Energy

1 (a) The photographs show two ways of supplying thermal energy.

Use words from the box to complete the sentence under each photograph.

chemical	electrical	kinetic	light	sound

(i) The photograph shows a kettle.

The kettle transfers .... energy to thermal energy.

(1)

(ii) The photograph shows a barbecue.

The barbecue transfers .... energy to thermal energy.

(1)

(b) This photograph shows a fan.

The blades of the fan are turned by an electric motor.

In one second, the motor gets 200 J of electrical energy from the mains supply.
Only 180 J of this energy is used to turn the blades of the fan.

The rest of the energy is wasted.

(i) Calculate how much of the 200 J of energy is wasted.

(1)

wasted energy = ... J

(ii) State what happens to the wasted energy.

(1)

....

....

(iii) Calculate the efficiency of the motor.

(2)

efficiency = ...

(c) A student want   o use sunlight to heat water in a container.

(i) The student can choose from four containers.

The containers:

- are all the same size
- have different colours
- have different surfaces.

Which container is the best absorber of thermal energy?
Put a cross (☒) in the box next to your answer.

(1)

	container colour	**container surface**
☒ **A**	light	shiny
☒ **B**	light	rough
☒ **C**	dark	shiny
☒ **D**	dark	rough

(ii) The student places the container in bright sunlight.
After half an hour, the temperature of the water is 50 °C.
The water then stays at 50 °C, even though the container is still in bright sunlight.

Which of these explains why the temperature stays at 50 °C?
Put a cross (☒) in the box next to your answer.

(1)

☒ **A** The water in the container is no longer absorbing thermal energy.

☒ **B** The container is losing thermal energy faster than it is absorbing it.

☒ **C** The container is losing thermal energy at the same rate it is absorbing it.

☒ **D** The water in the container has started to boil.

(Total for Question 1 = 8 marks)

Dropping eggs

2 The photograph shows a man dropping an egg inside a padded box from a height.

He is investigating to see if the padding stops the egg from breaking.

(a) State the type of energy which the egg gains as it falls.

(1)

....

(b) The weight of the egg is 0.6 N.

Calculate the work done on the egg to lift it up by 20 m. State the unit.

(3)

work done on egg = ... unit ....

(c) The velocity of the container was 18 m/s as it hit the floor.
The mass of the container was 0.5 kg.

Calculate the momentum of the container.

(2)

momentum = ... kg m/s

*(d) A student stands on the ground with an egg in his hand.
He throws the egg vertically upwards.
The egg rises to a height of 10 m.
Then the egg falls and lands on the ground.

Describe the energy changes of the egg during this sequence of events.

(6)

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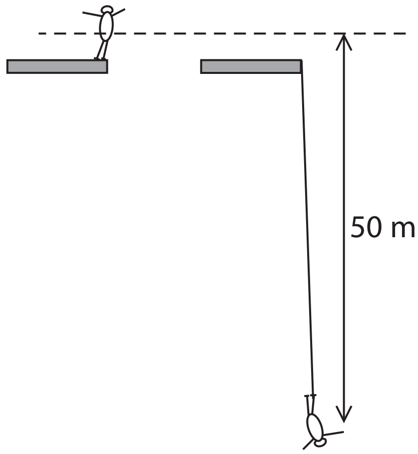
(Total for Question 6 = 12 marks)

Bungee jumping

3 A 60 kg student weighs 600 N.
He does a bungee jump.



The bungee cord becomes straight and starts to stretch when he has fallen 50 m.

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

He first stops moving

(1)

☒ **A** before all the energy has disappeared

☒ **B** before the bungee cord starts to stretch

☒ **C** when the bungee cord is stretched the most

☒ **D** when the elastic potential energy is zero

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

When his speed is 10 m/s his momentum is

(1)

☒ **A** 600 kg m/s

☒ **B** 3 000 kg m/s

☒ **C** 6 000 N m/s

☒ **D** 30 000 N m/s

(c) (i) Calculate the change in gravitational potential energy as the student falls 50 m.

Give the unit.

(3)

change in gravitational potential energy = ... unit ....

(ii) State at what point in the bungee jump the student has maximum kinetic energy.

(1)

....

....

(iii) Explain why his maximum kinetic energy is likely to be less than your answer to (c)(i).

(2)

....

....

....

(Total for Question 2 = 8 marks)

Running like clockwork

4 The diagram shows Simon's clock.
Once a week, Simon turns a key to tighten the spring.
The spring uncoils slowly to keep the clock working.

(a) Which type of energy is stored in the tightened spring?

