Read 6.4-6.5

Exam II next Monday

H.w. solutions available

Practice questions

cover sheet with equations

coming before exam

Exam:

A: Start at 8:00

B: Start at 7:30

chapter 6
Energy

First talk about money

DEFINE money

CASH

CREDIT

LAND

STOCKS

⋮

Total amount of money DOES not change. Can be transferred from one type to another

Energy

Hard to define energy

Total amount of energy never changes

It is conserved

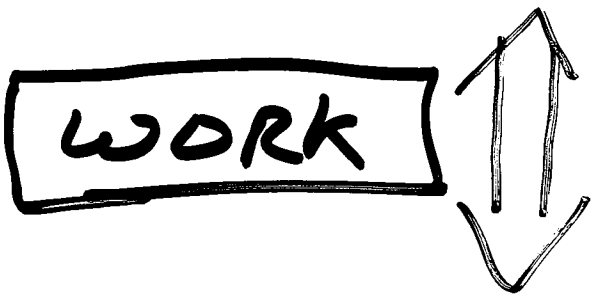
But it can be transferred from one system to another

mechanical Energy

E = Kinetic Energy + Potential Energy

System

- Energy of motion
  - = kinetic energy $(K) = \frac{1}{2}mv^2$
- stored energy
  - = potential energy (u)



Energy transfer

Environment

Energy → ability to do work

→ DEFINE Work

Lift a box of mass m at a constant velocity

1st lift straight up

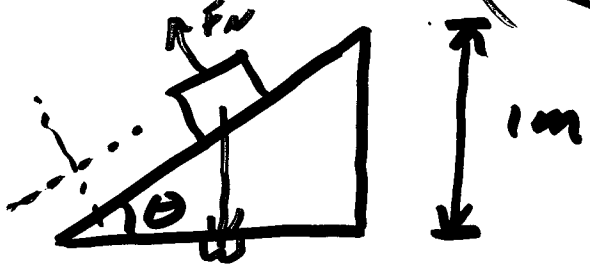
Force needed? $= mg$

Distance $= 1m$

Force x distance $= \boxed{(mg \times 1m)}$

$F = w = mg$

Now use ramp



Force $= F_N - w\sin\theta = 0$

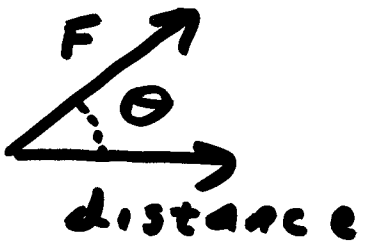
$F = mg\sin\theta$

Distance $= \sin\theta = \frac{1m}{L} \Rightarrow L = \frac{1m}{\sin\theta}$

Force x distance

$(mg\sin\theta)\left(\frac{1m}{\sin\theta}\right) = \boxed{(mg \times 1m)}$

Work is product of component of force along direction of displacement times magnitude of distance

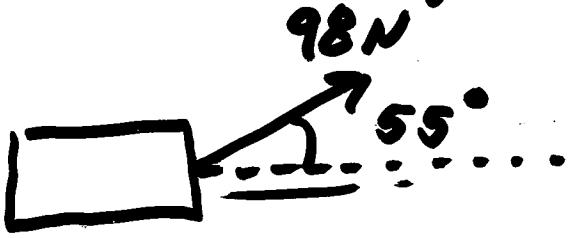


Work

$$W = F d \cos\theta$$

θ = angle between direction of force and direction of motion

ex) Pull a crate with a force of 98 N at an angle of 55° above the horizontal for 62 m. What is total work done by me on the crate?



$F = 98\,N$

$d = 62\,m$

$\theta = 55^\circ$

$W = Fd\cos\theta$

$= 98\,N \cdot 62\,m \cos 55^\circ$

$= 3490\,N\text{-}m$

New unit Joule (N-m)
(J)

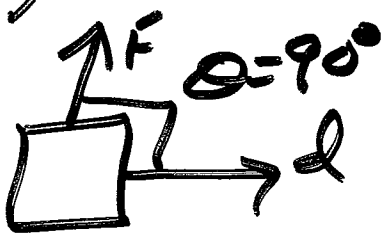
$= 3490\,J$

ex) I am carrying a package of mass 1kg a distance of 10m. How much work is done by me on the package?

$F = mg = (1kg)(9.8 m/s^2)$

$d = 10m$

$\theta = 90^\circ$



$\cos 90^\circ = 0$

$work = (mg)(10m) \cdot \cos 90^\circ =$

0J

ex) A weight lifter is holding up a weight of 300 N. How much work is he doing?

0J $d = 0$

There will always be an object or objects doing work on another object. NEED to determine what entity is doing the work on which object

Work is a scalar not a vector

SIGN ($\pm$) is important

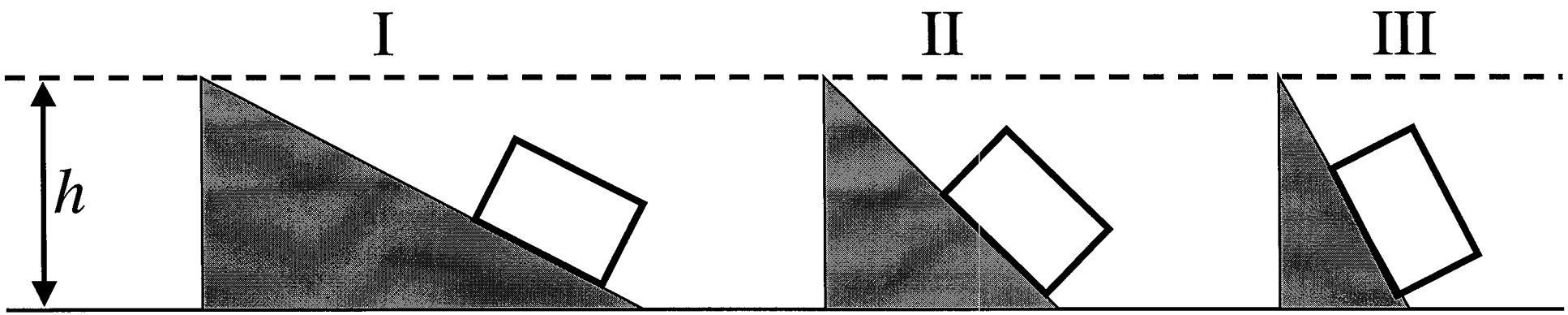
Interactive Question

You lift a 10 N physics book up in the air a distance of 1 meter at a constant velocity of 0.5 m/s. The work done by gravity is

A) +10 J
B) – 10 J
C) +5 J
D) –5 J
E) zero

Interactive Question

Consider the three different frictionless ramps shown below. If you push an identical box up each ramp at constant speed, rank the ramps in order from the one that would take the least work to the one that would take the most work.



A) I, II, III
B) III, II, I
C) II, I, III
D) I, III, II
E) None of the above

Interactive Question

Suppose you wanted to ride your mountain bike up a steep hill. Two paths lead from the base to the top, one twice as long as the other. Compared to the average force you would exert if you took the short path, the average force you exert along the longer path is

A) four times as small.
B) three times as small.
C) half as small.
D) the same.
E) it depends on the time taken.

Interactive Question

Suppose you wanted to ride your mountain bike up a steep hill. Two paths lead from the base to the top, one twice as long as the other. Compared to the work you would do if you took the short path, the work you do along the longer path is

A) four times as small.
B) three times as small.
C) half as small.
D) the same.
E) it depends on the time taken.