Energy transfers ☒

1 Some students carry out investigations with an electric motor.

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

The students read the statement: 'All the energy supplied to the motor eventually ends up as thermal energy in the surroundings.'

This statement best describes the idea of

(1)

☒ **A** renewable energy

☒ **B** energy efficiency

☒ **C** sustainable energy sources

☒ **D** conservation of energy

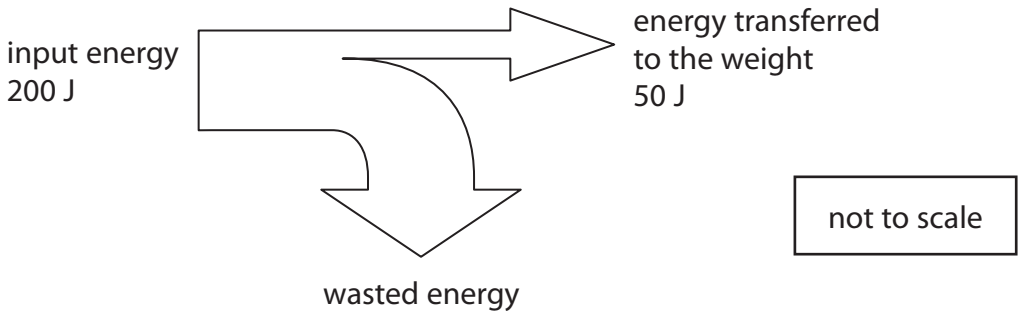
(b) The students use the electric motor to lift a weight.
The current in the motor is 0.5 A.
The potential difference (voltage) across the motor is 6 V.

Calculate the input power to the motor.
State the unit.

(3)

input power = ... unit = ...

(c) The diagram represents the energy transfers in the electric motor.



(i) How much energy is wasted?

(1)

wasted energy = ... J

(ii) Calculate the efficiency of the motor.

(2)

efficiency = ...

(d) The case of the motor is painted black.

Give a scientific reason why the case of the motor is painted black.

(1)

.....

.....

(Total for Question 1 = 8 marks)

Energy transfers

2 (a) Here are some forms of energy:

chemical	elastic potential	electrical
heat (thermal)	kinetic	light
nuclear	sound	

(i) Use words from the box to complete the table.
Each word may be used once, more than once, or not at all.

The first one has been done for you.

(3)

device	energy transferred from...	energy is mostly transferred into...
electric motor	electrical	kinetic
bow and arrow	elastic potential	
electric kettle	electrical	
microphone		electrical

(ii) In the electric motor only some of the electrical energy is transferred into kinetic energy.

State what happens to the remaining electrical energy.

(1)

.....

(b) Many appliances are sold with an energy efficiency rating.

A-rated appliances are the most energy efficient.

Here is some information about two types of electric lamp.

	halogen lamp	compact fluorescent lamp (CFL)
energy efficiency rating	B	A
energy transfer diagrams (not drawn to scale)	energy transfer in one second electrical energy = 20 J light energy = 2 J	energy transfer in one second electrical energy = 20 J light energy = 8 J

(i) Calculate how much energy is wasted in one second by the compact fluorescent lamp (CFL).

(1)

energy wasted = ... J

(ii) Use the energy transfer diagrams to explain why the CFL lamp has a better efficiency rating than the halogen lamp.

(2)

.....

.....

.....

.....

(c) The photograph shows an electric heater used to warm garages.

When the heater is switched on, it quickly warms up and then stays at a constant temperature.

Explain why the heater stays at a constant temperature.

(2)

.....

.....

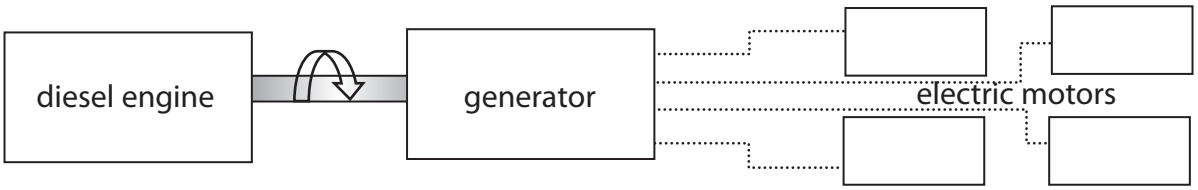
.....

