Energy, Work & Power

Question Paper

Course	CIE IGCSE Physics
Section	1. Motion, Forces & Energy
Topic	Energy, Work & Power
Difficulty	Hard

Time Allowed 60

Score /44

Percentage /100

Question 1a

Fig. 2.1 shows a fork-lift truck lifting a box.

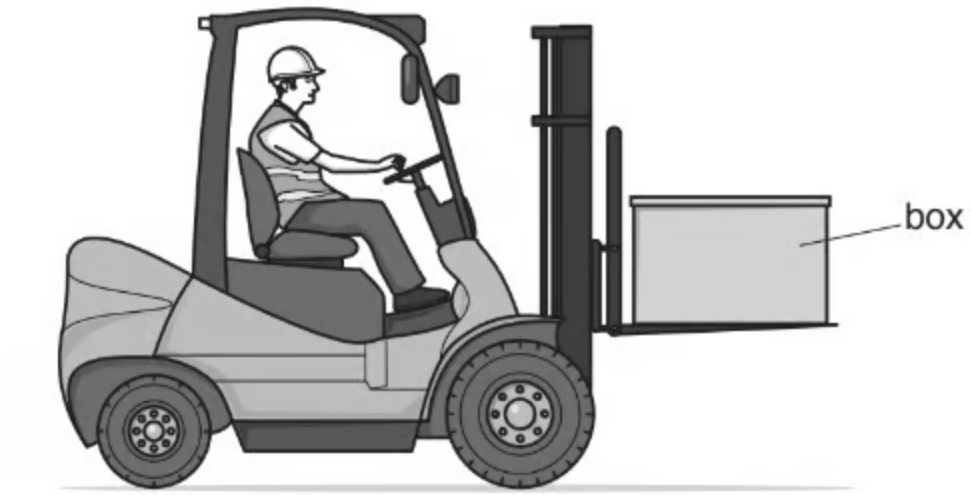


Fig. 2.1

The electric motor that drives the lifting mechanism is powered by batteries.

Name the store that energy is usefully transferred from by the batteries.

[1 mark]

Question 1b

Extended tier only

The lifting mechanism raises a box of mass 32 kg through a vertical distance of 2.5 m in 5.4 s.

(i) Calculate the energy transferred to the gravitational potential energy store of the box.

energy = ...[2]

(i) The efficiency of the lifting mechanism is 0.65 (65%).

Calculate the input power to the lifting mechanism.

input power = ...[3]

[5 marks]

Question 1c

The batteries are recharged from a mains voltage supply that is generated in an oil-fired power station.

By comparison with a wind farm, state one advantage and one disadvantage of running a power station using oil.

[2 marks]

Question 2a

A man is working on a platform. He uses a rope to raise a bag from the ground to the platform as shown in Fig. 4.1.

