, red and yellow

(vii) Velocity of sound is constant in ....
   (a) all mediums
   (b) vacuum
   (c) homogeneous medium
   (d) heterogeneous medium

(viii) A man stands in between two cliffs, such that he is at a distance of 133.6 m from nearer cliff. He fires a gun and hears first echo after 0.8 s and second echo after 1.8 s. The distance between two cliffs is
   (a) 434.2 m
   (b) 234.2 m
   (c) 334.2 m
   (d) 134.2 m

(ix) In a step down transformer :
   (a) number of turns in primary coil are less than the secondary coil.
   (b) the primary and secondary coils are wound on separate steel cores
   (c) number of turns in primary coil are more than the secondary coil.
   (d) number of turns in primary coil are equal to the secondary coil

(x) An average lighting circuit of a poor family has a fuse rating of
     (a) 5 A
     (b) 15 A
     (c) 10 A
     (d) 2 A

(xi) A current I flows through a resistance R for the time 't', the electric energy consumed by
      the resistance is:
      (a) $I \times R \times t$
      (b) $I \times R^2 \times t$
      (c) $\dfrac{I^2 \times R}{t}$
      (d) $I^2 \times R \times t$

(xii) A copper ball is dropped from a vertical height of 1200 m. If the initial temperature of
       copper ball at the height is 12°C, what is its temperature of copper is 400 $Jkg^{-1}°C^{-1}$ and
       $g = 10$ ms^{-2}.
       (a) 24°C
       (b) 84°C
       (c) 48°C
       (d) 42°C

(xiii) With the increase in carbon dioxide in the atmosphere the acidity of oceans will
        (a) increase
        (b) remain unaffected
        (c) decrease
        (d) none of these

(xiv) Which lens is thicker at the periphery and thinner in the middle?
       (a) Bi-convex
       (b) plano-convex
       (c) convex
       (d) concave

(xv) When a ray of light passes through an equilateral glass prism :
      (a) it bends towards the base on both refracting surfaces.
      (b) it suffers refraction on the first refracting surfaces.
      (c) it suffers refraction on both the refracting surfaces.
      (d) both (b) and (c)

QUESTION 2.

(i)   (a) What is the unit of mechanical advantage?   [3]
      (b) State one use of radioisotopes.
      (c) A nucleus of an element X which has a symbol $^{235}_{92}X$ emits α and then a β-radiation. The final nucleus in $^{b}_{a}Y$. Find 'a' and 'b' ?

(ii) A half meter rod is pivoted at the centre with two weights of 20 gf and 12 gf suspended at a perpendicular distance of 6 cm and 10 cm from the pivot respectively as shown below: [2]
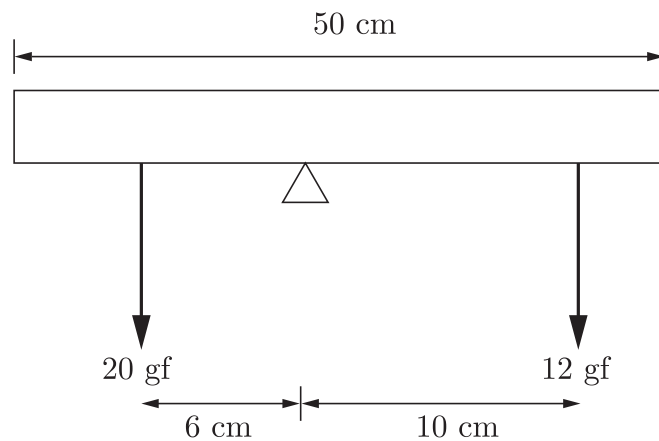
      (a) Is the rod in equilibrium ?
      (b) The direction of 20 kg-f force is reversed. What is the magnitude of the resultant moment of the forces on the rod ?

(iii) What is the relationship between the mechanical advantage and the velocity ratio for: [2]
      (a) an ideal machine;
      (b) a practical machine?

(iv) A man having a box on his head, climbs up a slope and another man having an identical box walks the same distance on a levelled road. Who does more work against the force of gravity and why?   [2]

(v)   (a) Can a body have energy without having momentum? Explain.   [2]
      (b) Can a body have momentum without having energy ? Explain.

