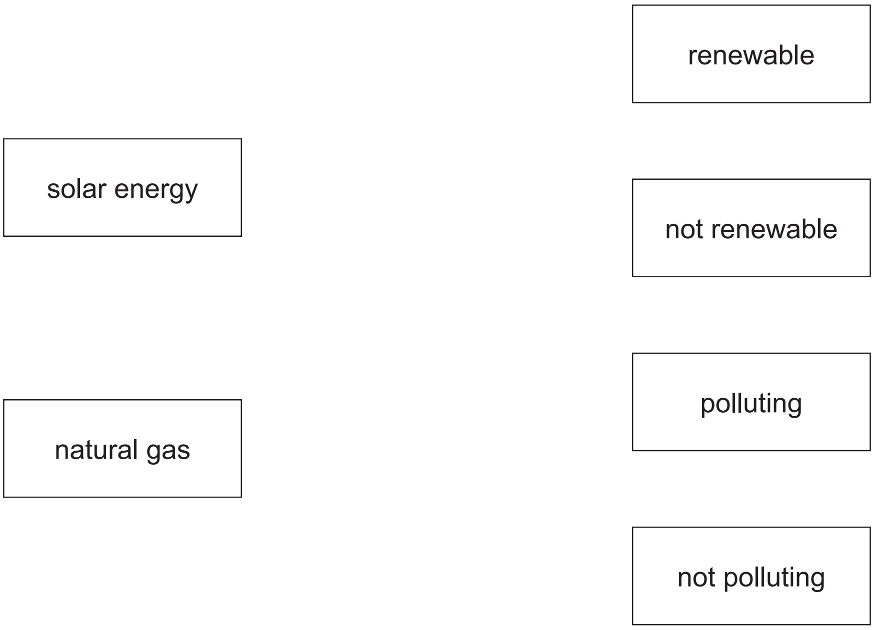
Energy Resources 2 chpt 15 - 18 Revision

1)

(a) The boxes on the left contain the names of some sources of energy. The boxes on the right contain properties of some sources of energy.

Draw **two** straight lines **from each box** on the left to the two boxes on the right which describe that source of energy.



[2]

(b) Coal-fired power stations are polluting.

State an advantage of using coal as a source of energy.

....

....[1]

(c) A coal-fired power station generates electricity at night when it is not needed.

Some of this energy is stored by pumping water up to a mountain lake. When there is high demand for electricity, the water is allowed to flow back through turbines to generate electricity.

On one occasion, 2.05×10^8 kg of water is pumped up through a vertical height of 500 m.

(i) Calculate the weight of the water.

weight = ...[1]

1 cont)

(ii) Calculate the gravitational potential energy gained by the water.

energy gained = ...[2]

(iii) The electrical energy used to pump the water up to the mountain lake is 1.2×10^{12} J. Only 6.2×10^{11} J of electrical energy is generated when the water is released.

Calculate the efficiency of this energy storage scheme.

efficiency = ...[2]

[Total: 8]

2) An electric train is initially at rest at a railway station. The motor causes a constant force of 360 000 N to act on the train and the train begins to move.

(a) State the form of energy gained by the train as it begins to move.

....[1]

(b) The train travels a distance of 4.0 km along a straight, horizontal track.

(i) Calculate the work done on the train during this part of the journey.

work done = ...[2]

(ii) The mass of the train is 450 000 kg.

Calculate the maximum possible speed of the train at the end of the first 4.0 km of the journey.

maximum possible speed = ...[3]

(iii) In practice, the speed of the train is much less than the value calculated in **(ii)**.

Suggest **one** reason why this is the case.

....

....[1]

(c) After travelling 4.0 km, the train reaches its maximum speed. It continues at this constant speed on the next section of the track where the track follows a curve which is part of a circle.

State the direction of the resultant force on the train as it follows the curved path.

....[1]

[Total: 8]

3) Fig. 3.1 shows a skier taking part in a downhill race.

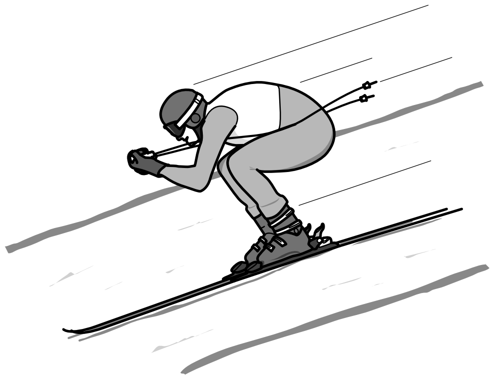


Fig. 3.1

(a) The mass of the skier, including his equipment, is 75 kg. In the ski race, the total vertical change in height is 880 m.

