PRELIMINARY EXAMINATION 2015 - 2016

Subject: Physics

Date: January 5, 2016

Std: X A

Time: 2 Hrs.
(plus 15 minutes reading time)

Marks: 80

General Instructions:
- Answers to this paper must be written on the separate answer booklet provided.
- This paper consists of two sections.
- All four questions in section A are compulsory.
- Solve any 4 out of 6 from section B.
- This paper consists of 10 questions on 7 pages.
- The intended marks for questions or parts of questions are given in brackets. [ ]

SECTION A (40 Marks)
Attempt all questions.

Question 1

(a) If 'm' is the mass of the body, 'v' its velocity and 'p' the momentum, then write the relationship between change in momentum, mass and velocity of the body when   [2]

(i) v is almost equal to c, the velocity of light.

(ii) v is very less as compared to c, the velocity of light.

(b) State the S.I. unit of energy. How is electron volt (eV) related to it?   [2]

(c) You are holding an object in your palm as shown in the figure.   [2]

(i) Draw a neat labelled diagram showing the forces acting on the object and the palm. (name the forces)
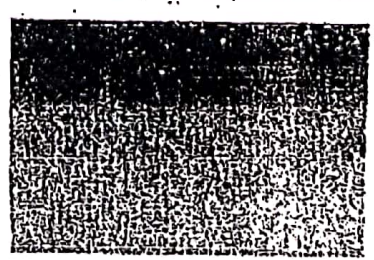
(d) A ray of light strikes the surface of a rectangular glass block   [4]

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such that the angle of incidence is (i) 0^0 (ii) 42^0. Sketch a diagram to show the approximate path taken by the ray in each case as it passes through the glass block and emerges from it.

(e) A horse exerts a pull on a cart of 300 N so that the cart system [2] moves with a uniform speed of 18 km/h on a level road.

    (i) Calculate the power developed by the horse in watts.

    (ii) Find its equivalent in horse power.(1 HP = 750 W)

Question 2

(a) (i) What is the relationship between M.A and angle of [2] inclination (θ) of the incline plane?

    (ii) A barrel 50 kg is raised up on a 10 m long inclined plane by an effort of 25 N. Calculate the vertical height through which the barrel rises. (g = 10 m/s^2)

(b) A uniform meter scale of weight 100 gf is balanced at 60 cm [2] mark and a weight of 25 gf is suspended at 10 cm mark. Where must a weight of 75 gf be suspended, to balance the meter scale?

(c) Which radiation in the electromagnetic spectrum is used for [2] photography in fog? Why is it used?

(d) Why does a wine glass start rattling when a note of some [2] particular frequency is struck by a piano?

(e) A cell of e.m.f.1.5 V is connected to an external resistance of [2] 2 Ω when potential difference at the ends of the resistance is 1.2 V. Calculate the internal resistance of the cell.

Question 3

(a) Distinguish between the renewable and non-renewable sources [2] of energy. (Two points)

(b) A geyser of 2 kW is used to heat 20 kg of water. Calculate the [2] time taken in raising the temperature of water by 30 °C.Specefic

heat capacity of water is 4 .2 J g^{-1} ^{0}C $^{-1}$.

(c) Why is quartz prism required for obtaining spectrum of [2]
Ultraviolet light? Write one use of Ultraviolet light.

(d) How can one distinguish the sound of two musical instruments [2]
even if they are of the same pitch and loudness? Draw a sketch
graph to substantiate your answer.

(e) There are three pins in an electric top. Answer the following: [2]

(i) How would you identify the earth pin?

(ii) In which of the three connecting wires should a switch be
connected and why?

Question 4

(a) In the nuclear reaction given below, nucleus X changes to [2]
another nucleus Y.

$_{88}$X^{226} → Y + α + energy.
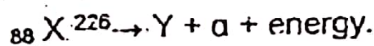
(i) What is the atomic and mass number of Y?

(ii) Name the gas formed when the α – particles acquires
two electrons.

(b) Explain the term 'thermionic emission'. Why is a vacuum [2]
required for thermionic emission?

(c) State the subjective property of light and sound which depends [2]
upon the wave length

(d) An electric bulb is rated 500 W, 240 V. [2]

(i) What information does it convey?

(ii) How much energy will it consume if it is used for 4 hours.

(e) Find the value of current in the circuit given below. [2]

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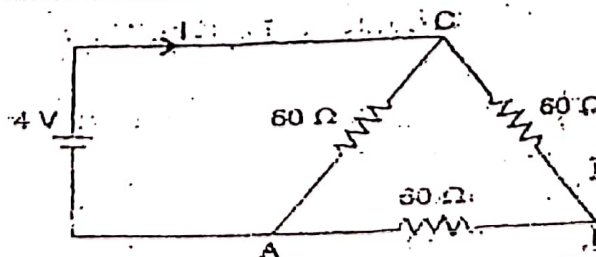
SECTION B (40 Marks)
Attempt any four out of six questions.

Question 5

(a) Draw a neat labelled diagram of a single movable pulley. [3]

    (i) What is the ideal M.A of a single movable pulley.

    (ii) State a factor which reduces its mechanical advantage.

(b) A student of mass of 40 kg carrying a bag of 10 kg after [3] covering a distance of 100 m climbs up a staircase of length 10 m and enters his room.

    (i) What is the total work done by him against the force of gravity, if the room is 5 m vertically above the ground?

    (ii) What is the increase in his potential energy?

    (iii) State work-energy theorem.

    (g = 10 m/s²)

(c) (i) Derive the relationship between kinetic energy and momentum. [4]

    (ii) Calculate the kinetic energy of a body of mass of 300 g and a momentum of 30 kg m s⁻¹.