(vi) Two bulbs A and B are rated 100 W, 120 V and 10 W, 120 V respectively. They are connected across a 120 V source in series. Calculate the current through each bulb. Which bulb will consume more power?   [2]

(vii) (a) What do you understand by free vibrations of a body?   [2]
      (b) Why does the amplitude of a vibrating body continuously decrease during damped vibrations?

QUESTION 3.

(i) (a) What is the relation between the refractive index of water with respect to air $(_a\mu_w)$ and the refractive index of air with respect to water $(_w\mu_a)$.   [2]
     (b) If the refractive index of water with respect to air $(_a\mu_w)$ is $\frac{5}{3}$. Calculate the refractive index of air with respect to water $(_w\mu_a)$.

(ii) (a) State the characteristics required in a material to be used as an effective fuse wire. [2]
     (b) Which coil of a step-up transformer is made thicker and why?

(iii) Bends in a rubber pipe reduce the flow of water through it. How would the bends in a wire affect its electric resistance ?   [2]

(iv) Calculate the amount of heat released when 5.0 g of water at 20°C is changed into ice at 0°C.   [2]
     (Specific heat capacity of water = 4.2 J/g °C
     Specific latent heat of fusion of ice = 336 J/g).

(v) Write four main sources of creation of nuclear waste.   [2]

SECTION - B

(Attempt any four questions.)

QUESTION 4.

(i) (a) The power of a lens is - 5D.   [3]
        (i) Find its focal length.
        (ii) Name the type of lens.
     (b) State the position of the object in front of a converging lens if :
        (i) It produces a real and same size image of the object.
        (ii) It is used as a magnifying lens.

(ii) (a) What should be the ratio of the speed of light through the liquid to the speed through glass so that there is no refraction of light at the boundaries of the glass block when the system is illuminated by light of one colour?   [3]
     (b) (i) State the equation for the relation between the frequency and wavelength of light in vacuum.
        (ii) What is the relation between the angle of incidence i in the liquid and the angle of refraction r in the glass?

(iii) Red light of wavelength $6600 \, \overset{\circ}{A}$ travelling in air gets refracted in water. If the speed of light in air is $3 \times 10^8 \, \mathrm{ms}^{-1}$ and refractive index of water is $4/3$, find (a) the frequency of light in air, (b) the speed of light in water and (c) the wavelength of light in water.   [4]

QUESTION 5.

(i) A convex lens forms a real image four times magnified at a distance of 60 cm from the lens. Calculate the focal length and the power of the lens.   [3]

(ii) (a) Can the absolute refractive index of a medium be less than one?   [3]
     (b) A coin placed at the bottom of a beaker appears to be raised by 4.0 cm. If the refractive index of water is $4/3$, find the depth of the water in the beaker?

(iii) (a) What do you understand by the terms: (i) wavelength, (ii) frequency and (iii) amplitude of a wave ?   [4]
      (b) Which of the above determine the loudness of a sound wave? What is the relationship between loudness and your answer in (ii) (a) above ?

QUESTION 6.

(i) Maya is climbing a hill from point A to point C as shown in the figure below. The distance between each point is 100 m and the hill has a constant slope of 30°. Maya has a mass of 50kg. Assume negligible friction throughout the climb.   [3]
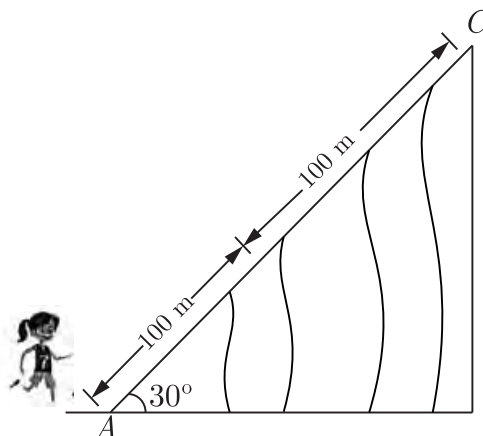

(a) Calculate the total work done by Maya in climbing from point A to C.
(b) Determine the potential energy gained by Maya at point C relative to point A.

