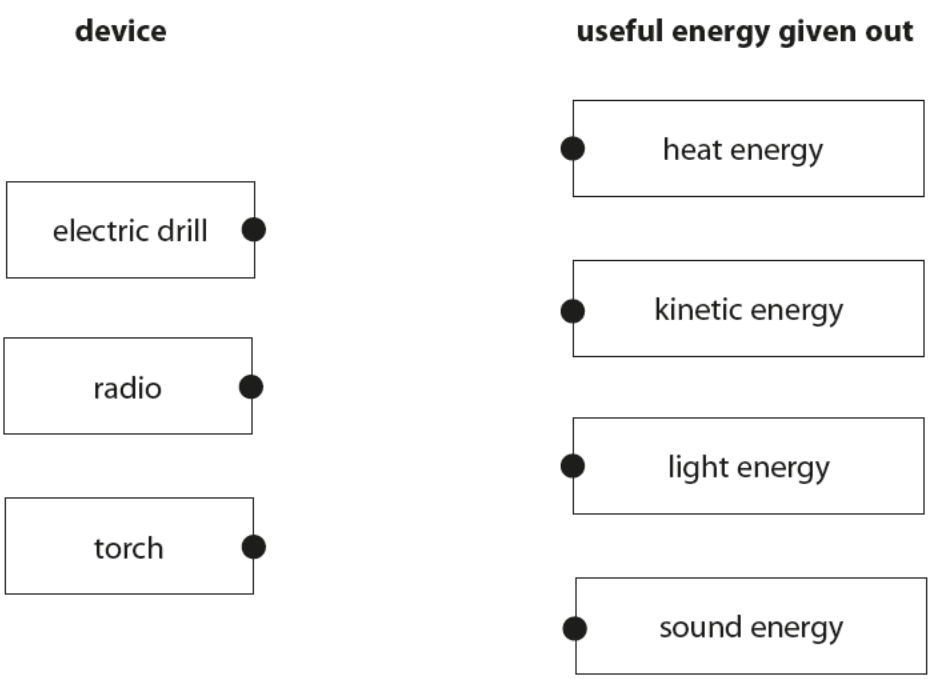
Energy transfers

1 (a) An electric drill, a radio and a torch all convert electrical energy into other forms of energy.

(i) Draw one straight line from each device to the most useful form of energy that it gives out.

(3)

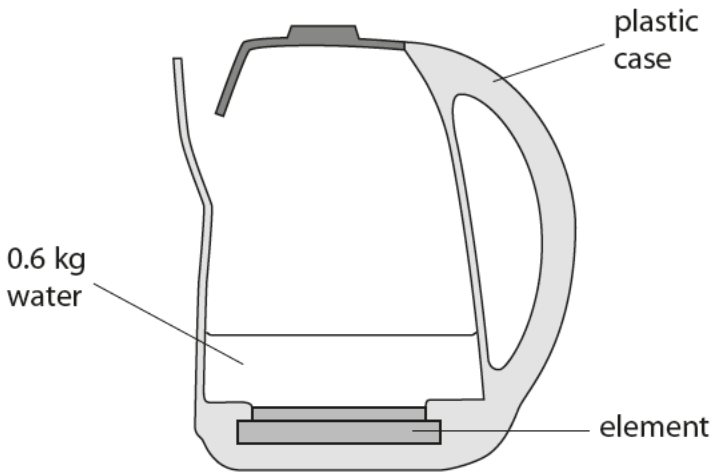


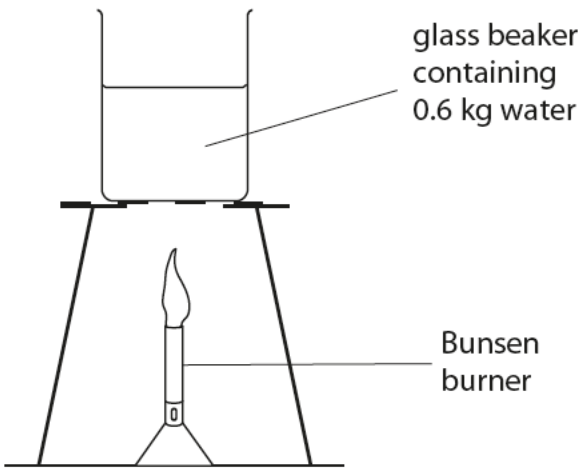
(ii) State the name of the one form of energy that is wasted by these devices.