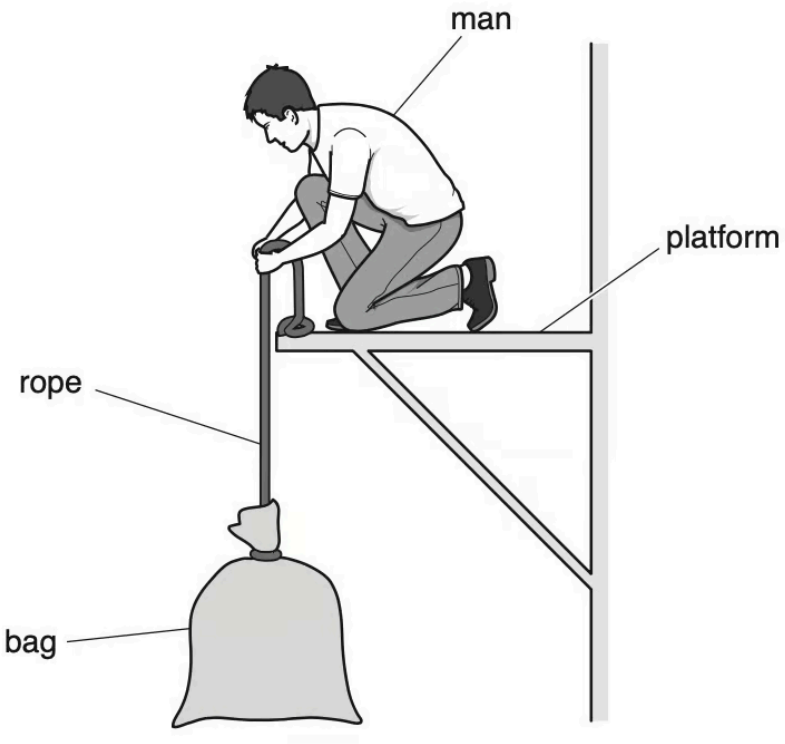


Fig. 4.1

(i) Name the energy store that energy is usefully transferred to as the bag is lifted at constant speed.

[1]

(ii) The man then lifts a second bag from the ground to the platform. The first bag weighs 100 N and the second bag weighs 150 N.

On which bag of materials does the man do more work?

Explain your answer.

[1]

(iii) The man wants to determine his useful power as he lifts one of the bags. He knows the weight of the bag. State the **two** other quantities he needs to know.

[2]

[4 marks]

Question 2b

The statements describe processes in a coal-fired power station. They are not in the correct order.

A Energy is transferred to the thermal store of the water

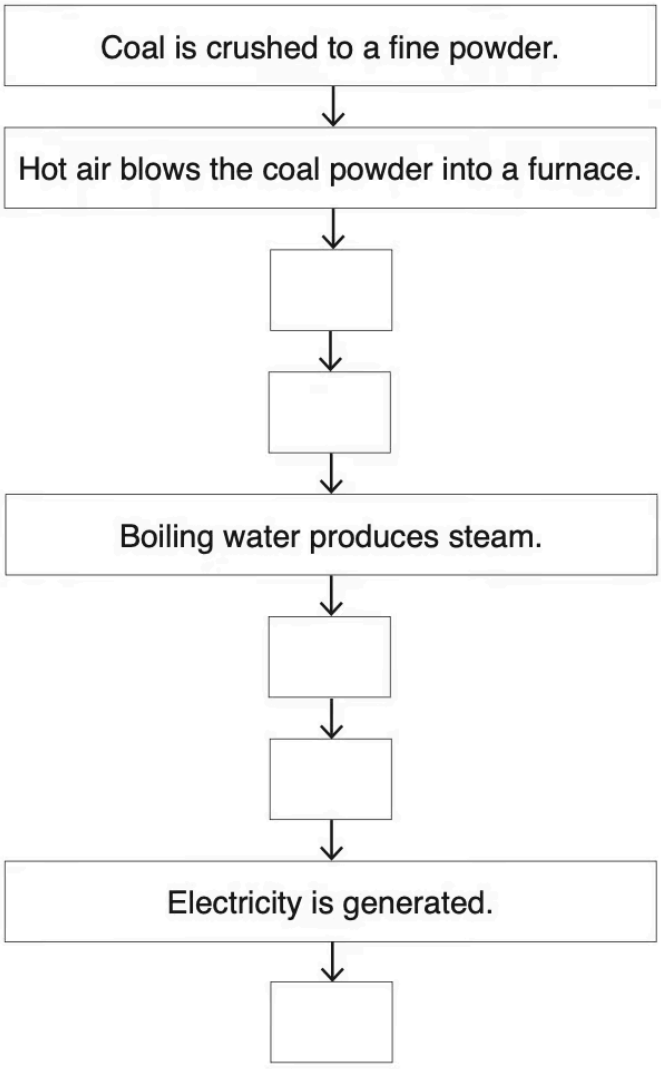
B Coal burns releasing energy from its chemical store

C Energy is transferred electrically via the national grid

D A turbine turns coils in a magnetic field

E Steam turns a turbine

Use the letters A, B, C, D and E to complete the flow chart explaining how the power station works.



