Q1. The diagram shows the design of a solar cooker. The cooker heats water using infrared radiation from the Sun.

(a) Why is the inside of the large curved dish covered with shiny metal foil?
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...........................................................................................................................................

(b) Which would be the best colour to paint the outside of the metal cooking pot?
Draw a ring around the correct answer.

black  silver  white

Give a reason for your answer.
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...........................................................................................................................................
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(c) Why does the cooking pot have a lid?
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...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................

(1)
(d) Calculate how much energy is needed to increase the temperature of 2 kg of water by 80 °C.

The specific heat capacity of water = 4200 J/kg °C.

Use the correct equation from the Physics Equations Sheet.

Energy = ................................................................. J

(Total 6 marks)

Q2. The diagram shows a simple type of portable shower. The water container is a strong plastic bag that is black on one side and white on the other. To warm the water, the bag is placed on the ground in direct sunlight, with the black side facing the Sun.

(a) (i) Name the process by which heat is transferred from the Sun to the outside of the bag.

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(1)

(ii) Explain why the black side of the bag and not the white side should face the Sun.

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(2)
(b) The graph shows how the temperature of the water inside a full bag increases after the bag is placed outside on a sunny day.

(i) How long does it take for the water to reach 37 °C?

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(1)

(ii) Describe how the temperature of the water changes during the three hours.

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(1)

(c) A different manufacturer makes the same type of portable shower but uses a bag with a larger surface area. The bag is made from the same coloured plastics and holds the same amount of water.

(i) To compare the efficiency of the two bags at heating water, several variables need to be controlled.

Name two variables that need to be controlled.

1 ...............................................................................................................

2 ...............................................................................................................

(2)

(ii) The second bag has a larger surface area.

Draw a line on the graph to show how the temperature of the water inside the second bag would change over the first hour.

Assume that the two bags are tested in exactly the same way.

(1)

(Total 8 marks)
Q3. The drawing shows someone ironing a shirt. The top of the ironing board is covered in a shiny silver-coloured material.

Explain why the shiny silver-coloured material helps to make ironing easier.

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(Total 2 marks)

Q4. A student did two experiments on radiation. The apparatus he used is shown in the diagram.

Experiment 1

• The student put the same volume of cold water into the two cans.
• He then switched on the heater.
• Ten minutes later the water in the can with the dull black surface was much hotter than the water in the other can.
Experiment 2

- The student filled both cans with boiling water.
- This time he left the heater off.
- Ten minutes later the water in the can with the dull black surface was much cooler than the water in the other can.

Use words from the box to complete the sentences.

<table>
<thead>
<tr>
<th>absorber</th>
<th>conductor</th>
<th>emitter</th>
<th>reflector</th>
</tr>
</thead>
</table>

Experiment 1 shows that the dull black surface is a good ......................... of radiation and that the shiny silver surface is a good .................... of radiation.

Experiment 2 shows that the dull black surface is a good ......................... of radiation.

Q5. The diagram shows four identical pieces of aluminium. Each had been painted with a different type of paint. A drop of water was placed on each and they were then heated by a radiant heater held about one metre above them.

A Shiny white
B Shiny black
C Matt white
D Matt black

(i) Suggest in which order the pieces of aluminium would become dry.

first ........................................ last

(ii) Explain why you chose your order.

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........................................................................................................................................
........................................................................................................................................

(Total 3 marks)
M1.  
(a) to reflect (the infrared)  
\[\text{accept (shiny surfaces) are good reflectors} \]
\[\text{ignore reference to incorrect type of wave} \]  
1
(b) black  
\[\text{best absorber (of infrared)} \]
\[\text{answer should be comparative} \]
\[\text{black absorbs (infrared) is insufficient} \]
\[\text{accept good absorber (of infrared)} \]
\[\text{ignore reference to emitter} \]
\[\text{ignore attracts heat} \]
\[\text{ignore reference to conduction} \]  
1
(c) to reduce energy loss  
\[\text{accept to stop energy loss} \]
\[\text{accept heat for energy} \]
\[\text{accept to stop / reduce convection} \]
\[\text{or} \]
\[\text{so temperature of water increases faster} \]
\[\text{accept to heat water faster} \]
\[\text{accept cooks food faster} \]
\[\text{or} \]
\[\text{reduces loss of water (by evaporation)} \]  
1
(d) 672 000  
\[\text{allow 1 mark for correct substitution, ie } 2 \times 4200 \times 80 \text{ provided no subsequent step shown} \]  
2

M2.  
(a) (i) radiation  
\[\text{ignore thermal / infrared} \]  
1
(ii) black is a better / good absorber (of heat / radiation)  
\[\text{ignore reference to black being a good emitter} \]
\[\text{black absorbs heat is insufficient} \]
\[\text{do not accept black attracts / absorbs the Sun} \]
\[\text{do not accept black attracts heat} \]  
1
(so) temperature rises faster

must be an indication of heating up quicker

or

white is a worse / poor absorber (of heat / radiation) (1)

accept white is a better / good reflector (of heat / radiation)

(so if white faces) temperature would rise slower (1)

ignore any reference to light

(b) (i) 1.2 (hours) or 1 hour 12 minutes

no tolerance

(ii) increases (rapidly at first then increases at a slower rate)

do not accept increases at a steady rate

(c) (i) any two from:

• (fill with) same mass / volume / amount of water

• same level of (sun)light / sunshine

  accept same heat / light source

  accept same place

• outside for the same (length of) time

• outside at same time (of day / year)

• initial water temperature

• the side of the bag facing the Sun

  do not accept any factors to do with the construction of plastic bags eg thickness

(ii) curved line drawn above given line

  both lines must start from the same point

  ignore if continues beyond one hour or levels off after 1 hour

  do not accept a straight line
M3. silver is a (good) reflector of heat (radiation) or silver reflects the heat (radiation)
    fact
    heat = infra red
    ignore references to light
    accept shiny for silver
    good radiator negates the mark
    ignore references to good conductor
    do not accept bounce back

    less heat is lost through the board or more heat is retained by the shirt
    explanation
    accept both sides of shirt heated
    reflects heat back up gets 1 mark only
    ignore mention of friction

    [2]

M4. absorber
    reflector
    emitter

    [3]

M5. (i) D, C or B, in either order, then A
    tick or cross on the A

    [1]

(ii) matt absorbs energy (better than shiny)
    the converse arguments are acceptable

    black absorbs energy (better than white)

    [3]