STD: X

Date: 30/09/2016

Marks: 80

Time: 2hrs

Section I

(Attempt all questions of this section)

Question 1

a.   State the amount of work done by an object when it moves in a circular path for one complete rotation. Give a reason to justify your answer.   [2]

b.   An object is placed in front of a convex lens such that the image formed has the same size as that of the object. Draw a ray diagram to illustrate this.   [2]

c.   Calculate the power of convex lens of focal length 25 cm.   [2]

d.   How do the frequency and amplitude affect a musical sound?   [2]

e.   Give one example each where high specific heat capacity of water is used:

   (1)   In cooling

   (2)   As heat reservoir.   [2]

Question 2

a.   Draw a graph showing the relationship between acceleration and mass for a constant force.   [2]

b.   Mention two properties of a wave: one property which varies and the other which remains constant when the wave passes from one medium to another.   [2]

c.   The diagram shows a point source of light S, a convex lens L, and a plane mirror M. These are placed such that rays of light, from S return to it after reflection from M.
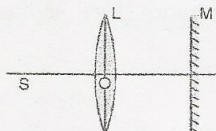
   (i)   What is the distance OS called?

   (ii)   To which point (left of S, on S, or right of S) will the rays return, if M is moved to the left and brought in contact with L.   [2]

d.   The ratio of the amplitudes of two waves is 4 : 9. What is the ratio of their intensities?   [2]

e.   A wire of uniform thickness with a resistance of 27 Ω is cut into three equal pieces and they are joined in parallel. Find the resistance of the parallel combination.   [2]

Question 3

a. Which physical quantity does the electron volt measure? How is it related to the SI unit of this quantity? [2]

b. From the ground floor, a man comes up to the fourth floor of a building using the staircase. Another person comes up to the same floor using an elevator. Neglecting friction, compare the work done in the two cases. [2]

c. How does the musical sound differ from noise? [2]

d. Two friends were playing on identical guitars whose strings were adjusted to give notes of the same pitch. Will the quality of the two notes be the same? Give a reason for your answer. [2]

e. What will an alpha particle change into when it absorbs?
   (i) One electron?
   (ii) Two electrons? [2]

Question 4

a. Give two reasons why the efficiency of a single movable pulley system is not 100%. [2]

b. Explain why scissors for cutting cloth may have blades much longer than the handles; but shears for cutting metals have short blades and long handles. [2]

c. Is it possible to burn a piece of paper using a convex lens in day-light without using matches or an direct flame? Draw a diagram to support your answer. [2]

d. An observer stands at a distance of 850 m from a cliff and fires a gun. After what time-gap will be hear the echo if sound travels at a speed of 350 m s^{-1} in air? [2]

e. The isotope of $^{238}U_{92}$ decays by alpha emission to an isotope of thorium (Th). The thorium isotope decays by beta emission to an isotope of Protactinium (Pa). Write down the equations to represent these two nuclear changes. [2]

Section II
### (Attempt any four questions of this section)

Question 5

a. A uniform meter scale is kept in equilibrium when supported at the 60 cm mark and a mass m is suspended from the 90 cm mark as shown in the figure. State with reasons, whether the weight o the scale is greater than, less than or equal to the weight of mass m. [3
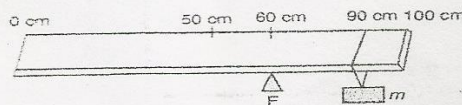
b.   A piece of metal at 10°C has a mass of 50 g. When it is immersed in a current of steam at 100°C 0.7 g of steam is condensed on it. Calculate the specific heat of the metal.
Given: Latent heat of steam = 540 cal/g.   [3]

c.   PQ and PR are two light rays emerging from the object P as shown in the figure below:
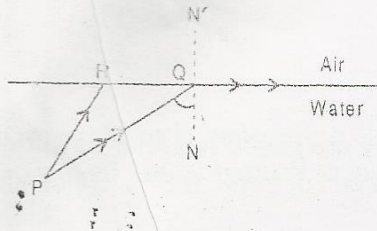
(i)   what is the special name given to the angle of incidence (∠PQN) of ray PQ?
(ii)   Copy the ray diagram and complete it to show the position of the image of the object P when seen obliquely from above.
(iii)   Name the phenomenon that occurs if the angle of incidence ∠PQN is increased still further
   [4]

