Energy

Work = F d

Work – work is done to objects to give them mechanical energy

2 types of mechanical Energy

Potential Energy - stored energy in an object due to its height

Kinetic Energy - moving energy

Dec 4-7:54 AM

Work $W = F d$

A girl pushes a box with a force of 20N for a distance of 10m.
What was the work done on the box?

$W = Fd = 20N\ (10m) = 200\ Joules$

200J

Unit for energy is Joules

Dec 4-7:56 AM

A boy lifts a 4.0kg box a distance of 2.0m. What is the work done on the box?

$W = Fd = 39.2N\ (2m) = 78.4J$

*To lift an object up, you must apply the force up equal to the weight of the object.

Ex 4kg object weighs $4kg(9.8) = 39.2N$
So you need to apply 39.2N upward.

Dec 4-7:57 AM

A girl carries a 4.0kg toy across a room for a distance 8.0m. How much work was done on the toy?

$W = Fd$

ANSWER: ZERO (because the force you apply while carrying it is up, but the distance traveled is left/right)

↑ The force applied to the object must be in the direction of motion (distance)

Dec 4-7:58 AM

Potential Energy

$E_p = mgh$

- E_p: Potential Energy (J)
- m: mass (kg)
- g: $9.8\ m/s^2$
- h: height (m)

Dec 4-8:37 AM

A 200kg roller coaster is at the top of a 20m high hill. What is the potential energy of the roller coaster?

$E_p = mgh = (200kg)(9.8\ m/s^2)(20m)$

$= 39200J$

Dec 4-1:52 PM

A boy lifts a 15kg box to a shelf 2.0m high. What is the potential energy of the box on the shelf? How much work did the boy do to the box?

$E_p = (15\,kg)(9.8\,m/s^2)(2.0m) = 294\,J$

$W = Fd = 147N(2) = 294\,J$

$w = mg = (15\,kg)(9.8) = 147N$

Dec 4-1:53 PM

Power

$P = \frac{W}{t}$ ← How much work/Energy is used/done (Joules)

← how long did it take to use the energy? (Seconds)

Power

J/s = Watt (W)

Dec 4-1:54 PM

If something uses 400watts of power. This means it uses 400 Joules per second.

Dec 4-1:54 PM

A worker does 300J of work in 10s. How much power did they exert?

$$P = \frac{W}{t} = \frac{300J}{10s} = 30J/s = 30W$$

Dec 6-8:14 AM

A girl pushes a box with a force of 40N for 10m. It takes her 5.0s to do it. What was her Power?

$$P = \frac{W}{t} = \frac{400J}{5.0s} = 80J/s = 80W$$

$$W = Fd = 40N(10m) = 400J$$

Dec 6-8:16 AM

A worker lifts a 20kg box from the floor to a 2.0m high shelf. He does it in 1.2s. What was his power?

$$P = \frac{W}{t} = \frac{392J}{1.2s} = 327W$$

$$E_p = mgh = (20kg)(9.8m/s^2)(2.0m) = 392J$$

Dec 6-8:19 AM

Kinetic Energy

(moving energy)

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

Kinetic Energy (Joules)

mass (Kg)

Velocity (m/s)

Dec 7-7:29 AM

A 1200kg car is traveling at 20m/s. What is the kinetic energy of the car?

$E_K = \frac{1}{2}mv^2 = \frac{1}{2}(1200\text{kg})(20\text{m/s})^2$

$= \frac{1}{2}(1200)(400)$

$= 240{,}000\text{J}$

Dec 7-7:30 AM

A 0.050kg bullet is traveling toward a target. While traveling in the air, it has 20J of kinetic energy. What is the velocity of the bullet?

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

$20J = \frac{1}{2}(.050kg)v^2$

$\frac{20}{.025} = \frac{.025v^2}{.025}$

$\sqrt{800} = \sqrt{v^2}$

$v = 28.3 m/s$

Dec 7-7:31 AM

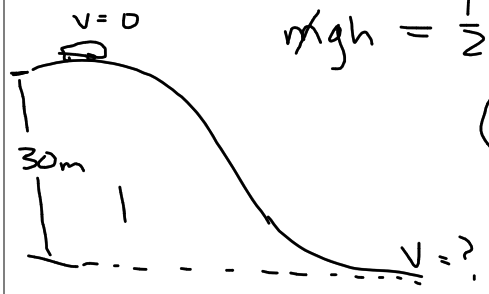
Conservation of Energy

two types of Energy an object can have:

Potential	mgh
Kinetic	$\frac{1}{2}mv^2$

Dec 10-8:01 AM

A roller coaster is at rest on the top of a 30m high hill. What is the velocity of the roller coaster when it gets to the bottom of the hill?



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

$(9.8)(30) = \frac{1}{2}v^2$

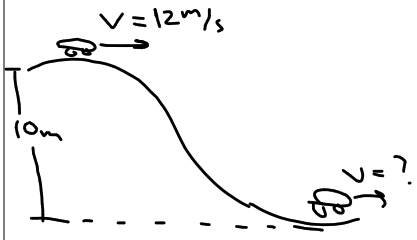
$(2)\ 294 = \frac{1}{2}v^2 \times$

$\sqrt{588} = \sqrt{v^2}$

$v = 24.2 m/s$

Dec 10-8:02 AM

A roller coaster is traveling 12m/s at the top of a 10m high hill. How fast is the roller coaster traveling at the bottom of the hill?



$\frac{1}{2}mv_i^2 + mgh_i = \frac{1}{2}mv_f^2$

B4 AFTER

$\frac{1}{2}v^2 + gh_i = \frac{1}{2}v_f^2$

$\frac{1}{2}(12)^2 + 9.8(10) = \frac{1}{2}v_f^2$

$72 + 98 = \frac{1}{2}v_f^2$

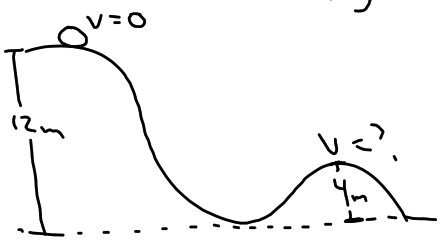
$(2)\ 170 = \frac{1}{2}v^2(2)$

$340 = v^2$

$v = 18.4 m/s$

Dec 10-8:03 AM

A rock at rest is at the top of a 12m high hill. It rolls down the hill and back to the top of a second hill only 4m high. What is the velocity at the top of the second hill?



$mgh_i = \frac{1}{2}mv^2 + mgh_f$

$gh_i = \frac{1}{2}v^2 + gh_f$

$(9.8)(12) = \frac{1}{2}v^2 + 9.8(4)$

$117.6 = \frac{1}{2}v^2 + 39.2$

$78.4 = \frac{1}{2}v^2$

$156.8 = v^2$

$v = 12.5\ m/s$

Dec 10-8:03 AM

Super man ride at Magic Mountain has a roller coaster that travels at 60 m/s into a hill. How high will the roller coaster go before it stops?

Dec 10-8:04 AM