Using solar energy

1 A student uses a solar powered battery charger to charge some batteries.



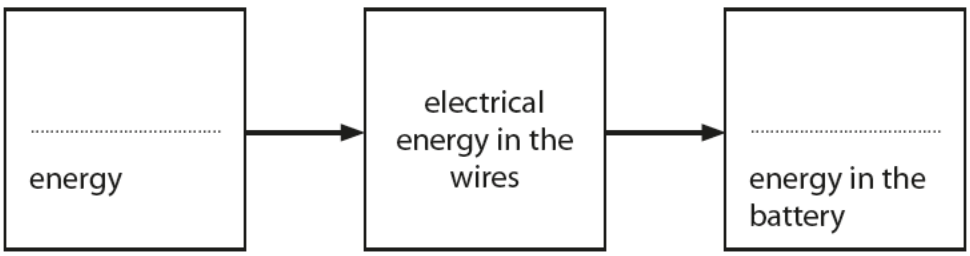
(a) The diagram is an energy transfer diagram for a battery being charged.

Use words from the box to complete the energy transfer diagram.

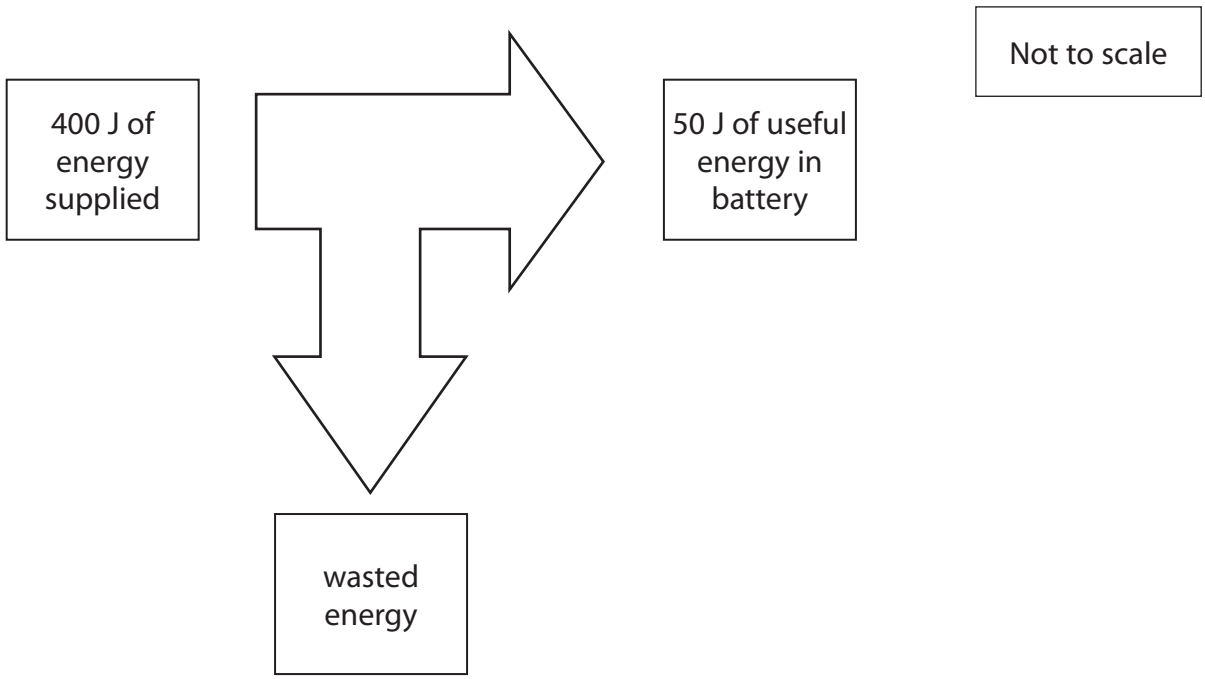
(2)

light	kinetic	sound
electrical	chemical	

Energy transfer diagram



(b) The diagram shows how much energy is usefully transferred by the battery charger.



(i) Calculate the amount of wasted energy.

