1 A child's toy launches a model parachutist of mass 0.40 kg vertically upwards. The model parachutist reaches a maximum height of 8.5 m.

(a) Calculate

(i) the gravitational potential energy gained by the model parachutist,

energy = ... [2]

(ii) the minimum possible speed with which the model parachutist was launched.

speed = ... [3]

(b) In practice, the launch speed must be greater than the value calculated in **(a)(ii)**.

Explain why.

.....

.....

..... [2]

(c) As the model parachutist returns to the ground, it loses gravitational potential energy.

Explain what happens to this energy as the model parachutist falls through the air at constant speed.

.....

..... [1]

[Total: 8]

2 The Sun is a large sphere of high temperature gas. An extremely large quantity of energy radiates from the Sun into space every second.

(a) A process releases energy inside the Sun and its temperature stays high.

State the name of this process.

..... [1]

(b) A gardener stores water in a large, cylindrical metal drum. The drum is painted black and has no lid. On a bright, sunny day, the water evaporates quickly and the water level in the drum falls.

(i) Suggest how, by using a drum of a different shape, the gardener can reduce the quantity of water lost by evaporation.

.....

..... [1]

(ii) The gardener is told that, by painting the drum white, he can reduce the quantity of radiation absorbed and so reduce the rate of evaporation.

Describe an experiment to show that black surfaces are better absorbers of radiation than white surfaces. You may include a diagram.

.....

.....

.....

.....

..... [4]

[Total: 6]

3 **(a)** State an example of the conversion of chemical energy to another form of energy.

example .....

energy conversion ..... [1]

(b) The electrical output of a solar panel powers a pump. The pump operates a water fountain. The output of the solar panel is 17 V and the current supplied to the pump is 0.27 A.

(i) Calculate the electrical power generated by the solar panel.

power = ... [2]

(ii) The pump converts electrical energy to kinetic energy of water with an efficiency of 35%.

Calculate the kinetic energy of the water delivered by the pump in 1 second.

kinetic energy = ... [2]

(iii) The pump propels 0.00014 m^3 of water per second. This water rises vertically as a jet. The density of water is 1000 kg/m^3.

Calculate

1. the mass of water propelled by the pump in 1 second,

mass = ... [2]

2. the maximum height of the jet of water.

maximum height = ... [2]

[Total: 9]