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

(1)

☐ **A** chemical energy

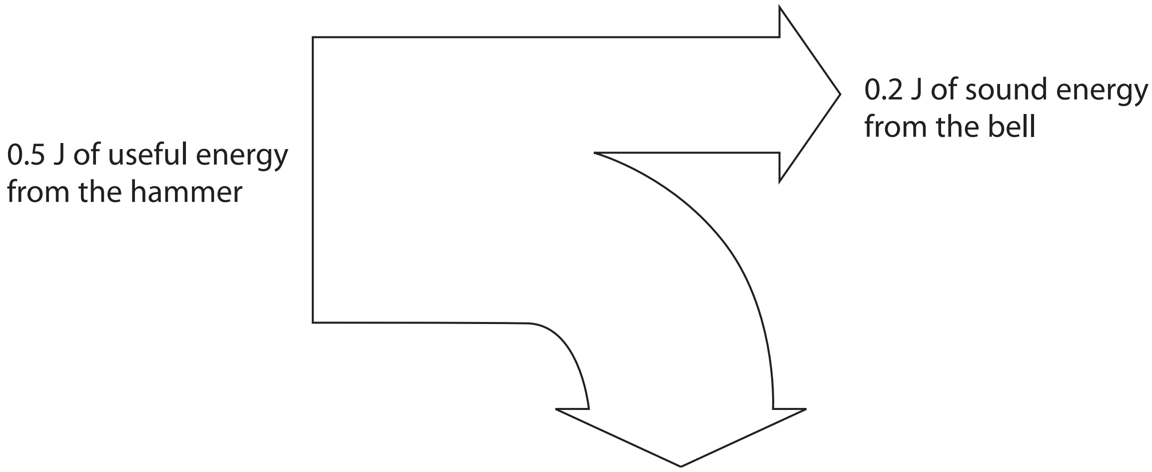
☐ **B** elastic potential energy

☐ **C** gravitational potential energy

☐ **D** thermal energy

(b) Every hour, the cl
The clock lifts a small hammer.
The hammer falls and rings a little bell.

The diagram shows what happens to the energy from the falling hammer.



(i) Calculate the energy wasted.

(1)

wasted energy = ... J

(ii) Calculate the efficiency of this process.

(2)

efficiency = ...

(iii) Suggest what happens to the wasted energy.

(2)

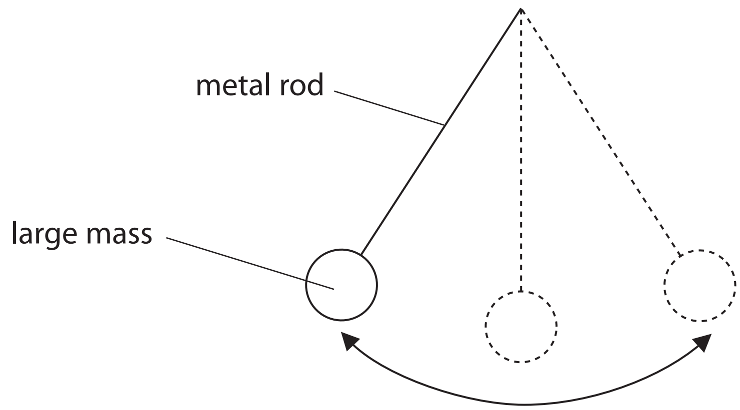
....

....

....

....

*(c) The clock uses a pendulum.
The pendulum is a metal rod with a large mass at the end.
The mass swings from side to side.



The spring keeps the pendulum swinging without stopping.

Describe the energy changes that happen as the pendulum continues to swing from side to side.

(6)

....

....

....

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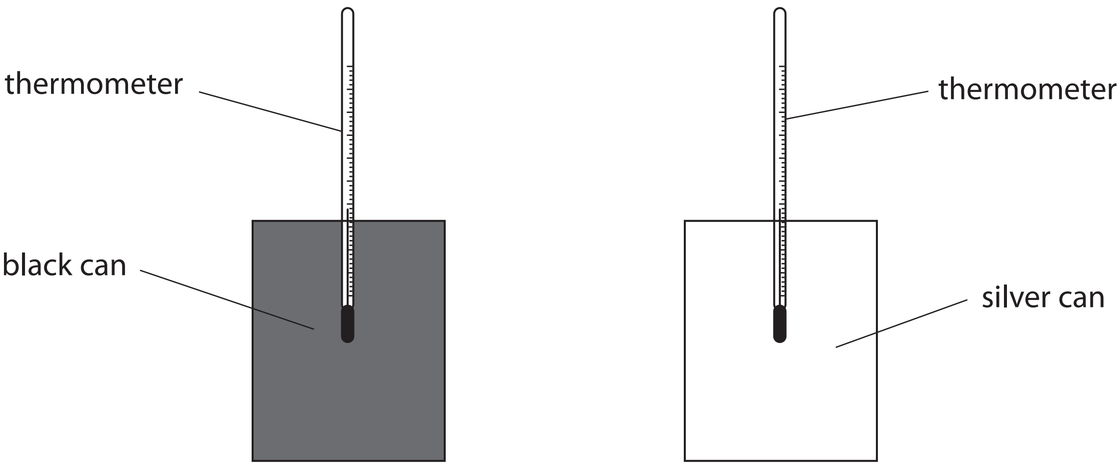
(Total for Question 5 = 12 marks)

Thermal radiation

5 Some students investigate the cooling of different coloured cans.

They use two cans each fitted with a thermometer.