Calculate the decrease in the gravitational potential energy (g.p.e.) of the skier.

decrease in g.p.e. = ...[2]

(b) The skier starts from rest. The total distance travelled by the skier during the descent is 2800 m. The average resistive force on the skier is 220 N.

Calculate

(i) the work done against the resistive force,

work done = ...[2]

(ii) the kinetic energy of the skier as he crosses the finishing line at the end of the race.

kinetic energy = ...[2]

(c) Suggest why the skier bends his body as shown in Fig. 3.1.

....[1]

[Total: 7]

4) A soft rubber ball of mass 0.15 kg is dropped, in a vacuum, from a height of 2.0 m on to a hard surface. The ball then bounces.

(a) State the main energy changes taking place when

(i) the ball is falling,

....

(ii) the ball hits the surface and is changing shape,

....

(iii) the ball is regaining its shape and is rising from the surface.

....
[3]

(b) Calculate the speed with which the ball hits the surface.

speed = ... [4]

(c) After rebounding from the surface, the ball rises to a height of 1.9 m.

Suggest why the height to which the ball rises is less than the height from which the ball falls.

....

....[1]

[Total: 8]

5) Fig. 3.1 shows the descent of a sky-diver from a stationary balloon.

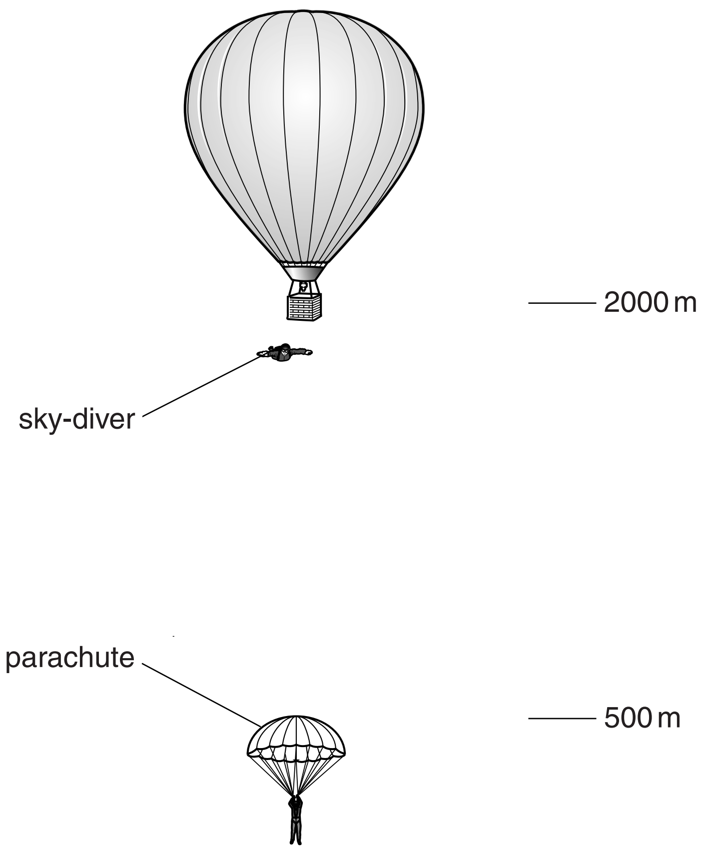


Fig. 3.1 (not to scale)

The sky-diver steps from the balloon at a height of 2000 m and accelerates downwards.

His speed is 52 m/s at a height of 500 m.

He then opens his parachute. From 400 m to ground level, he falls at constant speed.

(a) The total mass of the sky-diver and his equipment is 92 kg.

(i) Calculate, for the sky-diver,

1. the loss of gravitational potential energy in the fall from 2000 m to 500 m,

loss of gravitational potential energy = ... [2]

2. the kinetic energy at the height of 500 m.

kinetic energy = ... [2]

(ii) The kinetic energy at 500 m is not equal to the loss of gravitational potential energy. Explain why there is a difference in the values.

....

....

....[1]

(b) State

(i) what happens to the air resistance acting on the sky-diver during the fall from 2000 m to 500 m,

....[1]

(ii) the value of the air resistance during the fall from 400 m to ground.

air resistance = ...[1]

[Total: 7]

6) Fig. 4.1 shows a cross-section of a double-walled glass vacuum flask, containing a hot liquid. The surfaces of the two glass walls of the flask have shiny silvered coatings.