(1)

.....

(b) The diagrams show two ways of heating water.





(i) The electric kettle is supplied with 2500 joules of energy each second.

The water in the kettle gains 2200 joules of heat energy each second.

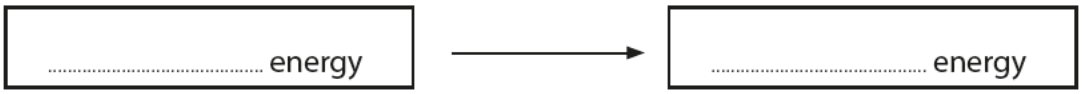
Calculate the amount of energy wasted each second.

(1)

energy wasted each second = ... J

(ii) Complete the diagram to show the main energy transfer that takes place when the Bunsen burner is used to heat the water.

(1)



(iii) Explain why heating the water using the kettle and the Bunsen burner waste different amounts of energy.

(2)

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(Total for Question 2 = 8 marks)

Solar energy

2 There are two types of solar panels.

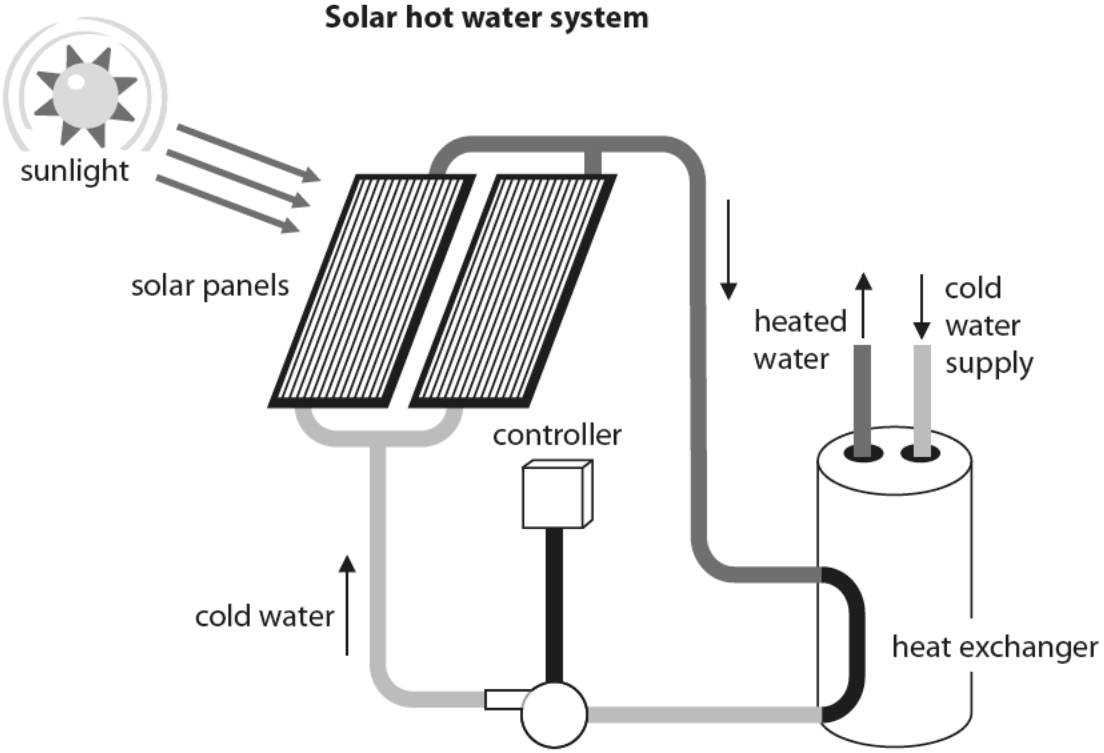
One type of solar panel uses the Sun's energy to heat water.

The other type uses solar cells to produce electricity.

(a) The diagram shows solar panels in a system used to heat water for a house.

Cold water goes into the panels and is heated by energy from the Sun.

Solar hot water system



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The solar heating panels are painted black because

(1)

☐ **A** black is a good absorber of heat

☐ **B** black is a good conductor of heat

☐ **C** black is a good radiator of heat

☐ **D** black is a good reflector of heat

(ii) On one sunny day no hot water is used in the house.