Hot water is poured into the cans and the temperature of the water in each can is measured every two minutes.

(a) The students want to find out if a black can cools quicker than a silver can.

Which row of the table shows the conditions they should use?

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

(1)

	the volume of water in each can should be	**the size of cans should be**
☒ **A**	the same	the same
☒ **B**	the same	different
☒ **C**	different	the same
☒ **D**	different	different

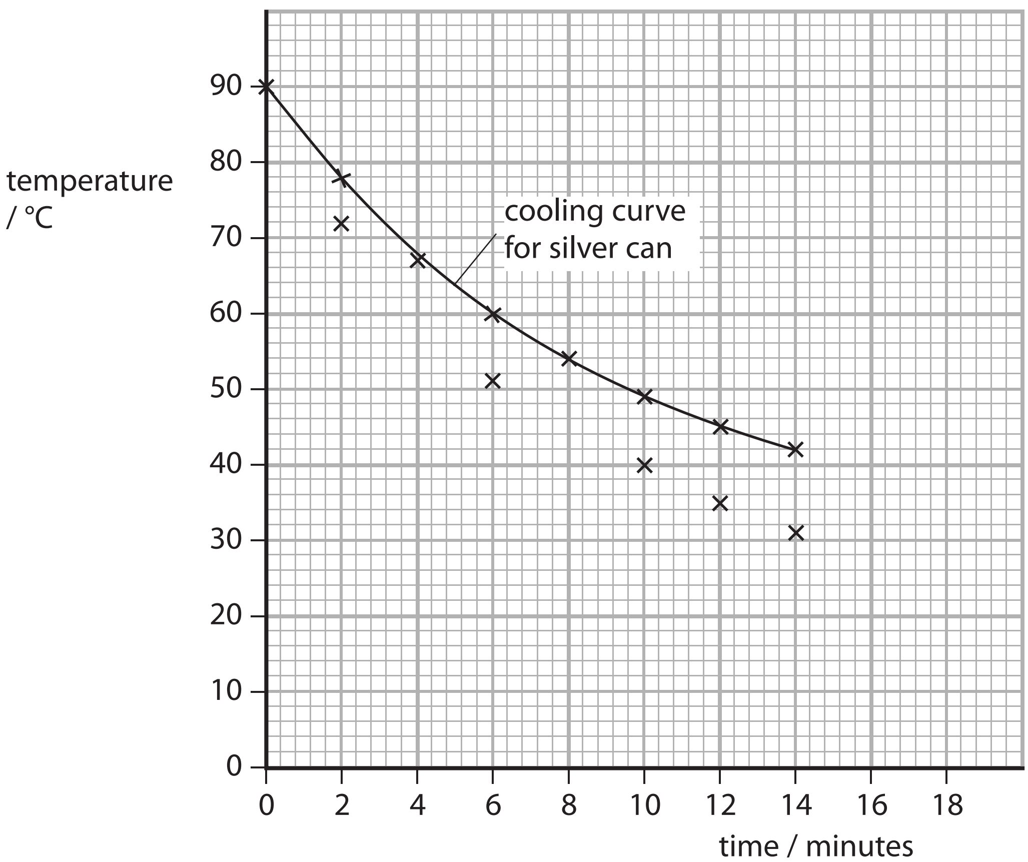
(b) The table shows the students results.

time / minutes	temperature / °C	
	black can	silver can
0	90	90
2	72	78
4	60	67
6	51	60
8	45	54
10	40	49
12	35	45
14	31	42

(i) The graph for the silver can has been plotted on the axes.
Six points for the black can have been plotted.

Plot the points for 4 minutes and 8 minutes for the black can.

(1)



(ii) The line of best fit has been drawn for the silver can.
Draw the line of best fit for the black can.

(1)

(iii) Estimate the temperature of the silver can when the time is 18 minutes.

(1)

temperature = ...°C

(iv) The room temperature is kept at a temperature of 21 °C.
Suggest what the temperature of the cans will be after two hours.

(1)

temperature = ...°C

(c) The photograph shows a solar water heater.

(i) State why the pipes in the solar water heater are painted black.

(1)

....

....

(ii) The heater supplies 9000 J of thermal energy in 20 seconds.

Calculate the power output of the heater.

(2)

power output = ... W

(iii) To produce the 9000 J of thermal energy, the heater needs 18 000 J of energy from the Sun.

Calculate the efficiency of the solar water heater.

(2)

efficiency = ...

(Total for Question 3 = 10 marks)