

Girls' High School & College, Prayagraj

Worksheet No. - 3

Session 2020-2021

Class - X A B C D E F

Subject- Physics

Chapter- Machines

Instructions: - Parents are expected to ensure that the student spends two days to read and understand the chapter according to the books and website referred and thereafter answer the given questions. Student should refer to the following books/website-

Concise Physics By R. P. Goyal and S. P. Tripathi (Selina Publishers) OR

A New Approach to I.C.S.E. Physics by V. K. Sally and R N Das Gupta (Goyal Brothers Prakashan) OR

ICSE Physics By S C Gupta and Smita Aggarwal (Srijan Publishers) OR

website-http://quiznext.in/study-material/learning_material/ICSE-10-Physics/Machines_1/machines-technical-terms-and-levers/#content

Topics: - 1. MACHINES, TECHNICAL TERMS AND LEVERS
2. PULLEY

1) Questions based on Machines, Technical Term and Levers:-

(A) Answer the following questions briefly:-

Q.1:- To which class do the following levers belong and why?

i) A man cutting bread with knife

ii) A railway signal

iii) A nut cracker

iv) Handle of water pump

v) A man rowing a boat

vi) Soda water opener

vii) Motor car foot brake

- viii) Fishing rod
- ix) Lemon squeezer
- x) Claw hammer.

Q.2:- Define the following.

- a) Load
- b) Effort
- c) Velocity ratio
- d) Mechanical advantage
- e) Efficiency.

Q.3:- When does a machine act as

- a) a force multiplier,
- b) a speed multiplier.

Q.4:- What is the use of the lever if its mechanical advantage is

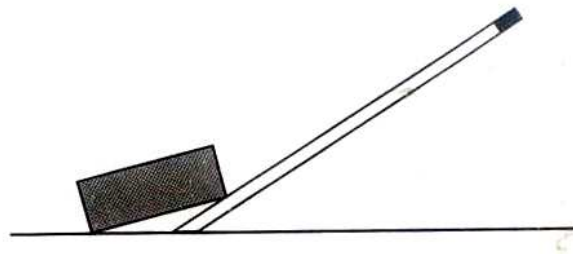
- a) more than 1,
- b) equal to 1, and
- c) less than 1.

Q.5:- Give two reasons, why a machine cannot be 100% efficient.

Q.6:- a) What is the principle of an ideal machine?
b) What do you mean by an ideal or perfect machine?

Q.7:- a) What is lever?
b) Explain why the mechanical advantage of a class II lever is always more than 1.
c) Explain why the mechanical advantage of a class III lever is always less than 1.

Q.8:- The diagram below shows a rod lifting a stone.



a) Mark position of fulcrum F and draw arrows to show the directions of load L and Effort E.

b) What class of lever is the rod?

c) Give one more example of the same class of lever stated in part (b).

Q.9:- What is the relationship between the mechanical advantage and velocity ratio for

(i) ideal machine,

(ii) practical machine.

Q.10:- Give example of each class of lever in a human body.

(B) Multiple choice questions :-

Q.11:- A fire tong is a lever of

a) second class

b) first class

c) third class

d) either first or second class.

Q.12:- The correct relationship between the mechanical advantage (M.A.), the velocity ratio (V.R.) and the efficiency (η) is :

a) $M.A. = \eta \times V.R.$

b) $V.R. = \eta \times M.A.$

c) $M.A \times V.R. = \eta$

d) $M.A \times V.R. > \eta.$

Q.13:- When we want to use a machine as a force multiplier then,

a) Effort < Load

b) Effort > Load

c) Effort = Load

d) Effort \geq Load.

Q.14:- For an ideal machine

a) Output energy = Input energy

b) Output energy > Input energy

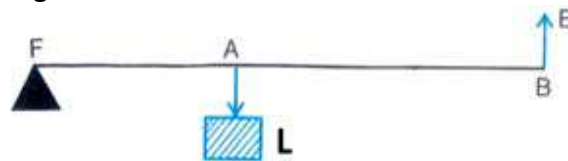
- c) Output energy < Input energy
- d) None of these.

Q.15:- The lever for which the mechanical advantage is less than 1 has the

- a) effort between the fulcrum and load
- b) load between the effort and fulcrum
- c) fulcrum at midpoint between the load and effort
- d) load and effort acting at the same point.

(C) Numerical problems :-

Q.16:- The diagram given below shows a lever in use.



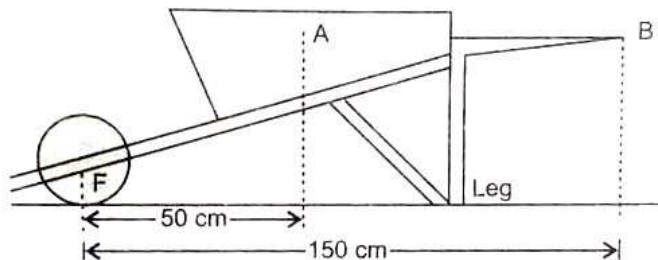
- i) To which class of lever does it belong?
- ii) If $FA=40$ cm, $AB=60$ cm, then find the mechanical advantage of the lever.

