THE FIRST COMPARATIVE EXAMINATION 2021-22
CLASS X (ICSE)
PHYSICS
SCIENCE Paper – 1

Time: Two hours   **Maximum marks: 80**

Instructions:
* *Answers to this paper must be written on the answer script 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.*
* *All subsections of each question must be answered in the correct order.*
* *Please **do not** write anything on the question paper except your name and roll number.*
* *The intended marks for questions or parts of questions are given in brackets [ ].*
* ***Section I** is compulsory. Attempt any **four** questions from **Section II**.*

SECTION I [40 marks]
*Attempt **all** questions from this section.*

Question 1

(a) A body is acted upon by a force. State two conditions when the work done is zero. [2]

(b) Calculate the height through which a body of mass 0.5 kg is lifted if the energy spent in doing so is 1 J (Take $g = 10$ ms^{-2}). [2]

(c) Compare the K.E. of a moving body if its velocity becomes halved. [2]

(d) Which physical quantity is measured in eV? How is it related to the SI unit of that quantity? [2]

(e) State the energy changes in the following devices while in use:

   (i) electric motor.   (ii) microphone. [2]

Question 2

(a) A tennis ball and a table tennis ball have the same momentum. Which of the two has more K.E. and why? [2]

(b) State two conditions for a body, acted upon by several forces, to be in equilibrium. [2]

(c) A spanner (or wrench) has a long handle. Why? [2]

(d) State a factor on which the position of the centre of gravity of a body depends. Explain your answer with an example. [2]

(e) Is it possible to have an accelerated motion with a constant speed? Name such type of motion. [2]

Question 3

(a) (i) For which colour of white light, the refractive index of a transparent medium is least.

   (ii) Which colour of light travels fastest in any medium except air? [2]

(b) State two necessary conditions for the total internal reflection to occur. [2]

(c) Speed of light in diamond is 125000 kms^{-1}. What is its refractive index? Speed of light in air $= 3 \times 10^8$ ms^{-1}. [2]

(d) Define critical angle. How is the critical angle related to the refractive index of a medium? [2]

(e) Draw a ray diagram to show the appearance of a stick partially immersed in water. [2]

Question 4

(a) State the condition for each of the following: [2]
   (i) a lens has both its focal lengths equal
   (ii) a ray passes undeviated through the lens.

(b) Copy and complete the following ray diagram. (Given that $i_c = 42°$ for glass-air) [2]
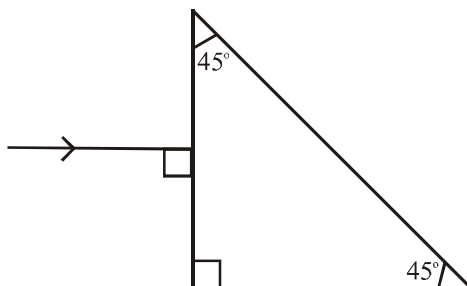
(c) A monochromatic light ray passes through a glass prism surrounded by air suffers minimum deviation. Draw a well labelled ray diagram representing the same. [2]

(d) A water pond appears to be 2.7 m deep. If the refractive index of water is $\frac{4}{3}$, find the actual depth of pond. [2]

(e) State one application each of a convex and a concave lens. [2]

SECTION II [40 marks]
*Attempt **any four** questions from this section.*

Question 5

(a) With reference to the motion of electrons around the nucleus in an atom, answer the following:
   (i) What type of motion is executed by the electrons?
   (ii) Name the force required for the motion of electrons.
   (iii) How do the electrons get the required force? [3]

(b) A boy weighing 350N runs up a flight of 30 steps each 20 cm high in 1 minute.
Calculate:

(i) the work done

(ii) the power spent. [3]

(c) A uniform meter rule is balanced at the 70 cm mark when a mass of 0.05 kg is hung from the 94 cm mark.

(i) Draw diagram of the arrangement.

(ii) Find the mass of the rule. [4]

Question 6

(a) How fast should a man weighing 600 N run so that his kinetic energy is 750 J?
$(g = 10ms^{-2})$. [3]

(b) A coolie A carrying a load on his head climbs up a slope and another coolie B carrying the identical load on his head moves the same distance on a frictionless horizontal platform. Who does more work? Explain the reason. [3]

(c) A ball of mass 10g falls from a height of 5m. It rebounds from the ground to a height of 4m. Find:

(i) Initial potential energy of the ball. [4]

(ii) The kinetic energy of the ball just before striking the ground.