.....

(Total for Question 2 = 9 marks)

Energy changes

3 (a) A train is powered by a diesel engine.
The diesel engine is used to turn a generator.
The generator provides electricity for electric motors which drive the wheels.



(i) Draw one straight line from each train part to its useful energy transfer.

(3)

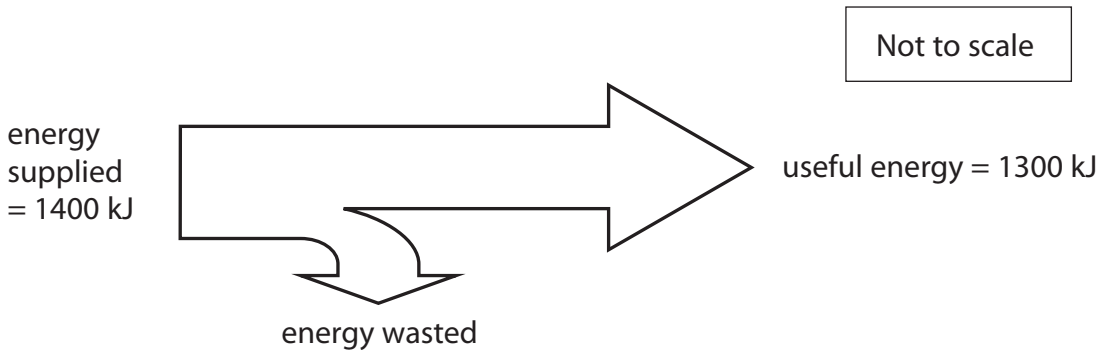
train part	**useful energy transfer**
diesel engine	chemical to electrical
	chemical to kinetic
generator	electrical to kinetic
	kinetic to chemical
motor	kinetic to electrical

(ii) State **one** example of a non-useful energy transfer in the motor.

(1)

.....

(b) The diagram represents the energy transfer in one second in the generator.



(i) Calculate the amount of energy wasted in one second in the generator.

(1)

energy wasted = ... kJ

(ii) Calculate the efficiency of the generator.

(2)

efficiency of generator = ...

(c) The electric motors which drive the wheels are painted black.

Suggest why the motors are painted black.

(1)

.....

