

St. Xavier's School Doranda Ranchi

Session: 2020-21

Physics

Class: XABC

Time:-2hrs

F.M.-80

Section A (40 marks)

Question01

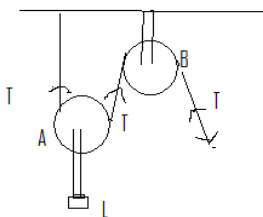
(5 × 2 = 10)

- a) On what factor does the position of the centre of gravity of a body depend?
- b) i) Define moment of couple. Write its S.I. unit.
- c) State the energy changes in (i) Respiration (ii) Steam engine
- d) Calculate the change in kinetic energy of a moving body, if its velocity reduced to $\frac{1}{3}$ of the initial velocity.
- e) Derive a relationship between S.I. and C.G.S. unit of work.

Question 02

(5×2=10)

- a) A type of single pulley is very often used as a machine, even though it does not give any gain in mechanical advantage. (i) Name the type of pulley used. (ii) For what purpose is such a pulley used?
- B) What is meant by the term critical angle? How is it related to the refractive index of the medium?
- c) State the conditions required for the total internal reflection of light to take place.
- d) An object AB is placed between f_1 and $2f_1$ on the principle axis of a convex lens. Using three rays from point A, obtain the image of the object formed by the lens.
- e) From the diagram, answer the questions.



- i) State the purpose of pulley B
- ii) What effort has to be applied at C to just raise a load $L=20$ kgf? (direction of load is downward)

Question 3**(5×2=10)**

- a) 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
- b) i) Name the prism required for obtaining spectrum of ultraviolet light. ii) Name the radiation which can be detected by a thermopile.
- c) The Speed of light is 2×10^5 km/s .What is the refractive index of glass?
- d) Name the constituent colour of white light for which :- (i) the deviation produced by the glass prism is least (ii) the refractive index of glass is maximum.
- e) How does the angle of minimum deviation produced by a prism change with increase in (i) the wavelength of incident ray and (ii) refracting angle of prism?

Question 4**(5×2=10)**

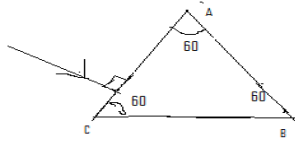
- a) Light of a single colour is passed through a liquid having a piece of glass suspended in it .On changing the temperature of liquid, at a particular temperature the glass piece is not seen. (i) When is the glass piece not seen? (ii) why is the light of a single colour used?
- b) A light mass and a heavy mass have equal momentum. Which will have more kinetic energy? Give reason.
- c) Write the S.I. unit of power and define it?
- d) A coin is placed at the bottom of a beaker appears raised by 4.0 cm. If the refractive index of water is $\frac{4}{3}$, find the depth of the water in the beaker.
- e) A uniform half metre rule balances horizontally on a knife edge at 29 cm mark when a weight of 20 gf is suspended from one end. What is the weight of the half metre rule .

Question 5**(3+3+4=10)**

- a) (i) A brass ball is hanging from a stiff cotton thread. Draw a neat labelled diagram showing the forces acting on the brass ball and cotton thread?
- (ii) Why is a jack screw provided with a long arm?
- b) A uniform metre scale of weight 50gf, is balanced at 60 cm mark, when a weight of 15 gf is suspended at the 10 cm marks. Where must a weight 100 gf be suspended to balance the metre scale?
- c) A boy of mass 55kg runs up a flight of 40 stairs, each measuring 0.15 m in 15 s. Calculate
- i) Work done by the boy ii) Gain of potential energy by the boy iii) power in kilowatt and horsepower.

Question 06**(3+3+4=10)**

- a) Calculate the horse power of an engine, which lifts 4000m^3 of water from a depth of 50 m in 40 minutes
- b) Copy the diagram given above and complete the path of ray till it emerges out of Prism. The critical angle of glass is 42° . In your diagram mark the angles wherever necessary. Fig.

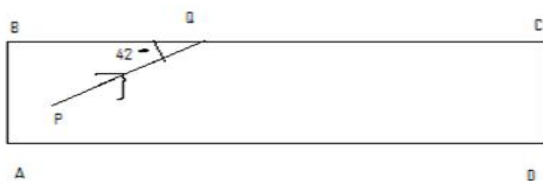


c) A block and tackle has two pulleys in each block, with the tackle tied to the hook of the lower block and the effort being applied upwards. (i) Draw a neat diagram to show this arrangement and calculate its mechanical advantage. (ii) If the load moves up a distance x , by what distance will the free end of the string move up?

Question 07

(3+3+4=10)

- a) i) If the lens is placed in water instead of air, how does its focal length change?
- ii) Which lens, thick or thin has greater focal length?
- iii) Why is the ratio of the velocities of wavelength 4000 \AA and 8000 \AA in vacuum is 1:1?
- b) Two bodies A and B have masses in the ratio 5:1 and their kinetic energies in the ratio 125:9. Find the ratio of their velocities?
- c) The diagram below shows a light source p embedded in a rectangular glass block ABCD of critical angle 42° . Complete the path of the ray PQ till it emerges out of the block (write necessary angle)



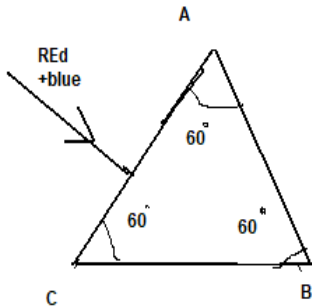
Question 08

(3+3+4=10)

- a) i) Name the force required for circular motion.
- ii) State its direction
- iii) What is the position of centre of gravity of a cylinder?

b) In a dam, waterfalls at a rate of 1000 kg s^{-1} from a height of 100 m . (i) Calculate the initial potential energy of the water. (ii) Assuming that 60% of the energy of the falling water is converted to electrical energy, calculate the power generated (take $g = 9.8 \text{ m s}^{-2}$).

c) The diagram alongside shows a beam of light (red + blue) incident normally on an equilateral triangular Prism. If the critical angle for the material of prism is 60° for the light of red colour, complete the diagram showing the path of light of each colour emerging out of the prism. Mark in the diagram the angles wherever necessary.



X-----X