8I1 | **What's the temperature?** | Help Sheet

What's the temperature?

Name ______________________ Class ______________________

1 For each of the temperatures in the table, estimate a value and enter it in column 1.
Then find the actual temperature to enter in column 2, either by measuring the temperature or by researching in books, CD-ROMs, or on the internet.

	1. Estimated temperature (°C)	*2. Actual temperature (°C)*
temperature of water as it freezes		
temperature of water as it boils		
room temperature		
typical outside temperature (summer)		
typical outside temperature (winter)		
body temperature		
coldest place on Earth		
hottest place on Earth		
hot oven temperature		
safe (hygienic) fridge temperature		
safe (hygienic) freezer temperature		

2 Draw a chart of these temperatures,
either as a 'temperature line' (cold at the left, hot at the right),
or as a bar-chart.

3 Conduct a survey (of adults or of pupils in other classes) to see how well they can estimate these temperatures (in °C).

Work out how much they estimated values too high or too low.
Analyse your results, taking into account the size of your sample.

If possible, combine your results with someone else's results.
How does this make your results more reliable?

Is there a pattern?

How could you become more certain of any pattern that you find?

8I1 Warming up with energy

LITERACY SHEET Extension

1 In a group of three, cut out and read the statements below.
2 Discuss the statements, and then put them into 2 groups: **true** or **false**.

Thermal energy is the same as temperature.

A bath full of warm water has more energy than a white-hot spark.

50 cm^3 of water at 50°C has the same amount of energy as 25 cm^3 of water at 50°C.

80 cm^3 of water at 80°C has less energy than 40 cm^3 of water at 40°C.

The kinetic theory is about particles vibrating.

If the particles in an object are vibrating a lot, the object will feel very hot.

Energy travels *from* a hot object *to* a cold object.

Energy travels in 3 ways.

Conduction happens because energy can be transferred from atom to atom in an object.

The particles in a wooden spoon pass the heat energy along the spoon easily.

Convection currents only happen in the air.

The Sun can cause large convection currents which we feel as a wind.

Convection currents carry the energy from a radiator around the room.

Solar energy is radiant energy from the Sun.

Radiant energy cannot travel through space.

We give out radiation, because we are warm.

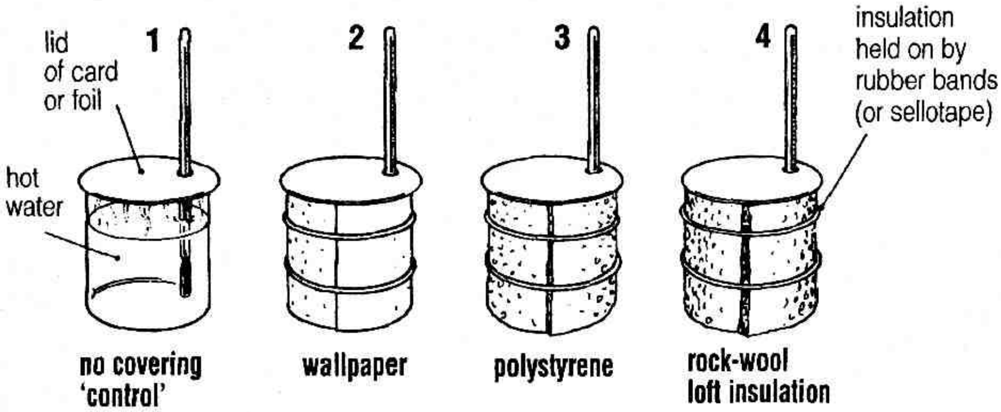
3 Now read 8I1 in Book 8 (pages 108 and 109) to check your answers.

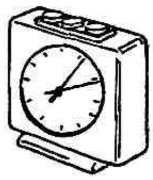
8I2 Keeping warm – 1

Help Sheet

Think about:

- You can use different materials to insulate some beakers.
- You can leave one beaker with no insulation, as a 'control'.
- You will need to put a lid on each beaker (to reduce evaporation and make it a fair test). You can make a hole in each lid for a thermometer:





stop-clock

- You can half-fill each beaker with the ***same*** amount of very hot water. Can you think of a way of doing this accurately and quickly, so that all 4 beakers start off at the same temperature?

hot water

- What else must you do, to make it a ***fair test***?
- You can take the temperature of each beaker, every 2 minutes, for 20–30 minutes. You can use a table like this:

	Time (mins):	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
Temperature (°C)	no insulation																
	wallpaper																
	polystyrene																
	loft insulation																

Questions

1 Which beaker cooled the fastest? Why?

2 Which material is the best insulator? ***Why*** do you think it is best?

3 What happens to the energy that was in the hot water at the beginning?

Extension work

4 On the same axes, plot 4 graphs, one for each beaker. Use a different colour for each material, and label them.
Does the best insulator have the smallest slope or the steepest slope?

5 Plan an investigation to see if the insulators are as good when they are ***wet***.

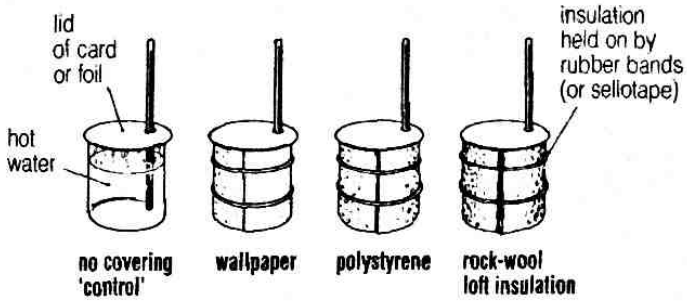
8I2 Processing results

Sc1 Skill Sheet 63

Name ________________________________

Some pupils carried out this insulation investigation.
Their results are shown below.