(iii) The kinetic energy of the ball after striking the ground.

Question 7

(a) (i) State the laws of refraction of light.

(ii) A ray of light falls normally on a glass slab. What is the angle of refraction? [3]

(b) A ray of green light enters a liquid from air as shown in the diagram. [3]

(i) Show in the diagram the path of rays of light after it strikes the mirror and re-enters in air.

(ii) Mark in your diagram the angles whenever necessary.

PLANE MIRROR
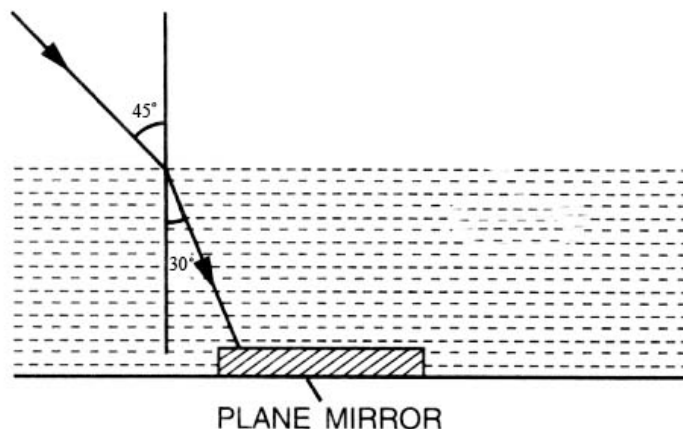
(c) When an object is placed infront of a lens at its focus, a virtual and diminished image is formed:

    (i)   Name the type of lens used.

    (ii)   Draw a ray diagram to show the formation of image with the above stated characteristics.   [4]
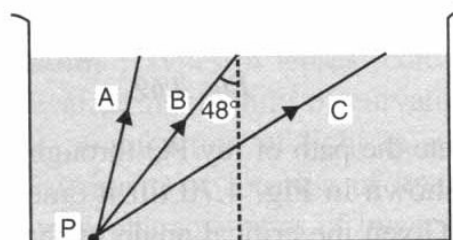
Question 8

(a) Copy and complete the following ray diagram   [3]
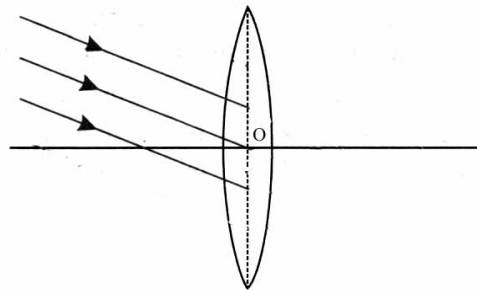
(b)   (i)   Show with the help of a ray diagram how a total reflecting prism ($45°$, $45°$, $90°$) can be used to turn a ray of light through $180°$.

    (ii)   Write the application of this action of prism.   [3]

(c) An object is kept between focus and optical centre of a lens produces virtual and magnified image. Draw the ray diagram to show the formation of image with the above stated characteristics. Write one application of the lens in the given condition.   [4]

Question 9

(a) State three factors on which the angle of deviation depends.   [3]

(b) Following figure shows a point source P inside a water container. The critical angle for water-air surface is $48°$. Completer the path of rays A, B and C after striking water surface.   [3]


(c) A convex lens has a focal length of 20cm. Calculate at what distance from the lens should an object be placed so that it forms an image at a distance of 40 cm on the other side of the lens. State the nature of image formed.   [4]

Question 10

(a) A spring is kept compressed by a toy cart of mass 150 g. On releasing the cart, it moves with a speed of 0.2 ms^{-1}. Calculate the potential energy (elastic) of the spring. [3]

(b) A, B and C are three forces each of magnitude 10N acting in the plane of papers as shown in diagram The point O lies in the same plane. Calculate the resultant moment of forces about O. [3]
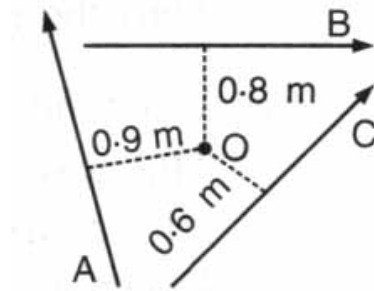
(c) State the principle of conservation of mechanical energy and prove it for a freely falling body under gravity. [4]