WORKSHEET 1

CHAPTER 3 – MACHINES

A. Tick (✓) the correct option.

1. The velocity ratio is given by

   a. $\frac{\text{Velocity of effort}}{\text{Velocity of load}}$. b. $\frac{\text{Load}}{\text{Effort}}$.

   c. $\frac{\text{Velocity of load}}{\text{Velocity of effort}}$. d. Velocity of effort × Velocity of load.

2. Efficiency (η) of an ideal machine is

   a. $\eta > 1$. b. $\eta < 1$. c. $\eta = 1$. d. $d.\eta = 0$.

3. Rounding of a boat is an example of

   a. class III lever. b. class I lever. c. class II lever. d. wedge.

4. There are 2 pulleys in the lower movable tackle and 2 pulleys in the upper fixed block. The mechanical advantage is

   a. 1. b. > 1. c. 2. d. 4.

5. In terms of load and effort, the mechanical advantage < 1 when

   a. effort arm > load arm. b. effort arm < load arm.

   c. effort arm = load arm. d. none of these.

B. Fill in the blanks.

1. A single movable pulley acts as a _____ multiplier.
2. The perpendicular distance of the effort from the fulcrum is called the _____
3. The ratio of the mechanical advantage to the velocity ratio is called _____
4. Scissors is an example of _____ lever.
5. The mechanical advantage of a single movable pulley is _____

C. State whether the following statements are true or false.

1. For an ideal machine $\eta > 1$.
2. If effort arm is equal to load arm then $MA = 1$.
3. Oars are Class I levers.
4. Velocity ratio is equal to $\frac{\text{load arm}}{\text{effort arm}}$.
5. Foot is Class II lever.

Name: ..... Teacher's signature: .....

Class: X Date: .....

D. Match the following.

1. Human-arm	$MA > 1$
2. Class II lever	force multiplier
3. Single movable pulley	work output = work input
4. Claw hammer	class III lever
5. $\eta = 1$	$MA = VR = 2$

E. Answer the following questions.

Very short answer questions

1. What is the principle of an ideal machine?
2. Name the six basic simple machines which are used commonly.

Short answer questions

1. Define the following terms.
   a. Simple machine b. Velocity ratio c. Pulley
2. Why is mechanical advantage of class II lever is always more than one?

Long answer questions

1. A pair of scissors is used to cut a piece of cloth placed 4 cm from the rivet. A force of 10 kgf is applied by the fingers 8.5 cm from the rivet. What is the resistance offered by the cloth?
2. A load of 120 N is lifted by applying the force of 180 N in the downward direction (as shown in Fig.).

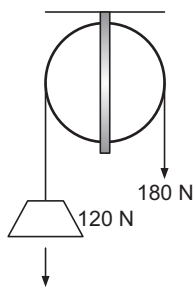

Fig.

   a. What will be the direction of the tension?
   b. What is the velocity ratio of the machine?
   c. Calculate mechanical advantage.

ANSWERS

WORKSHEET 1

A. Tick (✓) the correct option.

1. a
2. c
3. b
4. d
5. b

B. Fill in the blanks.

1. force
2. effort arm
3. efficiency
4. class I
5. 2

C. State whether the following statements are true or false.

1. F
2. T
3. T
4. F
5. T

D. Match the following.

1. Human-arm	class III lever
2. Class II lever	$MA > 1$
3. Single movable pulley	$MA = VR = 2$
4. Claw hammer	force multiplier
5. $\eta = 1$	work output = work input

E. Answer the following questions.

Very short answer questions

1. The principle of an ideal machine is that there is no loss of energy in any manner. The work input will be equal to the work output.
2. The six basic simple machines, which are used commonly, are:
   i. the lever
   ii. the pulley
   iii. the inclined plane
   iv. the screw
   v. the wedge
   vi. the wheel and the axle.

Short answer questions

1. a. A simple machine is a device which is used to do work more conveniently and more quickly.
   b. The velocity ratio of a machine is the ratio of the velocity of the effort to the velocity of the load.
   c. A pulley is a metallic (or wooden) circular disc having a groove along its rim and capable of rotating about a rod called the axle which passes through its centre.
2. The mechanical advantage of class II lever is always more than 1 since the load is in between the effort (E) and the fulcrum (F), the effort arm is thus always longer than the load arm.

Long answer questions

1. A pair of scissors is a lever of first order (class I).

   We are given,

   Effort (E) = 10 kgf
   Effort arm = 8.5 cm
   Load = ?
   Load arm = 4 cm

Now, according to the principle of lever,

$$\text{Load} \times \text{Load arm} = \text{Effort} \times \text{Effort arm}$$

$$\Rightarrow \quad \text{Load} \times 4 \text{ cm} = 10 \text{ kgf} \times 8.5 \text{ cm}$$

$$\Rightarrow \quad \text{Load} = \frac{10 \times 8.5}{2} \text{kgf} = 42.5 \text{ kgf}$$

Thus, the resistance offered by the cloth is 42.5 kgf.

2. a. The tension is in upward direction.

b. Velocity ratio $= \dfrac{\text{Effort arm}}{\text{Load arm}} = \dfrac{d_E}{d_L}$

$\because$ Distance moved upwards by load, $L = d$

and distance moved upwards by

Effort, $E = d$

$\therefore$ Velocity ratio $= \dfrac{d}{d} = 1$

c. We know,

$$\text{Mechanical advantage} = \frac{\text{Load}}{\text{Effort}}$$

Here, Load $= 120$ N

Effort $= 180$ N

$\therefore$ $MA = \dfrac{120\text{N}}{180\text{N}} = 0.67$ (approx.)