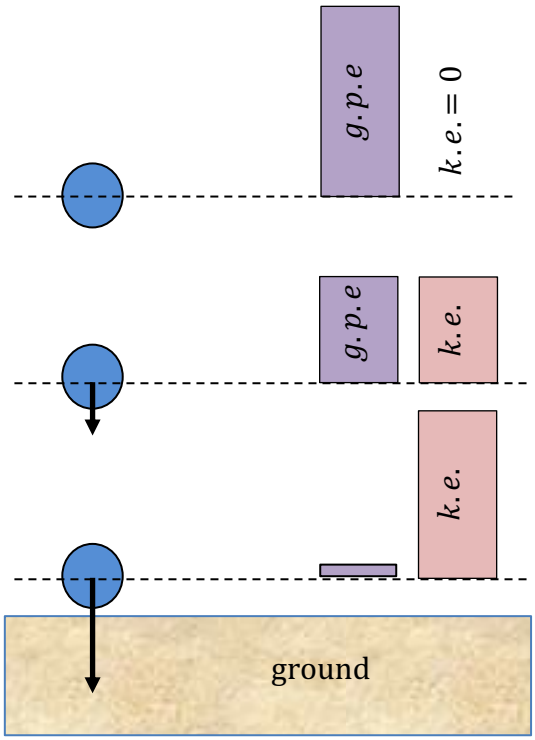
1.2 Changes in energy

Energy can't be created or destroyed, but it can be transferred from one energy store to another.

Consider an object falling. When the object is up high (to start), it has a store of gravitational potential energy (*g.p.e*). As it falls towards the Earth, its store of gravitational potential energy is transferred to kinetic energy (*k.e.*).



(1) What energy transfer is taking place when a catapult is used to fire a pebble vertically upwards?

(2) What energy transfer is taking place when a battery is used in a circuit to light a bulb?

(3) What energy transfer is taking place when brakes on a car are used to decelerate?

Calculating energy stores

We can use the following equations to calculate gravitational potential, kinetic and elastic potential energy stores.

gravitational potential energy

When we lift an object through a certain height (Δh) in a gravitational field, it gains gravitational potential energy ($\Delta g.p.e$).

$$\Delta g.p.e = m \times g \times \Delta h$$

where m=mass of object, g=gravitational field strength (= 9.8N/kg on Earth)

kinetic energy

When an object is moving at a speed v, it has a store of kinetic energy.

$$k.e. = 0.5 \times m \times v^2$$

where m=mass of moving object

elastic potential energy

When a spring is stretched or compressed by a distance Δx, it gains a store of elastic potential energy ($\Delta e.p.e.$).

$$\Delta e.p.e. = 0.5 \times k \times \Delta x^2$$

where k=spring constant

(4) Calculate the change in gravitational potential energy ($\Delta g.p.e$) when a 1kg mass is lifted up by 10m.

(5) Calculate the kinetic energy of a bus (3000kg) travelling at 10m/s.

(6) Calculate the gain in elastic potential energy ($\Delta e.p.e.$) when a spring (k=3.5 N/m) is stretched by 0.01m.

(7) A 5kg mass is lifted up by 30m. What is its gain in gravitational potential energy.

(8) The 5kg mass in the previous question is dropped. What is its kinetic energy just before it hits the ground?

(9) What is the speed of the 5kg, in the previous question, just before it hits the ground? (Hint: You will need to rearrange the k.e. equation to find the speed)

(10) Experimentally, it is found that the speed at which the 5kg mass hits the ground is less than calculated. Why might this be?