(ii) Ramesh applies a force of 6 kg f to draw a 4.8 kg bucket of water from a well using a single fixed pulley. Assuming that all of the extra force applied is to overcome frictional forces, calculate force of friction, mechanical advantage and efficiency. (Take $g = 10 \, \mathrm{m \, s}^{-2}$).   [3]

(iii) A boy weighing 40 kgf climbs up a stair of 30 steps each 20 cm high in 4 minute and a girl weighing 30 kgf does the same in 3 minutes. Compare: [4]
(a) The work done by them.
(b) The power developed by them.

QUESTION 7.

(i) A person is standing at the sea shore. An observer on the ship, which is anchored in between a vertical cliff and the person on the shore, fires a gun. The person on the shore hears two sounds, 2 seconds and 3 seconds after seeing the smoke of the fired gun. If the speed of sound in the air is 320 ms^{-1}, then calculate : [3]
(a) the distance between the observer on the ship and the person on the shore.
(b) the distance between the cliff and the observer on the ship.
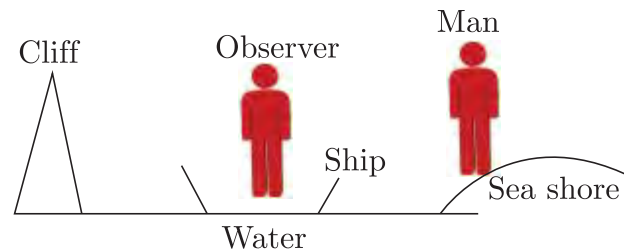
(ii) (a) Name the radiations which are absorbed by greenhouse gases in the earth's atmosphere. [3]
(b) A radiation X is focused by a particular device on the bulb of a thermometer and mercury in the thermometer shows a rapid increase. Name the radiation X.
(c) Name two factors on which the heat energy liberated by a body depends.

(iii) Derive a relationship between mechanical advantage, velocity ratio and efficiency of a machine. [4]

QUESTION 8.

(i) (a) Which particles are responsible for current in conductors? [3]
(b) To which wire of cable in a power circuit should the metal case of a geyser be connected?
(c) To which wire should the fuse be connected?

(ii) (a) What is nuclear energy? [3]
(b) After emission of a nuclear radiation, the atomic number of the daughter nucleus increases by 1. Identify the nuclear radiation.
(c) Write a nuclear reaction indicating the nuclear change mentioned in (ii).

(iii) An electric bulb rated 220 V, 60 W glows when connected with 220 V mains.   [4]
   (a) Find the resistance of the filament of the bulb.
   (b) Another identical bulb is connected in series with the first one and the system is connected across the 220 V mains. Draw a diagram to show the arrangement and find:
   (i) the rate of conversion of energy in each bulb, and
   (ii) total power consumed.
   (c) If two bulbs are connected in parallel, draw a diagram of this arrangement. What will be the total power then consumed?

QUESTION 9.

(i) A molten metal weighing 150 g is kept at its melting point 800°C. When it is allowed to solidify at the same temperature, it gives out 75000 J of heat. What is the specific latent heat of the metal ?   [3]
   If its specific heat capacity is 200 J/kg K, how much additional heat will it give out in cooling to -50°C ?

(ii) Can the specific heat of a substance be (a) zero (b) infinite?   [3]

(iii) (i) Name two factors on which the magnitude of an induced emf in the secondary coil depends.   [4]
   (ii) In the following diagram an arrow shows the motion of the coil towards the bar magnet.
   (a) State in which direction the current flows, A to B or B to A ?
   (b) Name the law used to come to the conclusion.

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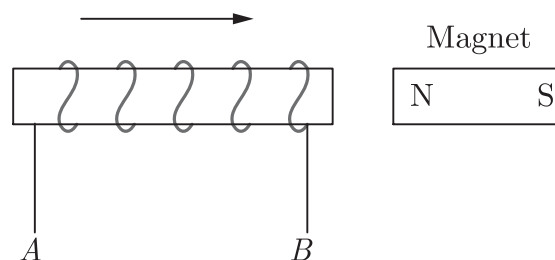
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