Review – Work-Energy - Physics 11 - notes for the video lesson - Chapter 4.1 and 4.2:

TOPICS: https://www.loom.com/share/260681a120ef4616ac2b3d87ab82bda1

Chapter 4.1: Energy Transformations

- Forms of energy – mechanical vs not mechanical
- Energy transformations

Chapter 4.2: Work

- W = Fd
- Horizontal
- Vertical
- Multiple forces and net work
- Positive work vs negative work
- Zero work
- Area under a F vs d graph = Work

Lesson Notes: Types

4.1 Energy

Mechanical

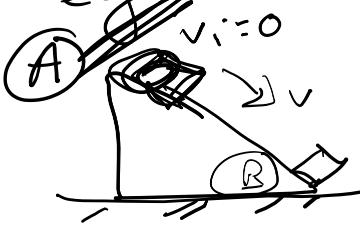
Kinetic energy
- energy of movement of a mass (matter)

Gravitational Potential Energy
(matter → has mass
- objects a ~~height~~ or separated by distance

Non-mechanical Energy
~~not~~ mass related
→ sound
- wave
(matter transmits wave ... but the energy is in the wave, not in the matter)
→ heat
→ solar radiation

Conservation of energy
- energy (total in the universe) cannot be created or destroyed
BUT it can change form

eg box sliding down a ramp
- $F_f > 0$



Ⓐ - gravitational PE
GPE decreases as it slides down
KE increases
- some E → heat + sound

d

scalar vectors

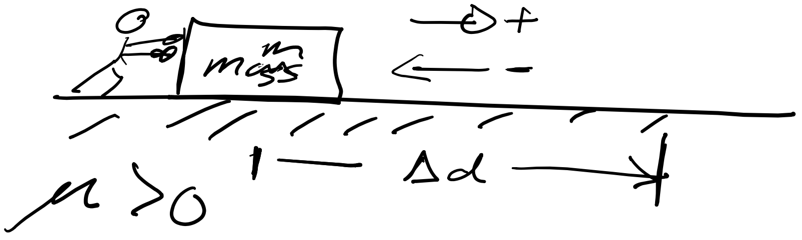
$$\boxed{4.2} \quad \boxed{\underset{\text{scalar}}{\text{Work}} = \underset{\text{vector}}{\vec{F}} \times \underset{\text{vector}}{\vec{d}}}$$

$$W = \vec{F} \times \vec{d}$$

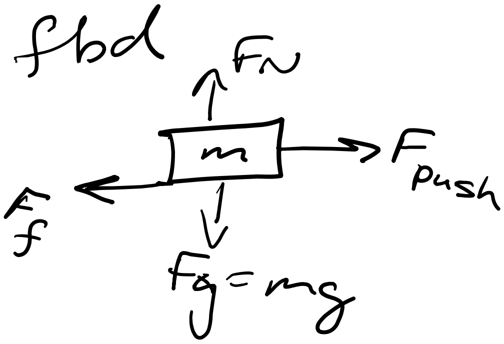
parallel components of $\vec{F}$ and $\vec{d}$

un

system diagram



fbd



$$\boxed{\underset{\substack{(N \cdot m)\\(J)}}{W_{F_p}} = \underset{(N)}{F_{push}} \times \underset{(m)}{\Delta d_x} = F_{push} \times d_x}$$

work done by $\underline{\underline{F_N}}$

$$W_{F_N} = F_N \times \Delta d_y \text{ (in direction of } F_N) = 0\text{ J}$$

work done by $\underline{\underline{F_g}}$

$$W_{F_g} = F_g \times \Delta d_y = 0\text{ J}$$

Work done by F_f

$$W_{F_f} = \vec{F_f} \times \vec{\Delta d_x} = (-F_f)\Delta d_x = -F_f \Delta d_x$$

$$\underline{\text{Net Work}} = W_{F_{push}} + W_{F_N} + W_{F_g} + W_{F_f}$$

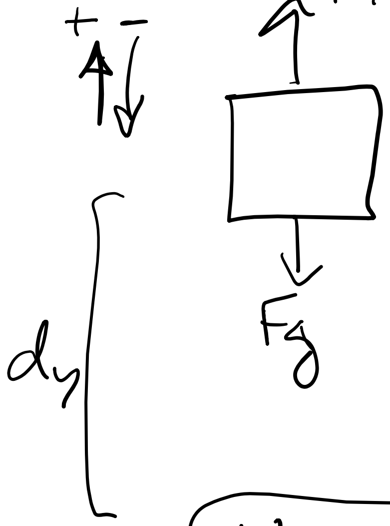
$$= F_{push} \times \Delta d_x + 0 + 0 + (-F_f \Delta d_x)$$

$$= (F_{push} - F_f)\,\Delta d_x$$

$$\boxed{W_{net} = \sum F_x \times d_x}$$

Vertical system

eg: elevator



$$W_{F_T} = F_T \times d_y$$

$$W_{F_g} = (-F_g) \times d_y$$

if d_y is down (negative)

$$W_{F_T} = -F_T \times d_y$$

$$W_{F_g} = (-F_g)(-d_y) = F_g \cdot d_y$$

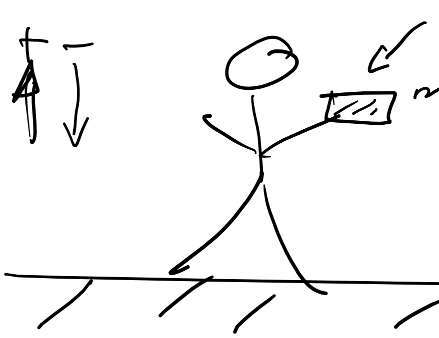
$$\boxed{\text{Net Work} = (F_g - F_T)\, d_y}$$