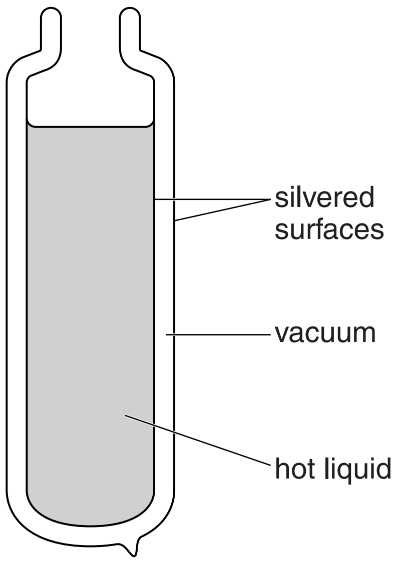


Fig. 4.1

(a) Explain

(i) why the rate of loss of thermal energy through the walls of the flask **by conduction** is very low,

....

....

....

....

(ii) why the rate of loss of thermal energy through the walls of the flask **by radiation** is very low.

....

....

....

....

[3]

(b) Suggest, with reasons, what must be added to the flask shown in Fig. 4.1 in order to keep the liquid hot.

....

....

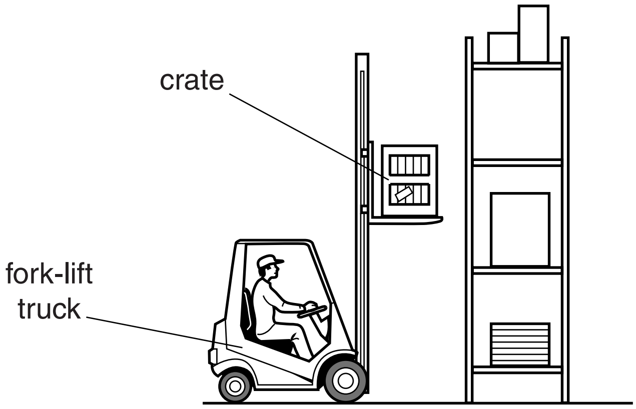
....

....

.... [3]

[Total: 6]

7) Fig. 3.1 shows a fork-lift truck lifting a crate on to a high shelf in a warehouse.



The fork-lift truck lifts a crate of weight 640 N through a vertical distance of 3.5 m in 4.0 s.

(a) Calculate the useful work done in lifting the crate.

work done = ... [2]

(b) A motor drives a mechanism to lift the crate. The current in the motor is 25 A. The motor is connected to a 75 V battery.

Calculate

(i) the energy supplied to the motor in 4.0 s,

energy = ... [2]

(ii) the overall efficiency of the fork-lift truck in lifting the crate.

efficiency = ... [2]

(c) Not all of the energy supplied is used usefully in lifting the crate.

Suggest two mechanisms by which energy is wasted.

1. ....

2. .... [2]

[Total: 8]

8) 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.

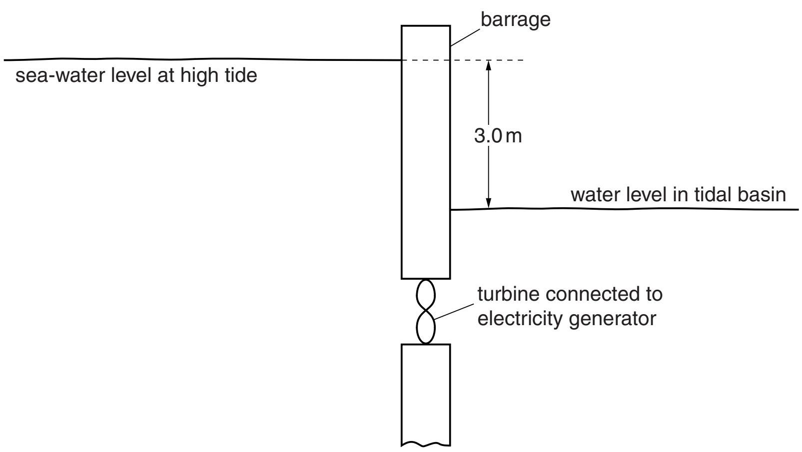
Explain what happens to this energy as the model parachutist falls through the air at constant speed.

....

.... [1]

[Total: 8]

9) Fig. 3.1 shows a water turbine that is generating electricity in a small tidal energy scheme.



At high tide, 1.0 m^3 of sea-water of density 1030 kg/m^3 flows through the turbine every second.

(a) Calculate the loss of gravitational potential energy when 1.0 m^3 of sea-water falls through a vertical distance of 3.0 m.

loss of gravitational potential energy = ... [3]

(b) Assume that your answer to **(a)** is the energy lost per second by the sea-water passing through the turbine at high tide. The generator delivers a current of 26 A at 400 V.

Calculate the efficiency of the scheme.

efficiency = ...% [3]

(c) At low tide, the sea-water level is lower than the water level in the tidal basin.

(i) State the direction of the flow of water through the turbine at low tide.

....

(ii) Suggest an essential feature of the turbine and generator for electricity to be generated at low tide.

....

....

....

[2]

[Total: 8]