The water in the panels reaches a constant temperature even though the water is still absorbing energy from the Sun.

Explain why the temperature of the water in the panels becomes constant.

(3)

.....

.....

.....

.....

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.....

(b) The photograph shows a solar farm which uses many thousands of solar cells to generate electricity.



(i) Which energy transfer takes place in a solar cell?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** chemical to electrical

☐ **B** electrical to light

☐ **C** electrical to chemical

☐ **D** light to electrical

(ii) A large solar farm has 21 700 solar panels and generates 5.0 MW of power.

1.0 MW = 1.0×10^6 W

Calculate the average power each panel produces.

(2)

average power produced by each panel = ... W

(iii) The solar farm receives 25 MW of power from the Sun to generate 5 MW of electrical power.

Calculate the efficiency of the solar farm.

(2)

efficiency = ...

(Total for Question 2 = 9 marks)

3 (a) Figure 1 shows a solar-powered charger for a mobile phone.

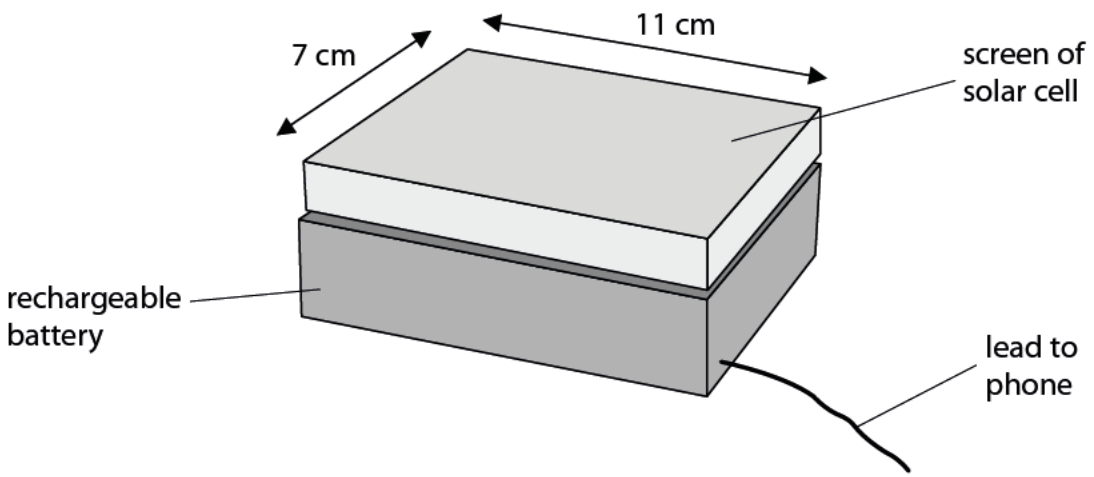


Figure 1

The screen of the solar cell takes in energy from the Sun.

(i) State how energy gets from the Sun to the screen.

(1)

.....

.....

(ii) State how energy is stored in the charger.

(1)

.....

.....

(iii) Each second, 0.12 J of energy from the Sun reaches 1 cm^2 of the screen.

Calculate the total amount of energy reaching the whole screen in 1 second.

(3)

energy = ... J

(b) Mobile phones emit microwaves.

Microwave ovens emit microwaves.

Explain why a mobile phone does not have the same heating effect as a microwave oven.

(2)

(Total for Question 1 = 7 marks)

4 A car accelerates at a constant rate of 1.83 m/s^2 along a flat straight road.

(a) The force acting on the car is 1.870 kN.

Calculate the mass of the car.

Give your answer to three significant figures.

(3)

mass = ... kg

(b) The car accelerates from rest for 16 s.

Calculate the speed of the car after 16 s.

(3)

speed = ... m/s

*(c) Figure 12 is a speed-time graph for a different car moving on a horizontal road.