[3 marks]

Question 3a

Extended tier only

A rifle fires a bullet of mass 0.020 kg vertically upwards through the air. As it leaves the rifle, the speed of the bullet is 350 m/s.

Calculate

(i) the energy in the kinetic store of the bullet as it leaves the rifle,

energy = ...[3]

(ii) the maximum possible height that the bullet can reach.

maximum height = ...[2]

[5 marks]

Question 3b

The actual height reached by the bullet is less than the value calculated in **(a)(ii)**.

(i) Explain, in terms of the forces acting on the bullet, why this is so.

[2]

(ii) As the bullet rises through the air, the amount of energy in its kinetic store decreases.

State what happens to this energy.

[2]

[4 marks]

Question 4a

Extended tier only

Salmon are born in freshwater rivers, spend most of their lives in the sea, but return to freshwater rivers to breed. As they swim up rivers, they often have to jump up waterfalls.

Fig. 1.1 shows a salmon attempting to jump up a waterfall with a vertical height of 0.36 m.

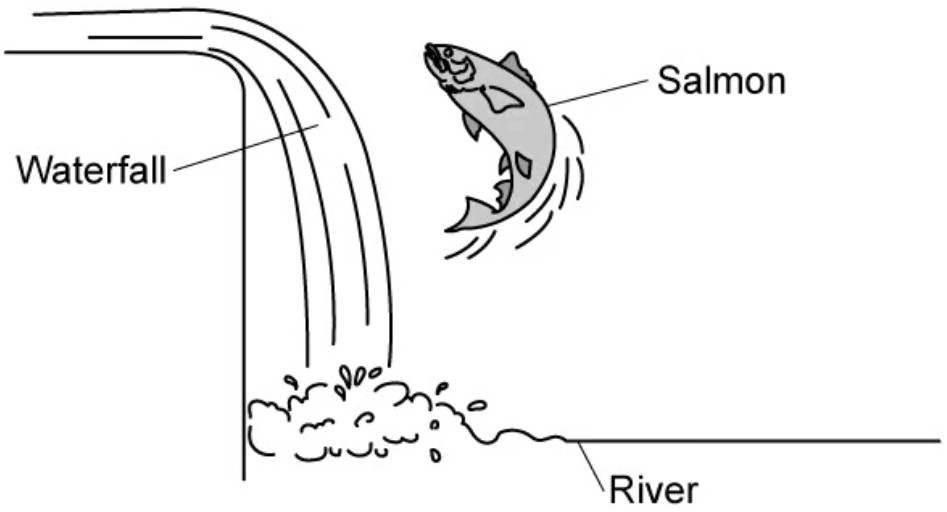


Fig. 1.1

The salmon has a mass of 1.84 kg.

The salmon leaves the water with a speed of 3.2 m/s.

Determine whether the salmon can make the height required for the jump.

[6 marks]

Question 4b

Extended tier only

Another salmon of mass 2.2 kg tries to make the jump.

Calculate the minimum speed with which the salmon would have to leave the water in order to reach the height required.

speed = ...

[4 marks]

Question 4c

The salmon swim further upstream and encounter a waterfall that is much higher than the previous one.

The salmon attempts the jump, but fails, and performs a somersault during the decent. The salmon straightens out before it enters the water as shown in Fig. 1.2.

