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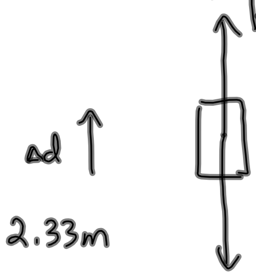
14. a) lifting

$F_a = 1765.8N$




$F_g = (180kg)(9.81m/s^2)$

$F_g = 1765.8N$

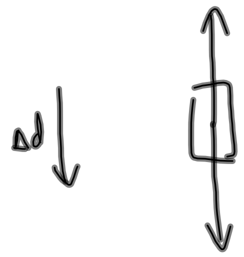
$W = F_{\parallel}\Delta d$

$W = (1765.8N)(2.33m)$

$W \doteq 4.11 \times 10^3 J$

b) lowering

$F_a = 1765.8N$




$F_g = 1765.8N$

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

$W = (1765.8N)(2.33m)\cos 180^\circ$

$W \doteq -4.11 \times 10^3 J$

↑ work done by $F_a$

c) lifting: $F_a$ does positive work
$F_g$ does negative work

lowering: $F_a$ does negative work
$F_g$ does positive work

## §6-2 Kinetic Energy + the Work-Energy Theorem

Kinetic energy is the energy of a moving object. It depends on the object's speed and mass.

$$E_k = \frac{1}{2}mv^2$$

Where $E_k$ is the kinetic energy (J)
$m$ is the mass (kg)
$v$ is the speed ($\frac{m}{s}$)

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$m = 0.200 kg$
$v_1 = 0$
$v_2 = 27.0 \frac{m}{s}$

a) $E_{k_1} = ?$
b) $E_{k_2} = ?$

a) at rest: $E_{k_1} = 0 J$

b) if $v_2 = 27.0 \frac{m}{s}$: $E_{k_2} = \frac{1}{2}mv_2^2$

$E_{k_2} = \frac{1}{2}(0.200 kg)(27.0 \frac{m}{s})^2$

$E_{k_2} = 72.9 J$

↑ Work must be done in order for the puck's kinetic energy to change.

Recall: $W = F_{\parallel}\Delta d$ and $F_{\parallel} = ma$

$$W = ma\Delta d$$

$$W = m\left(\frac{\Delta v}{\Delta t}\right)(v_{ave}\Delta t)$$

$$W = m(\Delta v)(v_{ave})$$

$$W = m(v_2 - v_1)\left(\frac{v_1 + v_2}{2}\right)$$

$$W = \frac{1}{2}m(v_2 - v_1)(v_1 + v_2)$$

$$W = \frac{1}{2}m(v_1v_2 + v_2^2 - v_1^2 - v_1v_2)$$

$$W = \frac{1}{2}m(v_2^2 - v_1^2)$$

$$W = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

$$W = \Delta E_k$$ ← WORK-ENERGY THEOREM

The work done on an object is equal to its change in kinetic energy.

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$m = 2.5\,kg$

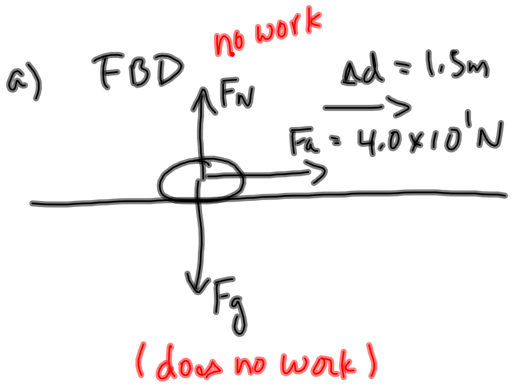
$F_a = 4.0 \times 10^1\,N$

$\Delta d = 1.5\,m$

a) $W = ?$

b) if $v_1 = 0$, $v_2 = ?$

a) FBD




Fa does positive work.

$$W = F_{\parallel} \Delta d$$

$$W = (4.0 \times 10^1\,N)(1.5\,m)$$

$$W = 6.0 \times 10^1\,J$$

b)

$$W = \Delta E_k$$

$$W = E_{k_2} - E_{k_1}$$

$$W = \tfrac{1}{2} m v_2^2 - 0$$

$$W = \tfrac{1}{2} m v_2^2$$

$$\frac{2W}{m} = v_2^2$$

$$v_2^2 = \frac{2(6.0 \times 10^1\,J)}{2.5\,kg}$$

$$v_2 = 6.9\,m/s$$

60J of work was done on the curling stone, so the curling stone's kinetic energy increased by 60J!

Positive Work => increases the energy

Negative Work => decreases the energy

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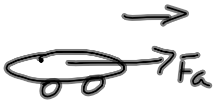


$m = 75\,kg$

$\Delta d = 5.0\,m$

$F_a = 2.0 \times 10^2\,N$

$v_1 = 8.0\,m/s$

$E_{k_2} = ?$

$W = \Delta E_k$

$F_{\parallel}\Delta d = E_{k_2} - E_{k_1}$ ← W

$E_{k_2} = E_{k_1} + F_{\parallel}\Delta d$

$E_{k_2} = \frac{1}{2}mv_1^2 + F_{\parallel}\Delta d$

$E_{k_2} = \frac{1}{2}(75\,kg)(8.0\,\frac{m}{s})^2 + (2.0 \times 10^2\,N)(5.0\,m)$

$E_{k_2} = 2400\,J + 1000\,J$
($E_{k_1}$) (W)

$E_k = \frac{1}{2}mv^2$

$E_{k_2} = 3400\,J$

you could find $v_2$ if asked!

TO DO

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② PP|245-246