(1)

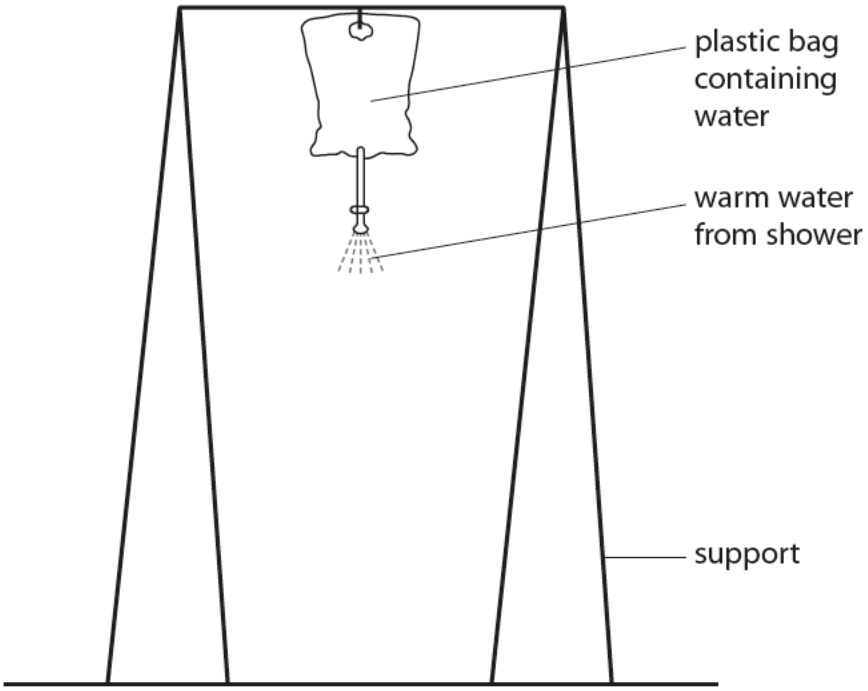
wasted energy = ... J

(ii) Calculate the efficiency of the battery charger.

(2)

efficiency of the battery charger = ... %

(c) The following arran



The bag is left out in the sunlight during the day.

(i) Explain what colour the bag should be to heat the water to the highest temperature.

(2)

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(ii) On a sunny day the bag is filled with cold water.
Explain why the temperature of the water increases and then stays constant.

(3)

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(Total for Question 4 = 10 marks)

Electromagnetic spectrum

2 The electromagnetic spectrum is continuous.

Different regions of the spectrum have different properties.

(a) (i) Name an electromagnetic wave that is also an ionising radiation.

(1)

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(ii) Genuine banknotes contain a special ink.
This ink is invisible under normal light.

Suggest why the ink glows when ultraviolet radiation is shone on it.

(2)

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(b) An electromagnetic wave has a frequency of 7×10^9 Hz.
The speed of the wave is 3×10^8 m/s.
Calculate the wavelength of the wave.

(3)

wavelength = ... m

*(c) Radiation from different regions of the electromagnetic spectrum can affect the human body in many ways.

Discuss the different ways in which excessive exposure to electromagnetic radiations of various frequencies may cause damage to the human body.

(6)

(Total for Question 5 = 12 marks)

Applications of light and sound

3 Diagram 1 shows a glass prism which can be used to turn an image the right way up.

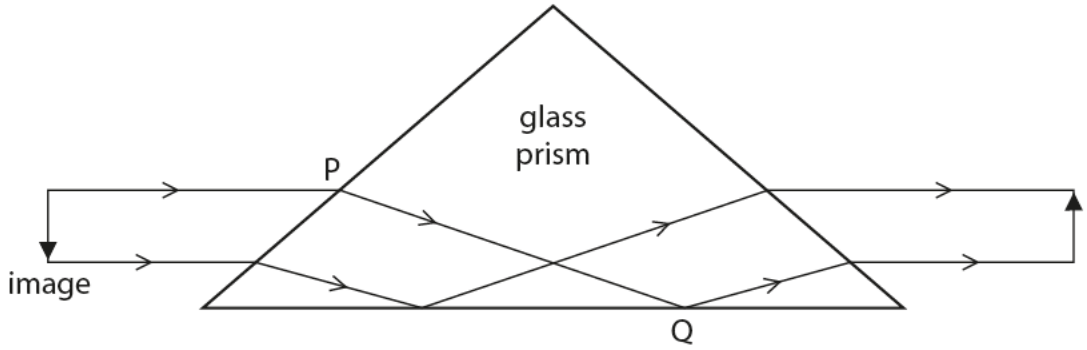


Diagram 1

(a) (i) In diagram 1, total internal reflection occurs at Q.
Explain why total internal reflection occurs at Q.

(2)

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(ii) The way in which the light changes direction at P is shown in diagram 2.

Mark on the diagram (*i*) for the angle of incidence and (*r*) for the angle of refraction for the ray of light shown.

