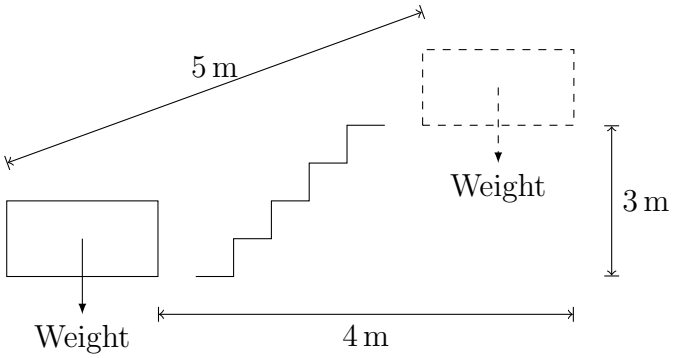
On types of energy

A.C. Norman
anorman@bishopheber.cheshire.sch.uk

Warm-up problems

1. Name four types of energy. What is the unit of energy, and why is energy such a useful quanitity in physics?

2. A box of mass 4 kg is lifted up a set of stairs as shown. Show how to calculate the amount of work which has been done, and explain your calculation.



3. Write down the formulæ which can be used to work out gravitational potential energy and kinetic energy. Make sure you write down what each of the symbols means, and what unit is usually used to measure it.

Regular problems

4. In each situation, calculate the work done (=energy transferred).

   (a) A force of 2000 N pulls a truck a distance of 40 m in the direction of the force?

   (b) A force of 20 N makes an object move 4.8 m in the direction of the force.

   (c) An object weighing 80 N is raised 1.2 m.

5. A car of mass 800 kg is pushed with a constant force of 450 N a distance of 12 m. There is a constant frictional force of 60 N.

   (a) How much work is done by the person pushing the car?

   (b) How much of this work is done against friction?

   (c) How much kinetic energy does the car end up having?

   (d) How fast does the car end up going?

6. A tennis ball weighing 0.5 N is dropped from a height of 1 m. It only bounces to a height of 0.6 m.

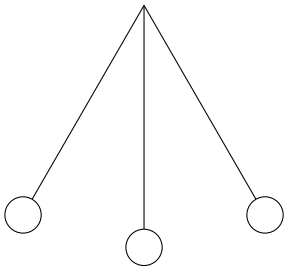
   (a) How much gravitational potential energy did it have at the start?

   (b) With what speed did it hit the floor?

   (c) How much gravitational potential energy did it have at the end?

   (d) Where did the extra energy go?

7. Draw a simple flow chart to show the energy changes that happen in each swing of a pendulum.



8. A wicked goblin has fallen down a well which is 15 m deep.

   (a) How much gravitational potential energy must the goblin gain if it is to escape from the well? (It is a well known fact that goblins have a mass of 39 kg.)

   (b) The sides of the well are very smooth and slippery, so climbing out is not an option. The goblin must try to jump out of the well. How quickly must the goblin jump upwards in order to have enough kinetic energy to be able to escape?

Extension problems

9. A brick is dropped from a scaffolding onto the floor. When the builder has climbed down to retrieve it, he finds it lying still on the floor. Where has all the energy gone? Explain how this happened. Could you convince the builder (and me!) that energy has been conserved?

10. It is often said that we use too much energy (sometimes there is talk of an 'energy crisis' if the energy supply cannot match up to the demand). If energy cannot be created or destroyed, how can we 'use up' energy? Why isn't it possible to keep 'using' the same energy over and over again?