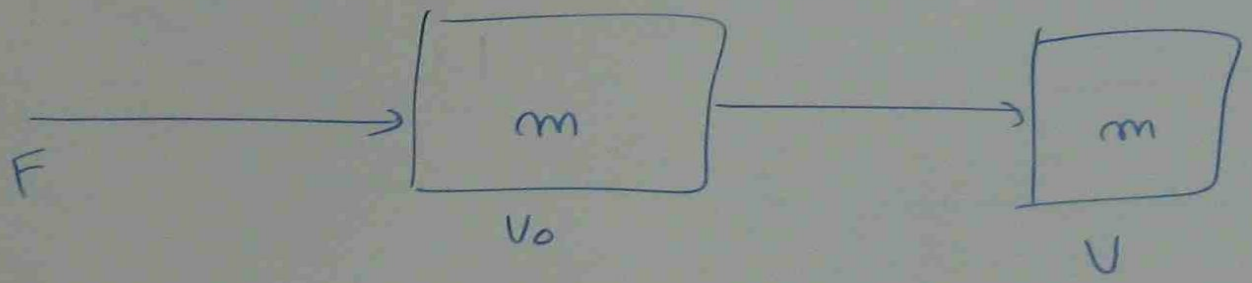
Impulse



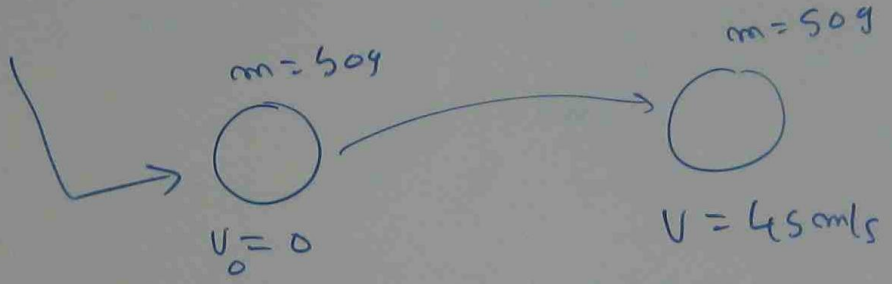
Time = t

$$F \times t = mv - mv_0$$

Impulse

pb

WHEN A GOLF BALL HAVING A MASS 50g IS STRUCK BY CLUB. THE BALL AND CLUB ARE IN INTACT FOR 0.001 sec IMMEDIATELY AFTER IMPACT, THE BALL TRAVELS AT 45m/s. DETERMINE THE AVERAGE FORCE OF COLLISION



$t = 0.001$ sec

$F = ?$

$$F \times t = mV - mV_o$$

$$F \times 0.001 = \frac{50}{1000} \times 45 - \frac{50}{1000} \times 0$$

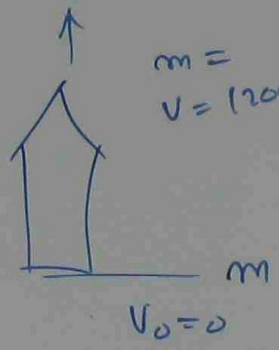
$$F = \frac{50 \times 45}{0.001 \times 1000}$$

$$= 2250N = 2.25kN$$

pb

THE EXHAUST GAS FROM A ROCKET HAVE A VELOCITY OF 1200 m/s AND FLOW AT THE RATE 5 kg/s

DETERMINE THE THRUST PRODUCED BY GAS



$$F \times t = m V - m V_0$$

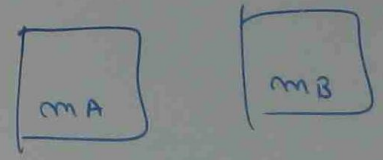
$t = 1$ sec

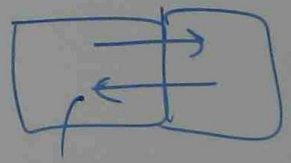
$$F \times 1 = 5 \times 1200 - 5 \times 0$$

$$F = 6000 N = 6 kN$$

IMPACT

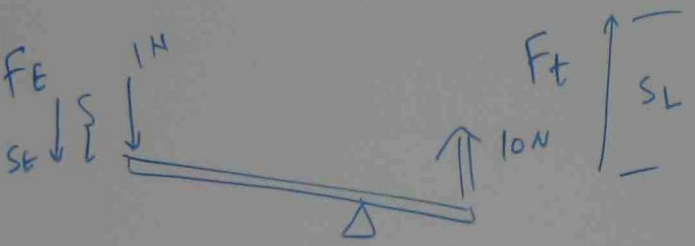
AN IMPACT IS A COLLISION BETWEEN TWO BODIES WHICH OCCURS IN VERY SHORT INTERVAL OF TIME AND INVOLVES RELATIVELY LARGE FORCES WHICH THE TWO BODIES EXERT ON EACH OTHER





