1

This question consists of a list of statements **a)** to **h)**. Some are true and some are false. **Write down** which are true, and which are false.

a) If two objects are travelling at the same velocity, the one with the **greater mass** will have **more kinetic energy**.
b) **Gravitational** potential energy is the **only type** of potential energy in which scientists are interested.
c) Two objects of the **same mass** will always have the **same kinetic energy**.
d) If one object is **double the height** above ground than another with the same mass, it will have **double the kinetic energy**.
e) **Kinetic energy** is measured in **joules**.
f) The **faster** an object travels, the greater its **potential energy**.
g) The gravitational field strength, g, is important when working out **kinetic energy**.
h) If two different cans are on the **same shelf**, they will have the **same gravitational potential energy**.

2

A light aircraft is taking a group of parachutists up into the air. Dressed in her parachuting gear, Amy has a mass of 90kg. The aircraft takes the group up to a height of 5000m before they jump.

a) How much **gravitational potential** energy does Amy gain?

Amy jumps from the aircraft and free falls to a height of 3000m before opening her main parachute.

b) How much more gravitational potential energy does she have when this happens than when she started off on the ground?

The main parachute fails to open properly. Amy jettisons it — its mass is 5kg — and opens her reserve parachute.

c) How much gravitational potential energy does she have when she is 1500m above the ground?

3

A tourist's Fiat is driving along a mountain road. The combined mass of the car and luggage is 2920kg. The car is powering uphill at 23m/s.

a) **How much** kinetic energy does the car have?

At the top of the road, the car has gained a total height of 1200m.

b) **Calculate** the potential energy the car has gained.

As the car rounds a bend at the top of the mountain, a suitcase falls from the roof into the valley below. The suitcase has a mass of 20kg.

c) Work out the **potential energy** the suitcase lost when it had fallen a distance of 60m.

d) If all of this potential energy of the suitcase is converted into kinetic energy, **how fast** will it be travelling when it has fallen 60m?

e) Explain why it will not actually be travelling **as fast** as this.

4

A bouncy ball has a mass of 0.3kg. It is dropped from a height of 3.0m.

a) **How much** potential energy has the ball lost when it hits the ground?

b) Ignoring air resistance, **how fast** will the ball be travelling?
The ball rebounds vertically at a speed of 7.0m/s.

c) What **kinetic energy** does it now have?

d) What **height** will it reach on the rebound?

e) **Explain** what has happened to the energy that the ball has lost.

5

Some workmen are using a rope to lower a bucket full of bricks from a window. They tie off the rope when the bucket is just above the ground. As they are making their way downstairs to unload the bucket, a strong wind sets the bucket swinging.

Draw a diagram of the **path** of the swinging bucket. On your diagram:

mark with the letter A — where the **potential** energy is greatest.

mark with the letter B — where the **kinetic** energy is greatest.

mark with the letter C — where the bucket is travelling **fastest**.

mark with the letter D — where the bucket's **velocity** is zero.

6

a Calculate the kinetic energy of a car of mass 600 kg travelling at 25 m/s.

b The car in part a slows down to a speed of 12 m/s. By how much has its kinetic energy decreased?

c A walker carries a 20 kg pack on his back. He climbs to the top of a mountain 2500 m high. Calculate the gain in gravitational potential energy of the pack. (Acceleration due to gravity $g = 10\ m/s^2$.)

A girl throws a ball upwards. The ball has a mass of 0.20 kg and it leaves her hand with a speed of 8 m/s.

d How high will it rise?

e In a game, a toy car slides down a slope. If the top of the slope is 2.0 m higher than the foot of the slope, how fast will the car be moving when it reaches the foot? (Assume that all of its g.p.e. is transformed to k.e.)