BOYS' HIGH SCHOOL AND COLLEGE
FIRST TERM EXAMINATION (2024-25)
CLASS - X
PHYSICS

Estd. 1861

MM.: 80   TIME: 2HRS

NOTE: *Section A is compulsory. Attempt **any four** questions from **section B**.*

SECTION A
(Attempt all questions from this section.)

Question 1. [15]

Choose the correct answers to the questions from the given options. *(Do not copy the question, write the correct answers only.)*

1. When a marble rolls down an inclined plane, its velocity increases. The unbalance force acting on the marble is:
   (a) Frictional force
   (b) Gravitational force
   (c) Force of gravity
   (d) None of the above

2. The correct relationship between the mechanical advantage (M.A.), the velocity ratio (V.R.) and the efficiency (η) is:
   (a) M.A. = η × V.R.
   (b) η = M.A. × V.R.
   (c) V.R. = η × M.A.
   (d) none of these

3. A body is pivoted at appoint. A force of 10 N is applied at a distance of 30 cm from the pivot, the moment of force about the pivot will be:
   (a) 3.0 Nm
   (b) 8.5 Nm
   (c) 5.0 Nm
   (d) 9.0 Nm

4. An object in a denser medium when viewed from rarer medium appears to be raised. The shift is maximum for:
   (a) Red light
   (b) Green light
   (c) orange light
   (d) violet light

5. In which of the following postures the centre of gravity will be outside the human body?
   (a) Posture A
   (b) Posture B
   (c) Posture C
   (d) In all postures, centre of gravity will be inside the human body
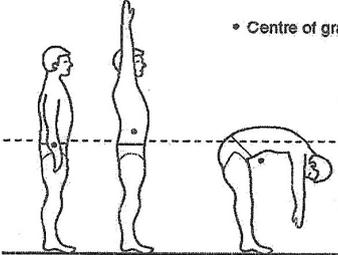
6. If A and B of the same mass can climb the third floor of the same building in 3 min and 5 min respectively, then the ratio of their powers of A to B in an ideal situation is:
   (a) 1:1
   (b) The information is insufficient to form a conclusion
   (c) 3:5
   (d) 5:3

7. A body at a height possesses:
   (a) Kinetic energy
   (b) Solar energy
   (c) potential energy
   (d) heat energy

8. Select the incorrect statement:
   (a) A machine always has the efficiency less than 100%
   (b) The mechanical advantage of a machine can be less than 1.
   (c) A machine can be used as a speed multiplier.
   (d) A machine can have the mechanical advantage greater than the velocity ratio.

9. A ray of light directed towards the optical centre of a lens suffers:
   (a) 0° deviation
   (b) 180° deviation
   (c) 90° deviation
   (d) none of the above

10. A body of mass 5 kg is taken from a height 5 m to 10 m, the increase in its potential energy is:
    (a) 250 J
    (b) 640 J
    (c) 4×10^4 J
    (d) 800 J

11. To an astronaut in a space-ship, the earth appears:

(a) White   (c) red
(b) Blue   (d) black

12. A movable pulley is used as:
    (a) a force multiplier   (c) a speed multiplier
    (b) a device to change the direction of effort   (d) an energy multiplier

13. The wavelength range of white light is:
    (a) 4000 nm to 7000 nm   (c) 400 nm to 700 nm
    (c) 40 nm to 70 nm   (d) 4 nm to 7 nm

14. A ray of light suffers refraction through an equilateral prism. The deviation produced by the prism does not depend on the:
    (a) material of prism   (c) size of prism
    (b) angle of incidence   (d) colour of light

15. For an object placed at a distance 20 cm in front of a convex lens, the image is at a distance 20 cm behind the lens. The focal length of convex lens is:
    (a) 20 cm   (c) 10 cm
    (b) 15 cm   (d) 40 cm

Question 2.

(i) What should be the angle between force and displacement to get the
    (a) minimum work   (b) maximum work?   [2]

(ii) Explain the following:
    (a) The screw drivers have long handles? Why?
    (b) It is easier to knock over a person who is standing on one foot than one who is standing on two. [2]

(iii) The wavelength of electromagnetic radiation is 900nm. Find its frequency. (Take speed of radiation $= 3 \times 10^8 m/sec$)   [2]

(iv) Two bodies A and B have same kinetic energies. Compare their velocities, if mass of A is four times the mass of B.   [2]

(v) What should be the angle of incidence for a ray of light which suffers minimum deviation of 36° through an equilateral prism?   [2]

(vi) Express the power of a concave lens of focal length 30 cm with its sign.   [2]