(2)

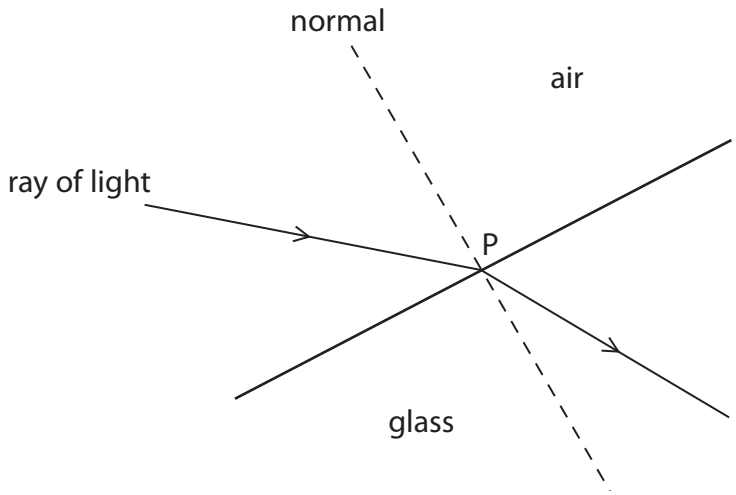


Diagram 2

(iii) Which of these is correct for the light as it enters the prism at P?

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

(1)

☒ **A** frequency decreases

☒ **B** frequency increases

☒ **C** speed decreases

☒ **D** speed increases

(b) Light waves and sound waves are both used in the diagnosis and treatment of medical conditions

(i) A doctor uses an endoscope to look inside the body of a patient.

Explain how optical fibres are used in endoscopes.
You may draw a labelled diagram to help with your answer.

(3)

(ii) Describe how ultrasound can be used as a medical treatment for illness or injury.

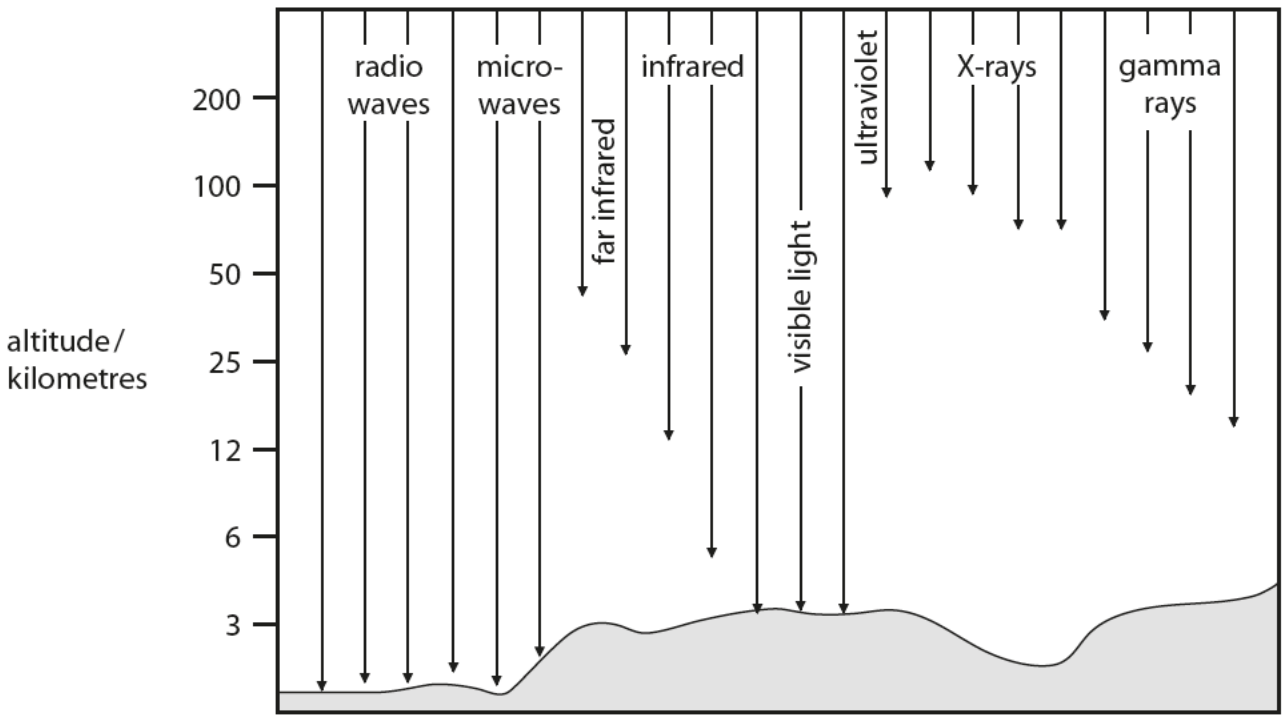
(2)

(Total for Question 3 = 10 marks)

The Solar System

4 Not all electromagnetic radiation coming from space reaches the Earth's surface.

The diagram shows how far radiation from each part of the electromagnetic spectrum travels down through the atmosphere.



(a) (i) Name **one** type of radiation that can reach the surface of the Earth from stars.

(1)

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(ii) Name **one** type of radiation from stars that cannot be detected at the Earth's surface but can be detected using satellites.

