Physics Test
Chapter: Machine

Marks: 40   Time: 1 hr 10 mins

1. **MCQ type question**   1×5=5

    a. Mechanical Advantage (M.A), Load (L) and Effort (E) are related as

    MA= L × E   M.A. × E = L.

    E=MA × L   None of these

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

    M.A. =η x V.R.   VR = η × MA

    η = MA × VR   None of these

    c. Select the incorrect statement

    A machine always has efficiency less   The mechanical advantage of a
    than100%.   machine can be less than 1
    A machine can be used as a speed   A machine can have mechanical
    multiplier   advantage greater than its velocity
                                               ratio.

    d. The mechanical advantage of an ideal single movable pulley is:

    1   2.

    Less than 1   Less than 2

    e. The liver for which mechanical advantage is less than 1 has:

    Fulcrum at the mid-point between   Load between effort and fulcrum.
    load and effort.

    Effort between fulcrum and load.   Load and effort acting at the same
                                             point

2. **Very short question**   1×10=10

    a. Explain why mechanical advantage less than 1 of class III liver.
    b. What is Mechanical Advantage of Liver?
    c. A pair of scissors has its blades 15 cm long, while its handles are 7.5 cm long. What is its mechanical advantage?
    d. State four ways in which machines are useful to us.
    e. What is Pulley?
    f. A woman draws water from a well using a fixed pulley. The mass of the bucket and water together is 6 kg. The force applied by the women is 70 N. calculate the mechanical advantage. (Take g = 10 m s^{-2}).
    g. What is Ideal Machine?
    h. Define the term velocity ratio. State its unit.

    i. What is the ideal mechanical advantage of a single fixed pulley? Can it be used as a force multiplier?
    j. What is Velocity Ratio?

### 3. Short answer type question   2×5=10

    a. The diagram 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.

    b. Explain why scissors for cutting cloth may have blades longer than the handles, but shears for cutting metals have short blades and long handles.

    c. State differences between a single fixed pulley and a single movable pulley.

    d. Draw a labelled diagram of a class I1 lever. Give one example of such a lever.

    e. Describe mechanical advantage of combination pullies of one fixed Pulley and other movable pulley?
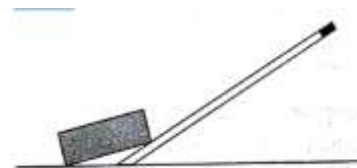
4. Numerical problems   3×5=15

    a. The diagram below shows a lever in use.
    (a) To which class of lever does it belong?
    (b) If AB =1 m, AF= 0.4 m, find its mechanical advantage.
    (c) Calculate the value of E.
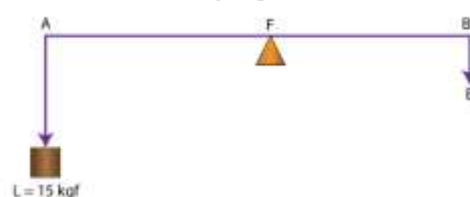
    b. A pair of scissors is used to cut a piece of a cloth by keeping it at a distance 8.0 cm from its rivet and applying an effort of 10 kgf by fingers at a distance 2.0 cm from the rivet. (a) Find: (i) the mechanical advantage of scissors and (ii) the load offered by the cloth. (b) How does the pair of scissors act: as a force multiplier or as a speed multiplier?

    c. A fixed pulley is driven by a 100 kg mass falling at a rate of 8.0 m in 4.0 s. It lifts a load of 75.0 kgf. Calculate: (a) The power input to the pulley taking the force of gravity on 1 kg as 10 N. (b) the efficiency of the pulley, and (c) the height to which the load is raised in 4.0 s.

    d. The figure shows a wheelbarrow of mass 15 kg carrying a load of 30 kgf with its centre of gravity at A. The points B and C are the centre of wheel and tip of the handle such that the horizontal distance AB = 20 cm and AC = 40 cm.
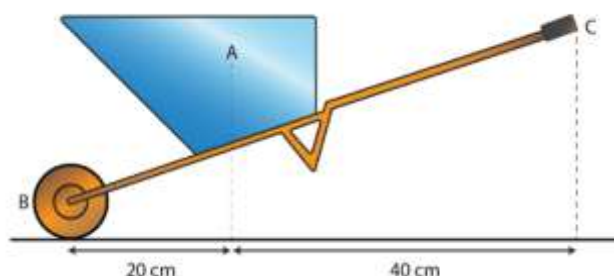
Find: (a) the load arm, (b) the effort arm, (c) the mechanical advantage, and (d) the minimum effort required to keep the leg just off the ground.

    e. A lever of length 9 cm has its load arm 5 cm long and the effort arm is 9 cm long. (a) To which class does it belong? (b) Draw diagram of the lever showing the position of fulcrum F and directions of both the load L and effort E. (c) What is the mechanical advantage and velocity ratio if the efficiency is 100%? (d) What will be the mechanical advantage and velocity ratio if the efficiency becomes 50%?