(vii) From the diagram given below, answer the following question: [3]
    (a) What kind of pulley are A and B?
    (b) State the purpose of pulley B.
    (c) What effort has to applied at C to just raise the load of 20kgf? (Neglect the weight of pulley A and friction.)
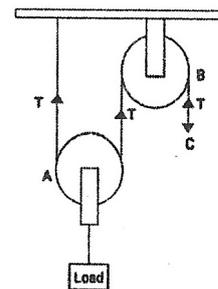
Question 3

(i) Why is the work done by a satellite revolving around the Earth in a circular orbit zero?   [2]

(ii) What is the cause of dispersion of light?   [2]

(iii) What do the following units measure?   [2]
    (a) Pascal   (b) kilowatt-hour

(iv) What do you understand by the term couple? State its effect. Illustrate its action by giving two examples.   [2]

(v) A machine raises a load of 750 N through a height of 16m in 5 sec. Calculate the power at which the machine works.   [2]
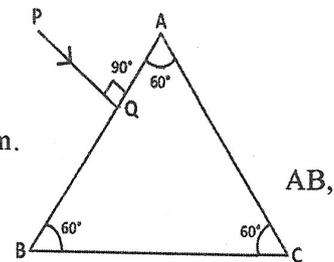
Section B
(Attempt any four questions.)

Question 4.

1. Express 1 KWh in joule.   [4]
2. Give two reasons why the efficiency of a single movable pulley is not 100%.   [2]

3. In the figure given below, a ray of light PQ is incident normally on the face AB of an equilateral glass prism. Complete the ray diagram showing its emergence into air after passing through the prism. Take critical angle for glass = 42°.
   (a) Write the angles of incidence at the faces AB and AC of the prism.
   (b) Name the phenomenon which the ray of light suffers at the face AC and BC of the prism. [4]

Question 5.

1. A man raises a box of mass 50 kg to a height of 2 m in 20 sec, while another man raises the same box to the same height in 50 sec. [4]
   (a) Compare: (i) the work done and (ii) the power developed by them.
   (b) Calculate: (i) the work done and (ii) the power developed each man.
2. State the principle of conservation of energy. [2]
3. How does the action of a concave lens differ from that of a convex lens on a parallel beam of light incident on them? Draw diagrams to illustrate your answer. [4]

Question 6.

1. Show that the sum of kinetic energy and potential energy (i.e., total mechanical energy) is always conserved in the case of a freely falling body under gravity (with air resistance neglected) from a height h by finding it when (i) the body is at the top, (ii) the body has reached the ground. [4]
2. A concave lens of focal length 20cm forms an image at a distance of 10 cm from the lens. What is the distance of the object from the lens? Also, draw ray diagram and find the nature of the image. [4]
3. If the wavelength for the light of red and blue colours are nearly $7.8 \times 10^{-7}m$ and $4.8 \times 10^{-7}m$ respectively,
   (a) Which colour has a greater speed in vacuum?
   (b) Which colour has a greater speed in glass? [2]

Question 7.

1. Draw sketch diagram and indicate the position of the centre of gravity of (a) rectangular lamina (b) lamina of the shape of a parallelogram (c) triangular lamina (d) a cylinder. [2]
2. Explain the term lateral displacement of a light ray when it passes through a rectangular glass block. State the factors on which lateral displacement depends. [4]
3. Show the dispersion of white light through a prism. [2]
4. Determine the horse power of an engine, which lifts 4000 m³ of water from a depth of 50m in 40 minutes. [2]

Question 8.

1. An object is placed in front of a lens between its optical centre and the focus and forms a virtual, erect and diminished image.
   (i)   Name the lens which formed this image.
   (ii)   Draw a ray diagram to show the formation of the image with the above stated characteristics. [3]
2. State the different between centripetal and centrifugal force? Explain it with the help of diagram and mention at least two examples of each. [4]
3. What happens to the kinetic energy when: [3]
   (i)   The mass of the body is doubled at constant velocity?
   (ii)   The velocity of the body is doubled at constant mass?
   (iii) The mass of the body is doubled but the velocity is reduced to half?

Question 9.

1. A block and tackle with 5 pulleys are found to have a M.A. of 4 when a load of 5 N is raised by it. Calculate (a) the effort applied (b) V.R. (c) efficiency and (d) the total resistance R due to friction. [3]
2. Explain briefly what causes the twinkling of stars at night. [2]
3. A light body and a heavy body have the same kinetic energy. Which one will have the greater momentum? [2]
4. A type of electromagnetic wave has wavelength 50 Å.
   (i)   Name the wave.
   (ii)   What is the speed of the wave in vacuum?
   (iii) State one use of this type of wave. [3]