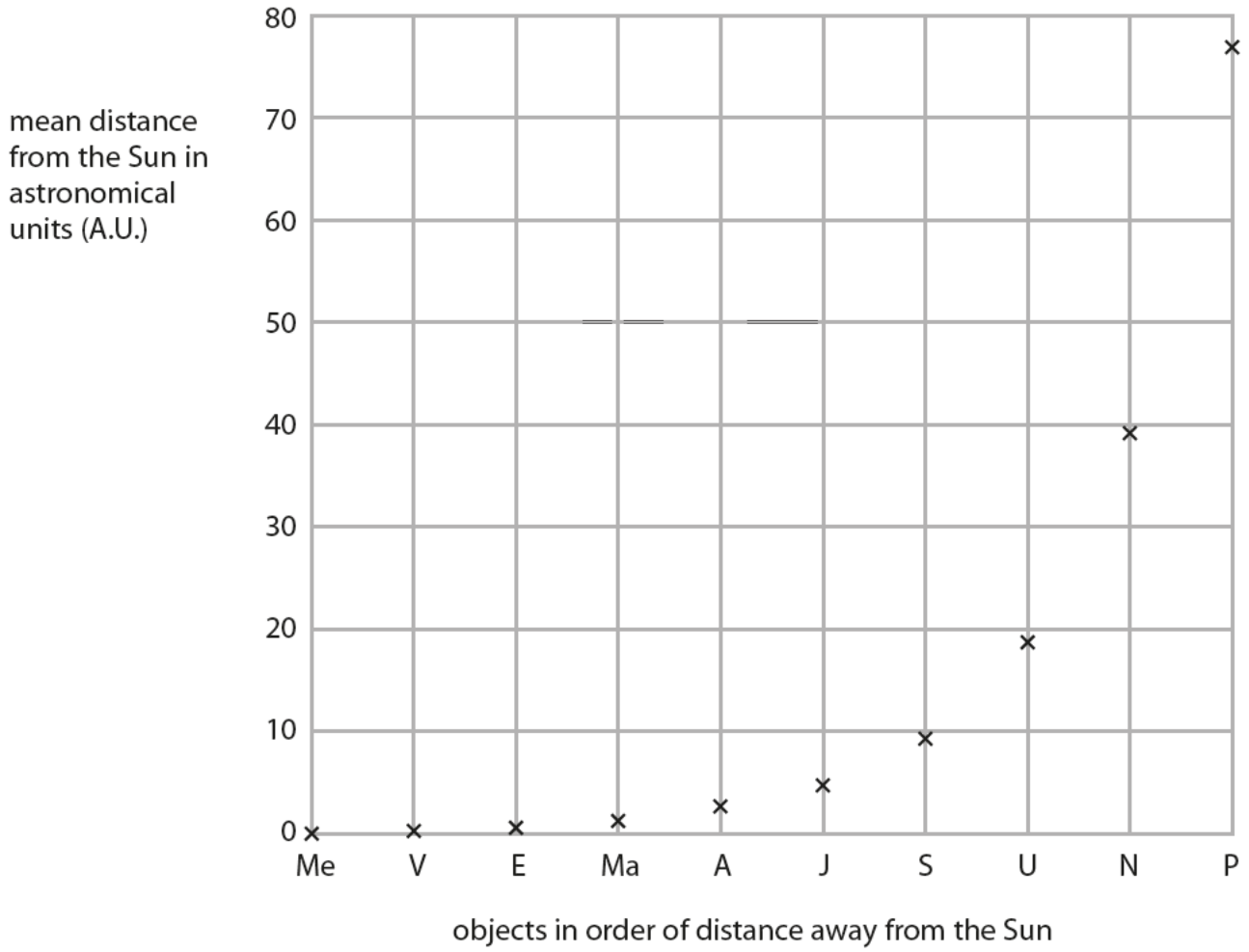
(1)

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(b) Bode, a scientist, found a rule predicting the distance of objects from the Sun.

The chart shows the mean distances from the Sun predicted by Bode's rule.



[Me – Mercury; V – Venus; E – Earth; Ma – Mars; A – Asteroid Belt; J – Jupiter; S – Saturn; U – Uranus; N – Neptune; P – Pluto]

(i) Read, from the chart, the predicted values for the distance from the Sun to Neptune and from the Sun to Pluto.

(2)

Sun to Neptune.....

Sun to Pluto.....

(ii) Bode's rule works well for all objects between Mercury and Uranus.
From scientific measurements, however, the actual mean distance from the Sun to Neptune is 30 A.U.
Some scientists think that Neptune was not part of the original Solar System.

Explain how the predicted value for Neptune supports the view of these scientists.

(2)

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*(c) Scientists are using a variety of methods to search for life beyond Earth.

Discuss the problems involved in using these methods.

(6)

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(Total for Question 6 = 12 marks)