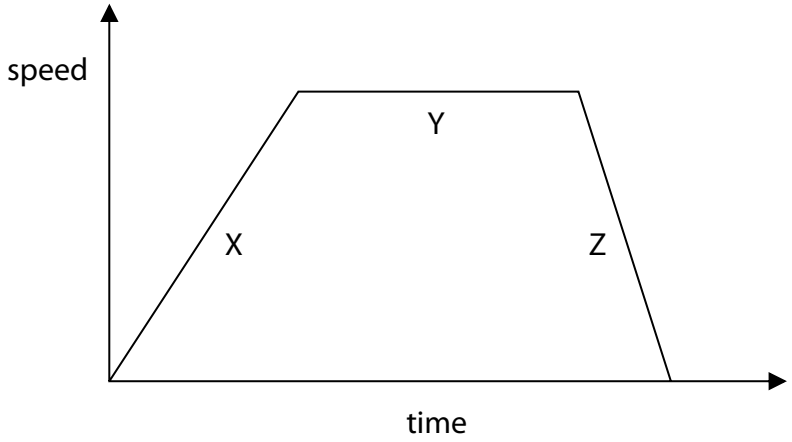


Figure 12

Describe the energy transfers taking place during the movement of the car.

You should refer to energy stores as well as transfers between energy stores for all three sections of the graph.

(6)

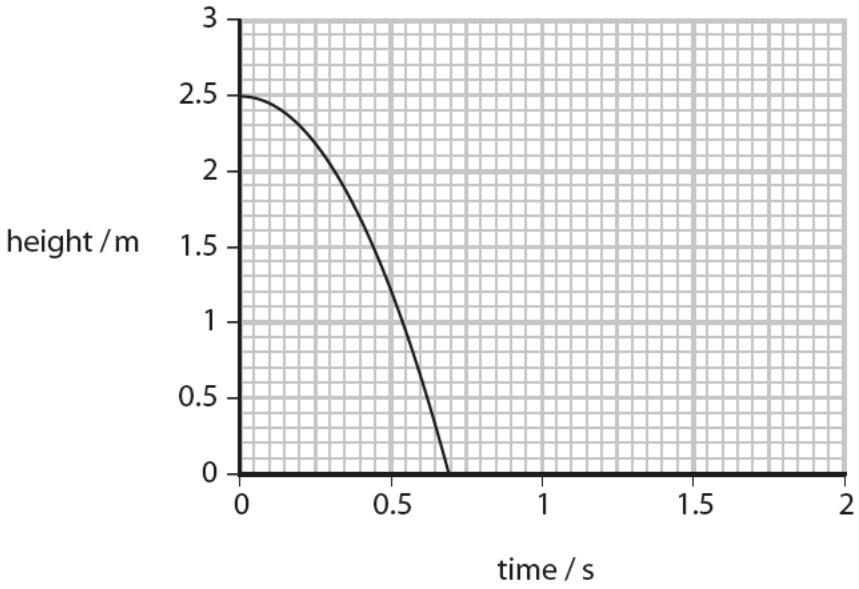
(Total for Question 9 = 12 marks)

Collision

5 (a) The man in the photograph balances a ball above the ground.



He lets the ball fall.
He starts a timer at the same time.
The graph shows how the height of the ball above the ground changes with time.



(i) From the graph, state the height of the ball above the ground when the timer was started.

(1)

height above ground = ... m

(ii) From the graph, state the time taken for the ball to reach the ground.

(1)

time = ... s

(iii) The ball bounces back to a height of 1.9 m.
Continue the line on the graph to show this.

(3)

(iv) Explain why the ball does not bounce back to its original height.

(2)

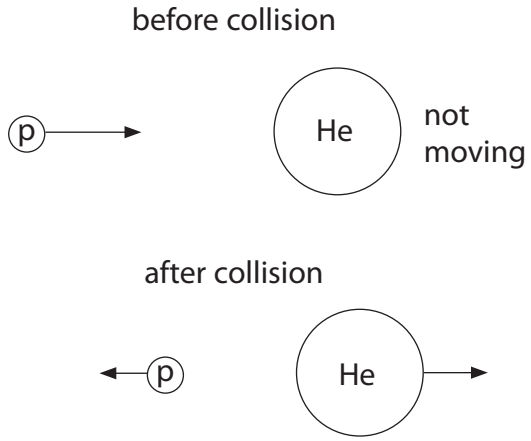
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(b) The diagram shows a collision between a proton (p) and a helium nucleus (He).



(i) The table gives some information about the collision.

		before collision	after collision
proton	kinetic energy (arbitrary units)	12.5	4.5
helium nucleus	kinetic energy (arbitrary units)	0	8

Use information from the table to show that the collision is elastic.

(2)

.....

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.....

(ii) State the name of **one** device that can be used to accelerate protons to very high speeds.

(1)

.....

.....

(Total for Question 4 = 10 marks)