Question 6

(a). State the principle under which the optical fibre works. Give [3] one practical use of an optical fibre.

used to transmit light signal over long distance negligible loss of energy

(b) [4]
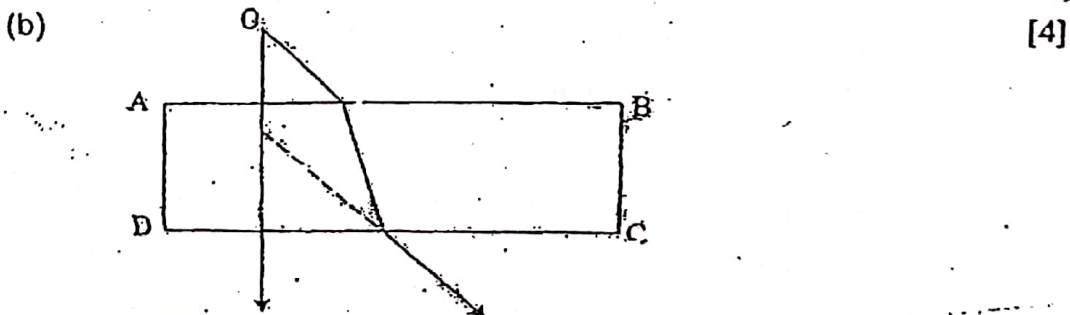
A monochromatic point source of light 'O' is seen through a rectangular glass block ABCD. Paths of two rays, in and outside the block, are shown in the figure above.

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(i) Does the source 'O' appear to be nearer or farther with respect to the surface AB?

(ii) How does the shift depend on the thickness (AD or BC) of the block?

(iii) Justify your answer in (ii) with the help of an appropriate ray diagram.

(iv) From the same rectangular glass block, which colour from the visible spectra will produce maximum shift?

(c) An object is placed in front of a lens, a real, inverted and same size image is formed.   [3]

(i) Name the lens which forms this image.

(ii) Draw a ray diagram (three rays) to show the formation of an image with the above characters.

Question 7

(a) A vibrating tuning fork is placed over the mouth of a burette   [3]
filled with water. The tap is opened and the water level gradually falls. It is observed that the sound at a particular level of water becomes louder.

(i) What is the phenomenon taking place when louder sound is heard?

(ii) Why does the sound become louder?

(iii) What is the name of the phenomenon taking place when sound is produced for another length of water column and sound is not the loudest?

(b) A man standing in front of a vertical cliff fires a gun. He hears   [3]
the echo after 3 s. On moving 150 m away from the cliff, he fires again and hears the echo after 4 s. Find:

(i) The distance of the cliff from the initial position of man

(ii) Speed of the sound.

(c) A straight conductor passes vertically through a cardboard   [4]

sprinkled with iron filings. Show the following with the help of diagrams:

(i) Your observation when current is passed in the down word direction.

(ii) When single conductor is replaced by two parallel conductors both current passing upward(same direction)

(iii) State right hand thumb rule.

Question 8

(a) A cell of e.m.f. 1.08 V and internal resistance 0.5 Ω is connected in series with a resistor R, The terminal potential difference is 0.81 V. [4]

(i) Draw a circuit diagram for the above.

(ii) The p.d. across the internal resistance. (back e.m.f.)

(iii) The current in the circuit.

(iv) The value of the external resistance R.

(b) (i) What do you mean by fuse rating? [3]

(ii) Name the material used for making a fuse wire and write a characteristic of this material.

(iii) What is the function of earth wire?

(c) (i) Write an expression for the resistance of a conducting wire in terms of its length area of cross section. [3]

(ii) Define the term resistivity and state its S.I. unit.

Question 9

(a) 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: [3]

(i) Ice to completely melt to water.

(ii) Water to be heated from 0°C to 80°C.

(iii) Define the term specific heat capacity.

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(S.H.C of Ice = 336 J/g, S.H.C of water = 4.2 J / g / °C)

(b) What is the effect of increase in pressure on the melting point [3] of ice and boiling point of water? Give a practical application of each.

(c)   (i) Draw a labeled diagram to show various components [4] of a step-down transformer.

    (ii) State one difference between step-up transformer and step-down transformer,

    (iii) Name one kind of energy loss that takes place in the core of a transformer and how it can be minimised?

Question 10

(a) Draw a labeled diagram of hot cathode ray tube. [4]

  i. Why cathode plate is coated with oxide of barium or strontium?

  ii. The screen is coated with _____ Barium.

(b) A radioactive element is kept in a lead box and radiation from [3] it is subjected to an electric field. Copy and complete the diagram given below by showing and labeling the paths of alpha, beta and gamma radiation. Name the radiation which has the least penetrating power.

Lead box
Radioactive substance
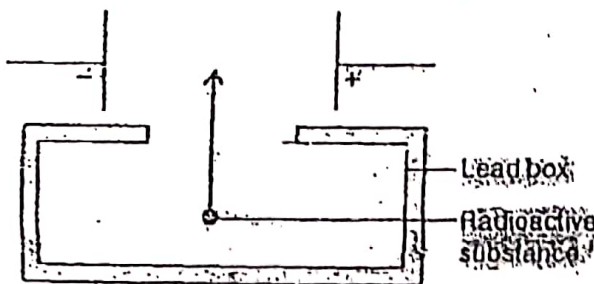
(c) Complete the following nuclear equations. Write the atomic [3] number and atomic mass number of P_1, P_2 and P_3.

$_{92}P^{238} \rightarrow P_1 \rightarrow P_2 \rightarrow P_3$ (P emits α radiation, P_1 and P_2 emits β radiation)