-h7 Kinetic Energy and Work

• Constant Force

$$W = \vec{F} \cdot \vec{d} = F \cos\theta \, d \qquad \text{Joul } (N.m)$$

↳ to use it, F should be cste in Mag and direction + object like particle

- Work can be:
  - Positive: Force adds energy to the system $(0 < \theta < 90^\circ)$
  - Zero: $\Rightarrow (\theta = 90^\circ)$ => Force does not add ~~or -~~ energy
  - negative: => Force decreases the Energy of the system $(\theta > 90)$

• Variable Force

- $$W = \int_{ri}^{rf} \vec{F} \cdot \vec{dr} = \int_{ri}^{rf} F \cos\theta \, dr = \int_{xi}^{xf} F_x \, dx + \int_{yi}^{yf} F_y \, dy + \int_{zi}^{zf} F_z \, dz$$

• (Remark!) the Area under the curve F_x vs x is (=) W

↳ $$W = \int_{xi}^{xf} F_x \, dx$$

• Work- Energy Theorem

- $W_{net} = \Delta K$ → Kinetic Energy
  - ↳ Work done by $\vec{F}_{net}$
- Units:
  - Joul
  - $1 KW.h$ = Kilowatt · hour = $3.6\,MJ$
    - ↳ used by Electrical companies

• Work Done by Gravity

$$W_g = (\vec{mg}) \cdot d \qquad \text{(Constant Force}$$

$$= \vec{mg} \cos\theta \, d$$

• In Circular Motion $W = 0$
Bcz θ between v and ~~θ~~ F ~~are~~ is 90
$\Rightarrow$ So $\cos 90 = 0$

Alaa Etaiwi

· Work Done by a spring force (variable force)

قوة المرونة في النابض (قانون هوك)

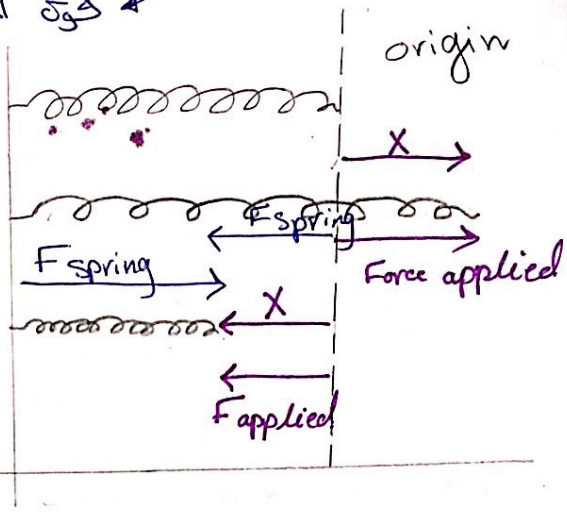
* $F_S = -kx$ (Hooke's law)

↳ elastic constant

which measures the stiffness of the spring so:

$k \uparrow$ → the material is stiffer

→ spring is stronger



$x^+ \Rightarrow$ stretched to the right

$x^- \Rightarrow$ " " " left

→ $W_S = \int_{x_i}^{x_f} F_x \, dx = \int_{x_i}^{x_f} -kx \, dx = -k \int_{x_i}^{x_f} x \, dx$

→ $W_S = -\frac{k}{2}(x_f^2 - x_i^2)$ if $x_i = 0 \Rightarrow W = -\frac{k}{2} x_f^2$

· Power القدرة scalar [Watt]

$P_{avg} = \frac{\Delta W}{\Delta t}$ $\frac{J}{s} = Watt$

$P_{instantinuous} = \vec{F} \cdot \vec{V}$

1hp : howrse power = 746 watt :قدرة الحصان

Alaa Ebaiwi