**123**

Simple Machines - Fundamentals

****

**Exercise 1**

What is the Mechanical Advantage of a machine if a 30 N force lifts a 20 kg load?

\_\_\_\_\_Convert 20 kg to Newtons \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_20 kg = 200N\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_M A = L/ E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_= 200/ 30\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_= 6.67\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

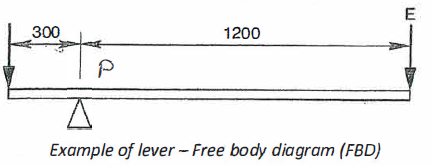
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Exercise 2**

Find the effort required to lift a toad of 300 N, if a lever is 1.5 m long. A fulcrum is placed under the lever 300 mm from the load.

Free body diagram.







= 0

= + 300 + 300 – E x 1200 **MA** \_\_\_\_\_4\_\_\_\_\_\_\_

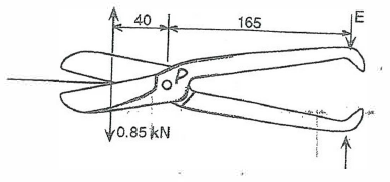
E = 90000

1200

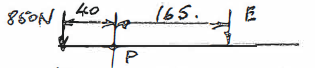
= 75N MA = L = 300

E 75

= 4

**Exercise 3**

If the maximum force resisting shear offered by the sheet metal is 0.85 kN, find the effort required and the mechanical advantage of the system.





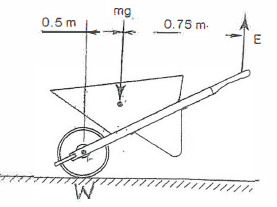
= 850 + 40 – E × 165 Effort \_\_\_\_206N\_\_\_\_

165E = 34000 MA 4.13

E = 206N ؞

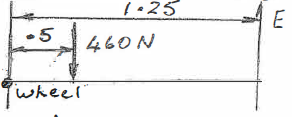
MA = L/ E L = 850N

= 850/ 206 = 413 E = 206N

**Exercise 4**

Calculate the force which must be applied to the handle in order to hold the wheelbarrow up in a stationary position. What is the mechanical advantage of the system?

The wheelbarrow+ load= 46 kg.



M = 46kg.

F = 46 × 10

= 460N

= -460 × .5 + E × 1.25 Force \_\_\_\_\_184N\_\_\_\_\_

1.25E = 230 MA \_\_\_\_\_2.5\_\_\_\_\_\_\_

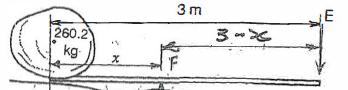
E = 184N

MA = L/E L = 460N

= 460/ 184 E = 184N

= 2.5

**Exercise 5**

A rock, to be raised by a 3 m lever, has a mass of 260.2 kg. If a vertical effort of 425 N is available, calculate: 

1. The mechanical advantage of the system.
2. The distance, x, for the position of the fulcrum. u L = 260.2kg

Disregard the mass of lever. = 2602N MA = L/E

E = 425N =2602/ 425

= +2602 × x – 425(3 – x) = 6.1

= 2602x – 1275 + 425x

2602x + 425x = 1275 MA \_\_\_\_\_6.1\_\_\_\_\_\_\_

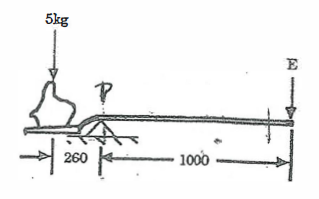
3027x = 1275 Distance \_\_\_\_\_421 mm\_\_\_

X = 1275/ 3027

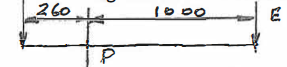
= .421 m

= 421 mm

**Exercise 6**

Some landscapers use a shovel as a lever to assist in moving rocks.

1. Calculate the force required at E to balance the 5kg rock on the shovel as shown. 

M = 5kg

= 50N

= 50 × .26 – E × 1 Convert mm to m

E = 13N Force at E: \_\_\_13N\_\_\_

1. Determine the mechanical advantage of the lever system shown in (a) when the shovel is used as shown.

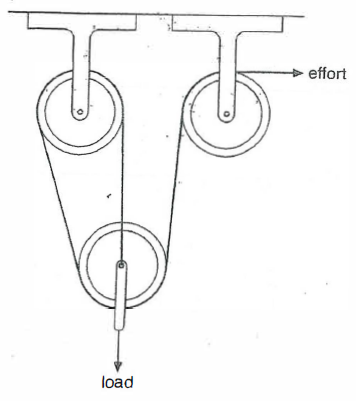
MA = L/ E L = 50N

= 50/ 13 E = 13N

= 3.85



**Exercise 7**

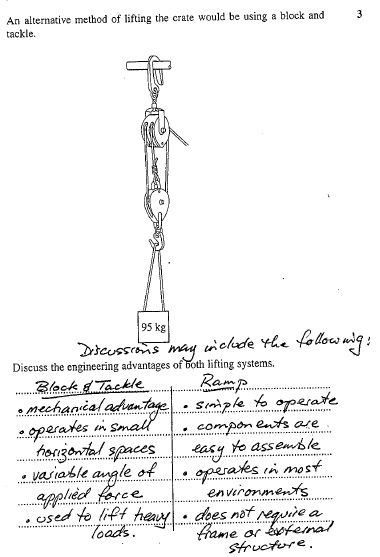
The pulley system shown is part of an apparatus attached to a bed-.in hospital to life the leg of patients. 

Determine the VR ·of the system.

Number of ropes supporting the load = 3

**VR** \_\_\_\_\_3\_\_\_\_\_

**Exercise 8**



**Exercise 9**