Question 6

a.   Define 'one joule', and establish a relationship between the SI and CGS unit of work.   [3]

b.   Calculate the speed of light in water.
Given: Speed of light in vacuum = 3×10^8 m s^{-1}, $_w\mu_a = \dfrac{3}{4}$ [3]

c.   A cell of emf 1.5 V and internal resistance 10 ohms is connected to a resistor of 5 ohms, with an ammeter in series (see Fig.).
i. What is the reading of the ammeter?
ii. What is the potential difference in the cell, when the current is drawn from the cell?
iii. What is the terminal voltage of the cell?   [4]
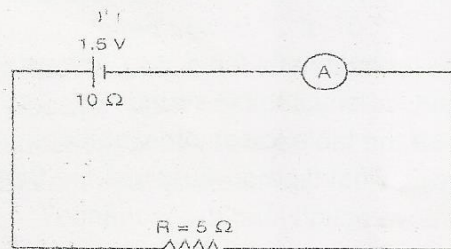
Question7

a. The diagram given below shows an object O and its image I. Copy the diagram and draw suitable rays to locate the lens and its focus. Name the type of lens in this case. [3]

b. State three precautions that must be taken while handling a radioactive source. [3]

c. Three resistors of 6.0Ω, 2.0 Ω and 4.0 Ω respectively are joined together as shown in the figure. The resistors are connected to an ammeter and to a cell of e.m.f. 6.0 V. Calculate:
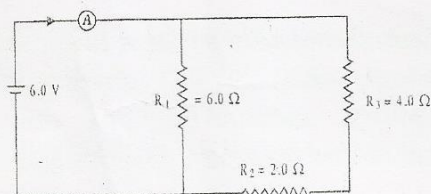
(i) The effective resistance of the circuit.

(ii) the current drawn from the cell. [4]

Question 8

a. (i) If a monochromatic beam of light undergoes minimum deviation through an equiangular prism, how does the beam pass through the prism, with respect to its base?

(ii) If white light is used in the same way as in (i) above, what change is expected in the emergent beam? [2]

b. Does the boiling point of water change with altitude? If so, how? [2]

c. If, in a central heating system, steam enters a radiator pipe at 100 °C and water leaves the radiato pipe at 100 °C, can this radiator pipe heat a room? Give an explanation for your answer. [2]

d. (i) The stem of a vibrating fork is pressed against a table top. Answer the following questions

(1) Would the above action produce any audible sound?

(2) Does the above action cause the table to set into vibration?

(3) If the answer (2) above is yes, what type of vibrations are they?

(ii) Under what conditions does the above action lead to resonance? [4]

Question9

a.   What rays exist beyond the visible-red end of the electromagnetic spectrum? State one use and
     one method of detecting these rays.   [3]

b.   How many alpha and beta particles are emitted when Uranium nucleus $^{238}U_{92}$ decays to Lead ^{206}
     Pb_{82}?   [3]

c.   (i)   what is meant by specific heat capacity of a substance? State its SI unit.   [2]

     (ii)   Why does the heat supplied to a substance during its change of state not cause any rise in
            its temperature?   [2]

Question 10

a.   A block of mass 30 kg is pulled up a slope (as shown in the diagram) with a constant speed by
     applying a force of 200 N parallel to the slope. A and B are initial and final positions of the block.
     Take $g = 10$ m s^2,   [3]
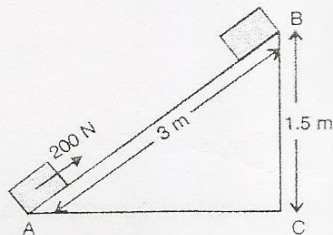
     (i)   Calculate the work done by the force in moving the block from A to B.

     (ii)   Calculate the increased potential energy of the block.

b.   A linear object is placed on the axis of a lens. An image is formed by refraction in the lens. For a
     positions of the object on the axis of the lens, the positions of the image are always between the
     lens and the object.

     (i)   Name the lens.

     (ii)   Draw a ray diagram to show the formation of the image of an object placed in front of the
            lens at any position of your choice except infinity.   [3]

c.   1 kg of ice at 0 °C is being continuously heated through an electric heater of 1 kW. Assuming that
     all the heat is transmitted to ice; calculate the time intervals in seconds for:

     (i)   Ice to completely melt to water at 0 °C,

     (ii)   Water to get heated from 0 °C to 100 °C,

     (iii) Water at 100 °C to convert into steam.

            [Given: Specific latent heat of ice =   3, 36, 000 J kg^{-1}
            Specific heat capacity of water   =   4,200 J kg^{-1} K^{-1}
            Specific latent heat of steam   =   22,600,000 J kg^{-1}]   [4]

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