4 Fig. 1.1 shows a car on a roller-coaster ride.

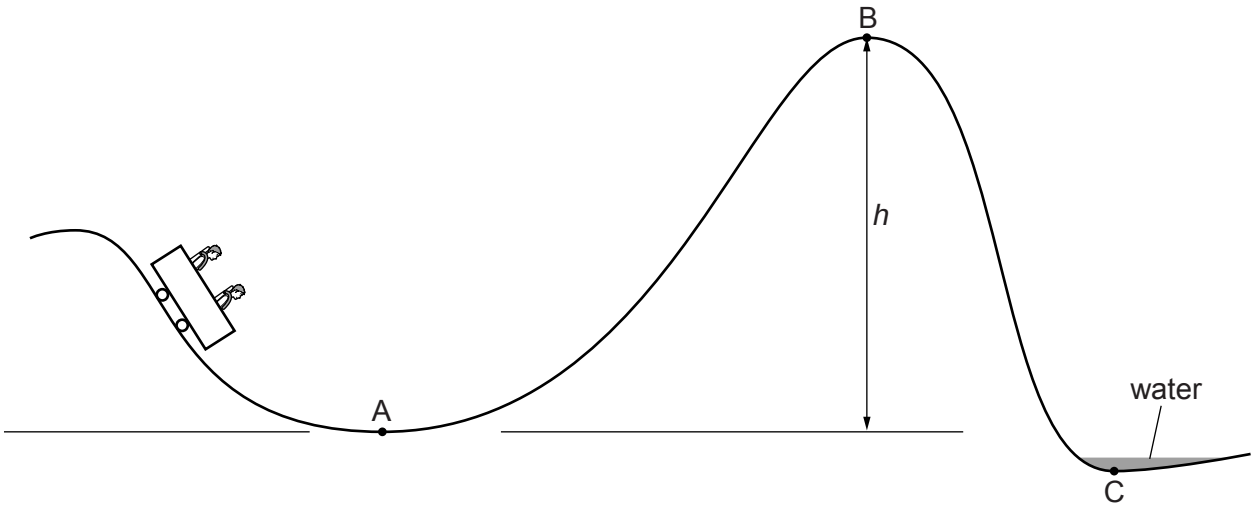

Fig. 1.1

mass of car = 600 kg
kinetic energy of car at point A = 160 kJ

(a) Calculate the speed of the car at A.

speed = ... [3]

(b) As the car travels from A to B, it loses 40 kJ of energy due to friction.

The car just manages to roll over the crest of the hill at B.

Calculate the height *h*.

height *h* = ... [2]

(c) At C, the car is slowed down by a shallow tank of water and the kinetic energy of the car is reduced to zero.

Make **three** suggestions for what happens to this kinetic energy.

1. .....

2. .....

3. .....

[3]

[Total: 8]

5 Some builders decide to measure their personal power ratings using apparatus they already have on site. Fig. 2.1 shows the arrangement they use.

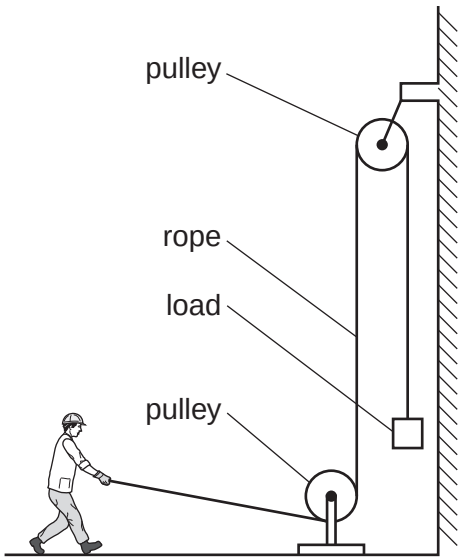

Fig. 2.1

(a) In the table below, list the three quantities they must measure in order to calculate one man's power, and the instrument they would use for each measurement.

quantity to be measured	instrument used for measurement
1.	
2.	
3.	

[3]

(b) One workman is measured as having a power of 528 W. His weight is 800 N.

He can develop the same power climbing a ladder, whose rungs are 30 cm apart.

How many rungs can he climb in 5 s?

number of rungs = ...[3]

(c) The human body is only about 15% efficient when climbing ladders.

Calculate the actual energy used from the body of the workman in **(b)** when he climbs 20 rungs.

energy used = ...[2]

[Total: 8]

6 Fig. 2.1 shows a conveyor belt transporting a package to a raised platform. The belt is driven by a motor.

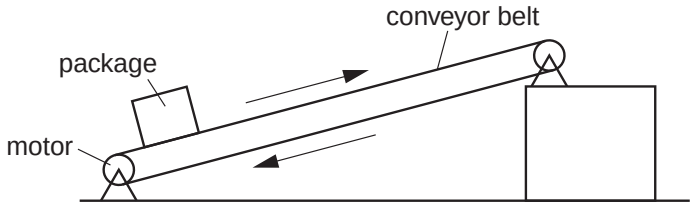

Fig. 2.1

(a) State **three** types of energy, other than gravitational potential energy, into which the electrical energy supplied to the motor is converted.

1. .....

2. .....

3. .....[2]

(b) The mass of the package is 36 kg. Calculate the increase in the gravitational potential energy (p.e.) of the package when it is raised through a vertical height of 2.4 m.

increase in p.e. = ...[2]

(c) The package is raised through the vertical height of 2.4 m in 4.4 s. Calculate the power needed to raise the package.

power = ... [2]

(d) Assume that the power available to raise packages is constant. A package of mass greater than 36 kg is raised through the same height. Suggest and explain the effect of this increase in mass on the operation of the belt.

.....

.....

.....

.....

.....[3]

[Total: 9]