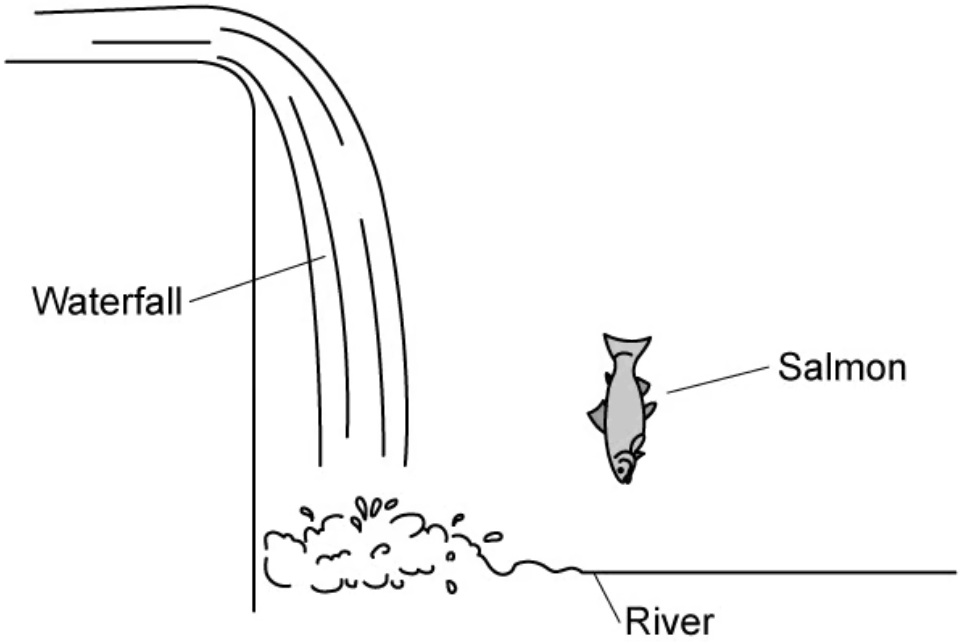


Fig. 1.2

Discuss whether the speed of entry into the water is greater than, less than or equal to the speed with which it leaves the water. Ignore any effects of air resistance.

[2 marks]

Question 4d

The temperature of the water at the bottom of a waterfall is greater than the temperature of the water at the top.

Suggest why this is the case.

[1 mark]

Question 5a

Define power.

[1 mark]

Question 5b

A fairground amusement uses the arrangement shown in Fig. 1.1 to measure the individual power rating of customers.

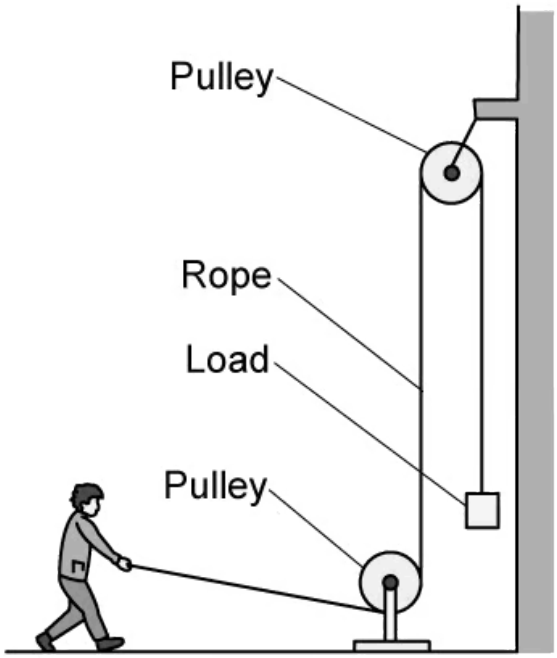


Fig. 1.1

Fig. 1.1

In the table below, list the quantities they must measure and the instrument used for measuring them.

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

[3 marks]

Question 5c

The mass of the load on the system is 30 kg. The length of rope able to pass through the pulley is 1.3 m.

The man pulled the rope as hard as he could and the time taken was measured to be 1.2 s.

(i) Determine the power rating of the man.

[3]

(ii) The amusement gave the man a power rating of 300 W.

Suggest a reason for the discrepancy.

[1]
[1 mark]

Question 5d

Extended tier only

The man's body was only 19% efficient whilst pulling on the rope.

Calculate the total energy he used.

energy used = ...
[2 marks]