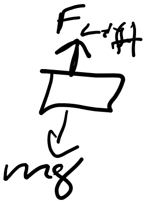
if d_y is ~~up~~ (positive)

$$W_{F_T} = F_T \cdot d_y$$

$$W_{F_g} = -F_g \cdot d_y$$

$$\boxed{W_{net} = (F_T - F_g)\, d_y}$$





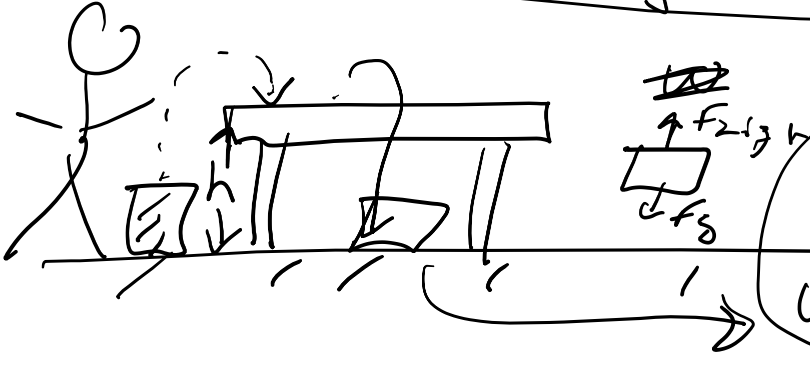
holding book stationary for hours....

tired... ugh....

$\Delta d = 0$

$$W_{F_{Lift}} = F_{Lift} \times \Delta d_y = 0J$$

$$W_{F_g} = -F_g \Delta d_y = 0J$$

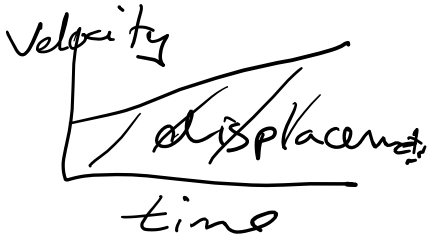


$$W = F_{Lift} \times h$$

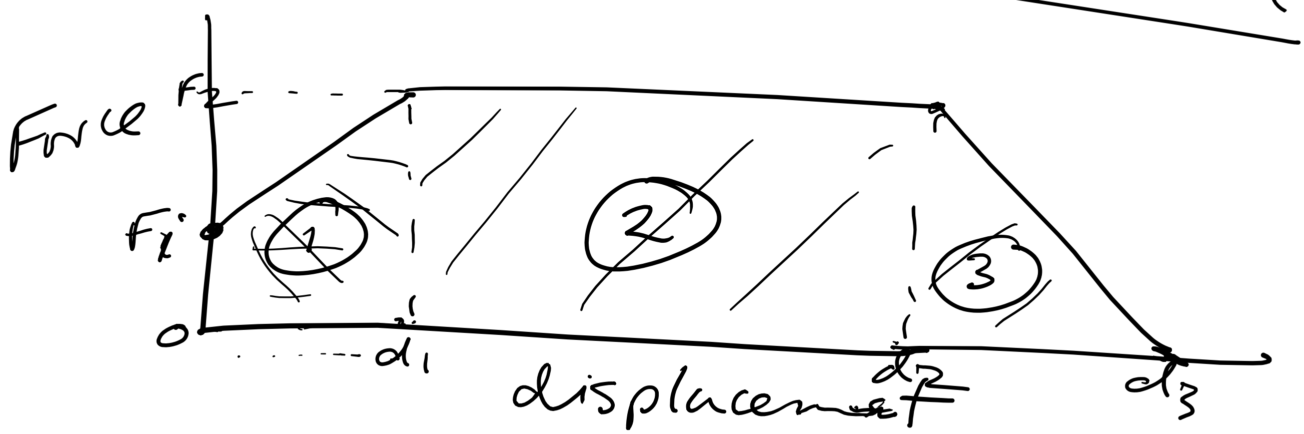
$$W = -F_g \times h$$

Net work = 0J

Area under graph → kinematices.



Area under $\vec{F}$ vs $\vec{d}$ graph = Work done



area ① $= \frac{1}{2}(F_1 + F_2)\,d_1$

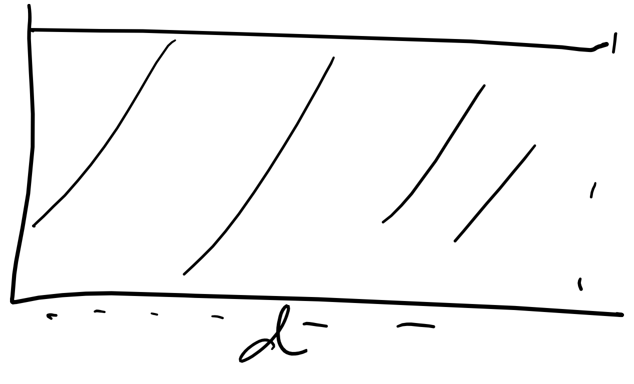
area ② $= (d_2 - d_1)\,F_2$

area ③ $= 1/2\,(d_3 - d_2)\,F_2$

Net work $= \frac{1}{2}(F_1 + F_2)\,d_1 + (d_2 - d_1)\,F_2 + 1/2\,(d_3 - d_2)\,F_2$

F

if F = constant



Area = $\vec{F} \cdot \vec{d} = W$