GPE and Kinetic Energy
01 October

Lesson Aims:

All learners:

1. All energy is measured in Joules.

Most learners:

1. Gravitational potential energy.
2. Kinetic energy formula.
3. Rearranging the kinetic energy formula.

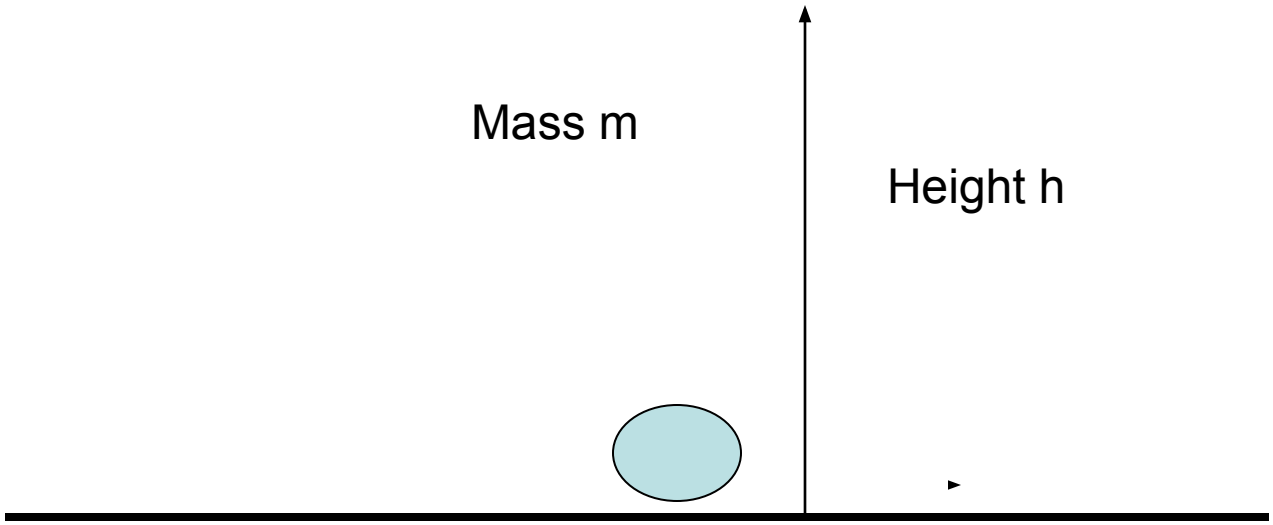
Some learners:

1. Complete all tasks.

Starter !!

1. What is the formula for Weight ?
2. What is the formula for work done?
3. What is the value of g on Earth ?

Gravitational Potential Energy



When an object is lifted up close to the Earth's surface, work is done against the gravitational force:

$$GPE = F \times h = m \times g \times h$$

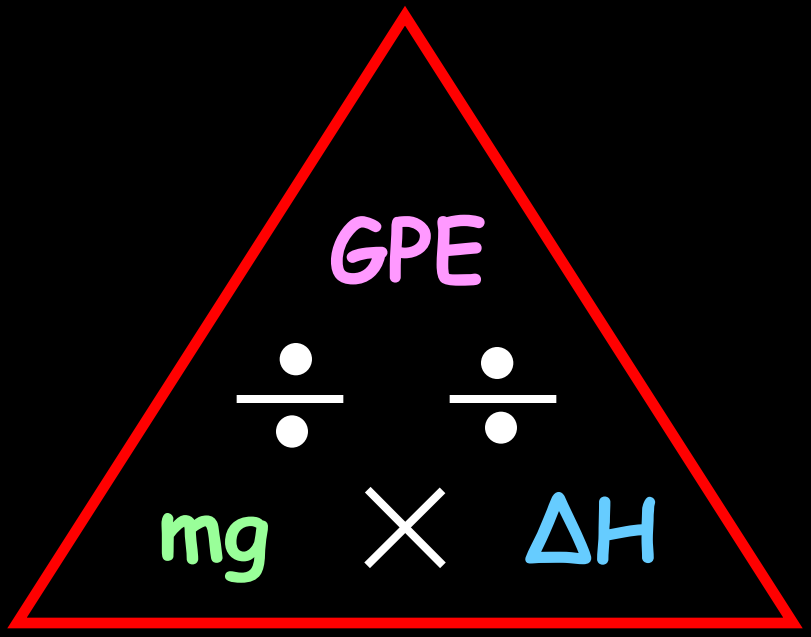
This energy is stored in the field.

To work out how much gravitational potential energy (GPE) an object gains when it is lifted up we would use the simple equation…

GPE = Weight x Change in height

(Joules) *(newtons)* *(metres)*

(Remember - W=mg)



GPE Questions

1 Goods in a warehouse are stored on shelves. Table **A** shows the changes in gravitational potential energy as different items are put onto their shelves.

Calculate the missing values in the table.

	Change in GPE	Mass	Change in height
a		4 kg	2 m
b		2.5 kg	3 m
c		500 g	2.5 m
d	800 J		2 m
e	1125 J	75 kg	
f	1.5 kJ	50 kg	
g	50 J		50 cm

A

2 **a** Calculate the change in GPE when an astronaut lifts a 2 kg hammer onto a shelf 1.5 m above the floor in a base on the Moon. The gravitational field strength on the Moon is 1.6 N/kg.

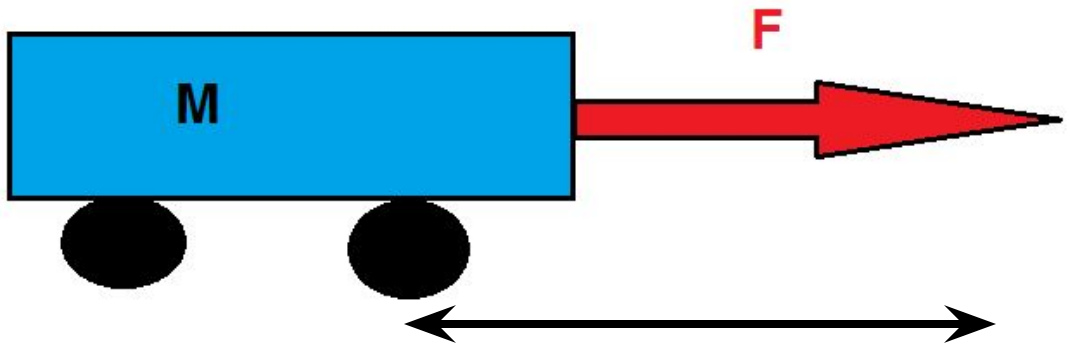
b The same hammer is lifted onto a shelf of the same height on Mars. It gains 11.1 J of GPE.

Calculate the gravitational field strength on Mars.

c A space probe with a mass of 400 kg lands on Titan (one of the moons of Saturn). When it is 500 m above the surface it stores 280 kJ of GPE.

Calculate the gravitational field strength on Titan.

Kinetic Energy



When a force accelerates an object, the work done is transferred as kinetic energy of the object.

We have:

$$\Delta W = F\Delta x = ma\Delta x.$$

$$but\ a = \frac{(v^2 - u^2)}{2x}$$

$$So\ \Delta W = \frac{m(v^2 - u^2)}{2}\ represents\ increase\ in\ kinetic\ energy$$

$$Or\ KE = \tfrac{1}{2}mv^2$$

Examples !!

1. A car of mass 1200kg is moving at 10 m/s. Calculate its kinetic energy.
2. A bullet of mass 0.10kg moves at 500 m/s. Calculate its kinetic energy.
3. A football of mass 0.55kg has kinetic energy equal to 400J. Rearrange the formula to find the speed of the ball.