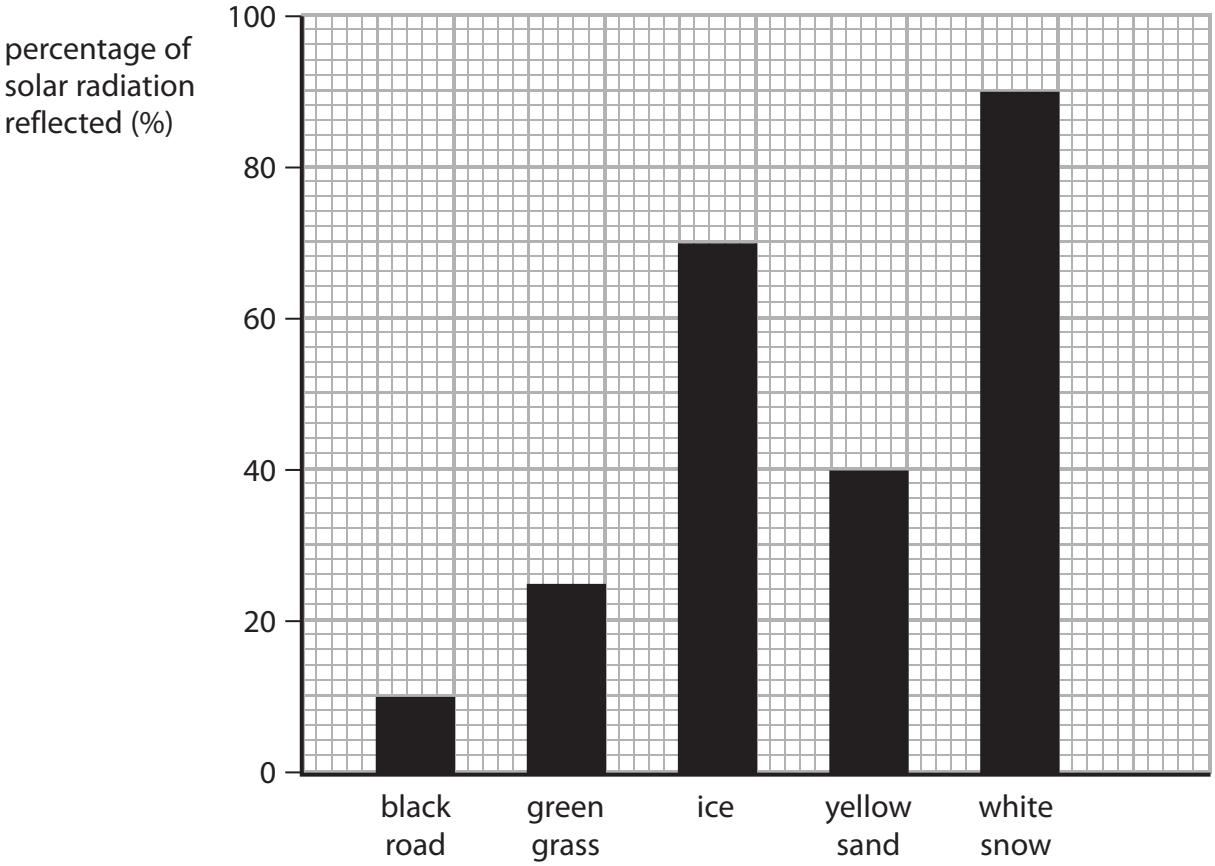
.....

(Total for Question 2 = 8 marks)

Solar radiation

4 Most of the energy we receive on Earth comes from the Sun.

The bar chart shows the percentages of solar radiation reflected by some materials.



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

A student used the bar chart to estimate the percentage of solar radiation **reflected** by a rough piece of coal.

The percentage is most likely to be about

(1)

☒ **A** 10%

☒ **B** 40%

☒ **C** 60%

☒ **D** 80%

(b) Radiation from the Sun which is not absorbed is reflected.
For water, the amount of solar radiation absorbed (taken in) is 94%.

(i) Calculate the percentage of solar radiation reflected by water.

(1)

percentage of solar radiation reflected by water .....

(ii) Use the graph to show how this information supports the idea that solid surfaces reflect better than liquid surfaces.

(1)

(c) As Antarctic ice melts, its surface area decreases.
At the same time, the area of water surface increases.

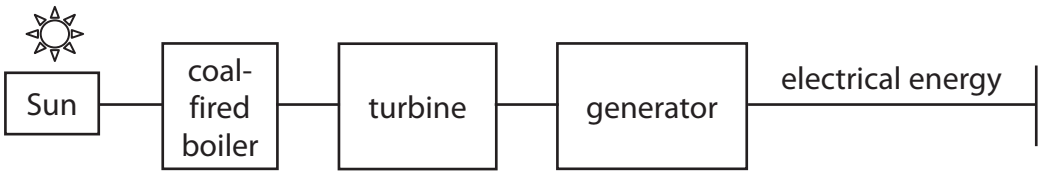
(i) Explain what happens to the amount of radiation absorbed.

(2)

(ii) State the effect that this change in the amount of radiation absorbed will have on the water.

(1)

*(d) The diagram shows how some of the energy released by the Sun is converted into electrical energy.



A student boils some water using energy which came from the Sun.