Q.17:- A pair of scissors is used to cut a piece of a cloth by keeping it at a distance of 8.0 cm from its rivet and applying an effort of 10 kgf by fingers at a distance of 2.0 cm from rivet.

Find:

- a) the mechanical advantage of scissors, and
- b) the load offered by the cloth.

Q.18:- In the diagram of a stationary wheel barrow, the centre of gravity is at A. The wheel and the leg are in contact with the ground. The horizontal distance between A and F is 50 cm and that between B and F is 150 cm.



- a) What is the direction of the force acting at A? Name the force.
- b) What is the direction of the minimum force at B to keep the leg off the ground? What is this force called?
- c) Find the mechanical advantage of a wheel barrow.

Q.19:- A pair of scissors has its blades 15 cm long, while its handles are 7.5 cm long. What is its mechanical advantage?

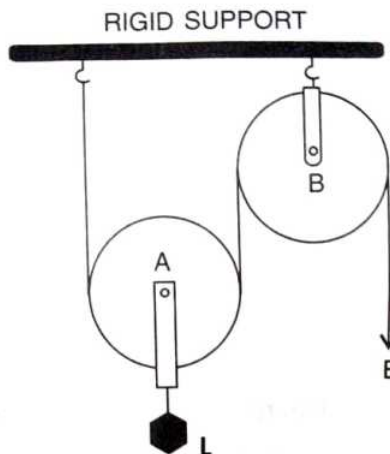
Q.20:- A force of 5 kgf is required to cut a metal sheet. A shears used for cutting the metal sheet has its blades 5 cm long, while its handles are 10 cm long. What effort is needed to cut the sheet?

2) Questions based on Pulley:-

(A) Answer the following questions briefly:-

Q.1:- In a single movable pulley, if the effort moves by a distance x upwards, by what height is the load raised?

Q.2:- The diagram given below shows a pulley arrangement.



- a) Name the pulleys A and B.
- b) In the diagram, mark the direction of tension on each strand of string.

- c) What is the purpose of the pulley B?
- d) If the tension is T , deduce the relation between (i) T and E , (ii) E and L .
- e) What is the velocity ratio of the arrangement?

Q.3:- Draw a diagram of combination of three movable pulleys and one fixed pulley to lift up a load. In the diagram, show the directions of load, effort and tension in each strand. Find :

- a) the mechanical advantage
- b) the velocity ratio, and
- c) the efficiency of the combination, in the ideal situation.

Q.4:- In a single fixed pulley, the velocity ratio is always more than the mechanical advantage. Give reason.

Q.5:- a) Draw a labelled diagram of a block and tackle system of pulleys with two pulleys in each block. Indicate the directions of the load, effort and tension in the string.

b) Write down the relation between the load and the effort of the pulley system.

Q.6:- A block and tackle pulley system has a velocity ratio 3.

a) Draw a labelled diagram of this system. In your diagram, indicate clearly the points of application and the directions of the load and effort.

b) Why should the lower block of this pulley system be of negligible weight?

Q.7:- When there is no gain in mechanical advantage of a single fixed pulley, why is it then used?

Q.8:- What is the velocity ratio of a single fixed pulley?

Q.9:- Give two reasons why the efficiency of a single movable pulley is not 100%.

Q.10:- State two differences between a single fixed pulley and a single movable pulley.

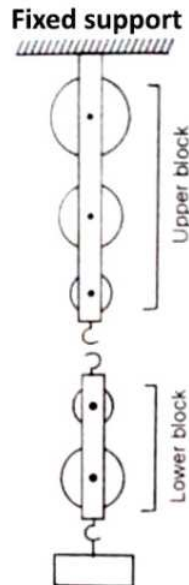
(B) Numerical problems :-

Q.11:- A single fixed pulley and a movable pulley both are separately used to lift a load of 50 kgf to the same height. Compare the efforts applied.

Q.12:- In a block and tackle system consisting of 3 pulleys, a load of 75 kgf is raised with an effort of 25 kgf. Find:

- a) the mechanical advantage,
- b) the velocity ratio, and
- c) the efficiency.

Q.13:- The diagram given below shows a system of five pulleys.

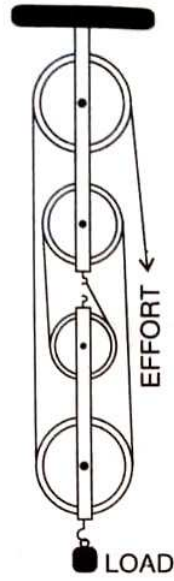


a) Copy the diagram and complete it by drawing a string around the pulleys.

Mark the direction of the load and effort.

b) If the load is raised by 2 m, through what distance will the effort move?

Q.14:- The diagram given below shows a block and tackle system of pulleys used to lift a load.



- a) How many strands of tackle are supporting the load?
- b) Draw arrows to represent tension T in each strand.
- c) What is the mechanical advantage of the system?
- d) When load is pulled up by a distance 1m , how far does the effort end move?
- e) How much effort is needed to lift a load of 100 N ?

END