IMPACT

MECHANICAL ADVANTAGE AND VELOCITY RATIO



F_E = EXERTED FORCE (EFFORT)

F_t = THRUST FORCE (LOAD)

$$\text{MECHANICAL ADVANTAGE} = \frac{\text{LOAD}}{\text{EFFORT}}$$

$$MA = \frac{F_t}{F_E}$$

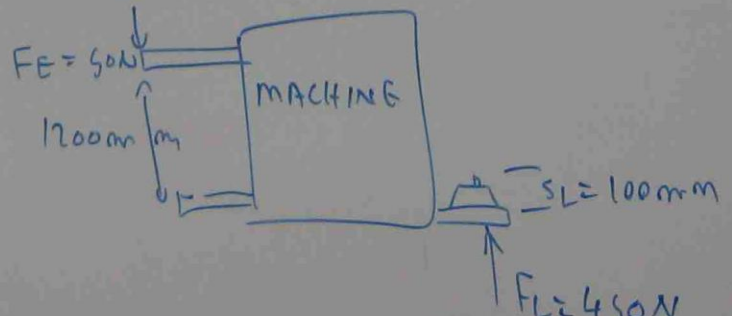
S_E = DISTANCE MOVED BY EFFORT

S_L = DISTANCE MOVED BY LOAD

$$\text{VELOCITY RATIO} = \frac{\text{DISTANCE MOVED BY EFFORT}}{\text{DISTANCE MOVED BY LOAD}}$$

$$V_R = \frac{S_E}{S_t}$$

Pb / A SIMPLE MACHINE IS REPRESENTED DIAGRAMMATICALLY IN GIVEN FIGURE. THE LOAD IS 450N. THE EFFORT IS 50N. THE DISTANCE MOVED BY THE LOAD AND THE EFFORT ARE 100 mm AND 1200 mm RESPECTIVELY. CALCULATE MECHANICAL ADVANTAGE AND VELOCITY RATIO



$$MA = \frac{ft}{FE} = \frac{450}{50} = 9$$

$$VR = \frac{1200}{100} = 12$$

WORK AND EFFICIENCY

$$\text{EFFICIENCY} = \frac{\text{WORK DONE IN MOVING LOAD}}{\text{WORK DONE BY THE EFFORT}}$$

$$= \frac{F_L \times S_L}{F_E \times S_E}$$

$$= \frac{ft}{FE} \times \frac{SL}{SE}$$

$$\eta = MA \times \frac{1}{VR}$$

$$\eta = \frac{MA}{VR}$$

ph FOR THE PREVIOUS PROBLEM, CALCULATE THE INPUT AND OUT PUT WORK AND EFFICIENCY.

$$\text{INPUT WORK} = F_E \times S_E$$

$$= 50 \times 1200 \text{ mm}$$

$$= 50 \times \frac{1200}{1000}$$

$$= 60 \text{ J}$$

$$\text{OUTPUT WORK} = F_L \times S_L = 450 \times \frac{100}{1000}$$

$$\text{EFFICIENCY} = \frac{\text{OUTPUT WORK}}{\text{INPUT WORK}} = \frac{45}{60} = 45 \text{ J}$$

$$= 75\%$$

2nd METHOD

$$\eta = \frac{MA}{VR} = \frac{F_L/F_E}{S_E/S_L} = \frac{450/50}{1200/100} = \frac{450}{50} \times \frac{100}{120}$$

$$= 0.75 = 75$$

FRICTION EFFORT

f_{th} = THEORETICAL EFFORT

$$f_{th} = \frac{\text{LOAD}}{\text{VELOCITY RATIO}} = \frac{Ft}{VR}$$

FRICTIONAL EFFORT = $F_E - F_{th}$

= ACTUAL FORCE − THEORETICAL FORCE

p14 A MACHINE CAN LIFT A 450 N WITH VELOCITY RATIO 12. ACTUAL FORCE IS 50 N.

CALCULATE FRICTIONAL EFFORT.

$$F_{th} = \frac{\text{LOAD}}{\text{VELOCITY RATIO}} = \frac{450}{12} = 37.5\ N$$

$$\text{FRICTIONAL EFFORT} = F_E - F_{th}$$

$$= 50 - 37.5$$

$$= 12.5\ N$$