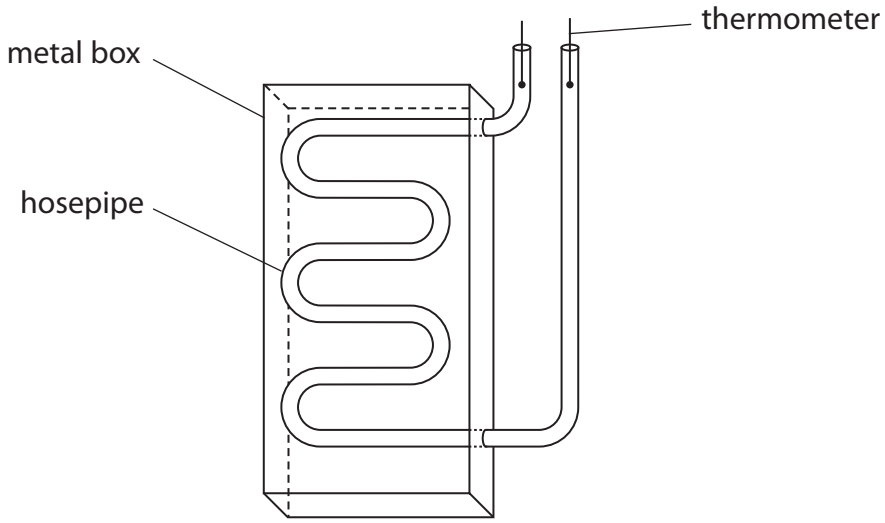
Using the information in the diagram, describe the energy transfers involved in producing the electrical energy he used.

(6)

(Total for Question 6 = 12 marks)

Solar heater

5 A student makes a solar water heater using a hosepipe.
He paints the hosepipe black and fills it with water.
He coils the hosepipe and fixes it into an open metal box as shown.



The student puts a thermometer in each end of the hosepipe.
The Sun shines on the hosepipe and heats the water.

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

The hosepipe is painted black because blackened surfaces are

(1)

☒ **A** good emitters of radiation

☒ **B** poor emitters of radiation

☒ **C** good absorbers of radiation

☒ **D** poor absorbers of radiation

(b) At first, the temperature of the water in the pipe increases.
After a while, the temperature becomes constant.

(i) Suggest **two** changes to the box which would increase the constant temperature reached.

(2)

1 .....

.....

2 .....

.....

(ii) Explain why the water reaches a constant temperature.

(3)

.....

.....

.....

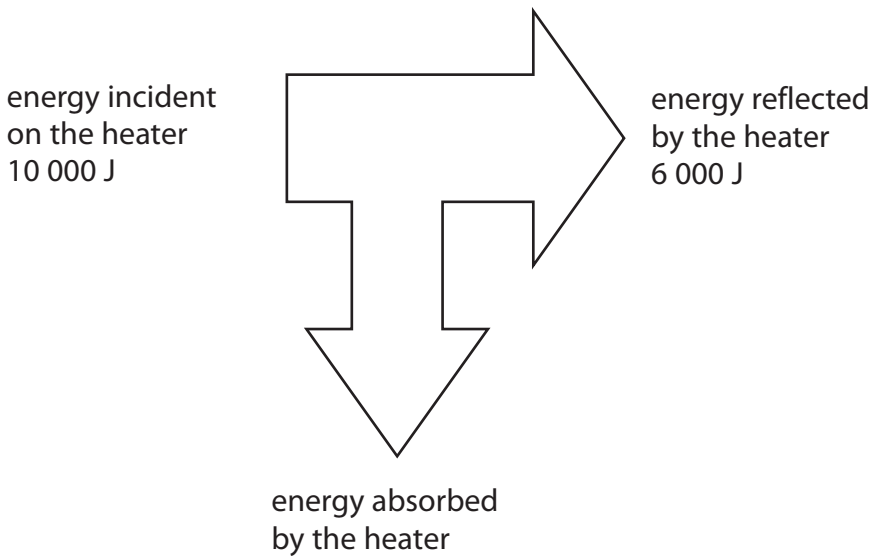
.....

.....

.....

(c) Some of the solar energy incident on the solar water heater is reflected. The rest is absorbed.

The diagram gives some information about energy transfer during the first 200 s.



Calculate the power absorbed by the heater.

(2)

power = ... W

(Total for Question 2 = 8 marks)