Plot each of them in turn on the grid below, and then draw a line of best fit for each one.



Time (min)	*0*	*2*	*4*	*6*	*8*	*10*	*12*	*14*	*16*	*18*	*20*	*22*	*24*	*26*	*28*	*30*
No insulation (°C)	94	85	77	69	62	55	49	43	38	34	31	29	27	26	25	24
Wallpaper (°C)	95	88	81	75	69	64	59	55	51	48	45	42	39	37	36	35
Polystyrene (°C)	94	88	82	77	72	67	63	59	55	52	49	46	44	42	41	40
Loft insulation (°C)	96	91	86	82	78	74	70	67	64	61	59	57	55	54	53	52

1 Which of the 4 containers cools down the slowest? Explain your answer in terms of energy flow using your ideas about conductors and insulators.

____

____

2 Explain why each of the graphs levels out towards the end of the investigation.

____

____

3 What temperature would all of the beakers get to eventually? ______________________

8I2 Recording results in tables

Sc1 Skill Sheet 64

Name ______________________ **Class** ______________________

Jenny was asked to find out how good wool is at keeping us warm.

She wrapped a boiling tube in wool and put some boiling water in the tube.

Then she measured the temperature of the water every 5 minutes for half an hour.

The starting temperature was 90°C.

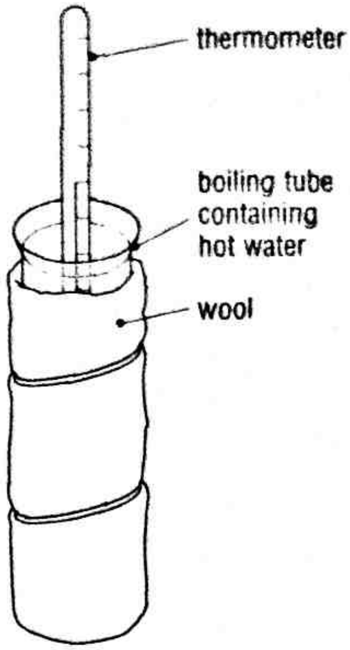
After 5 minutes it was 76°C.

When the time was 15 minutes, it was 58°C.

After 20 minutes it had fallen to 54°C.

She looked at her results and remembered that after 10 minutes the temperature was 66°C.

After 25 minutes and 30 minutes, the temperatures were 51°C and 49°C.



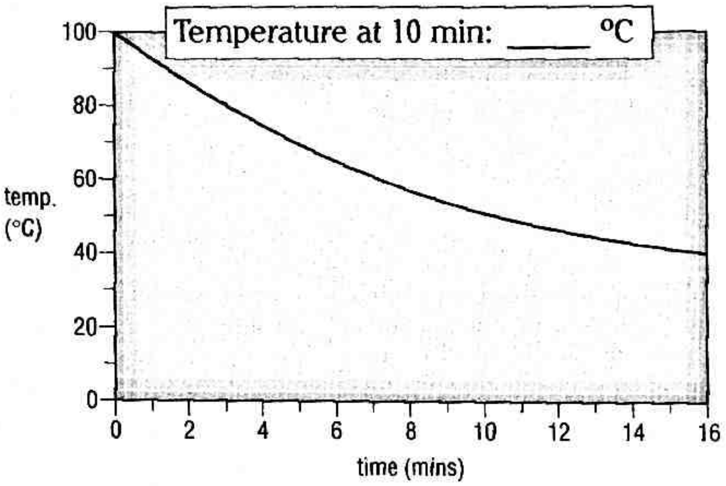
Help Jenny to make sense of her results.
Design a table and put her readings into it:

Interpreting graphs

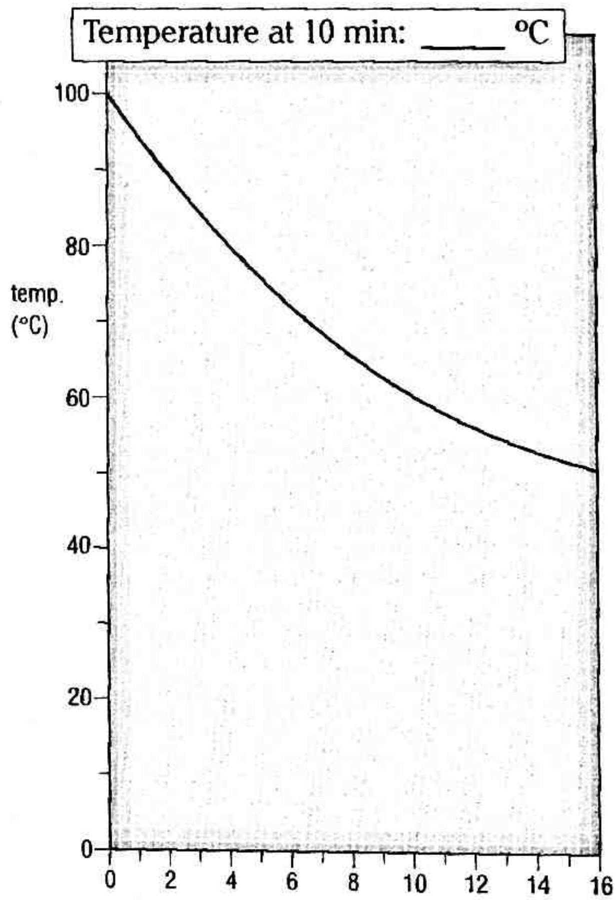
Name ______________________ **Class** ______________________

Look carefully at these 4 cooling curves for water.

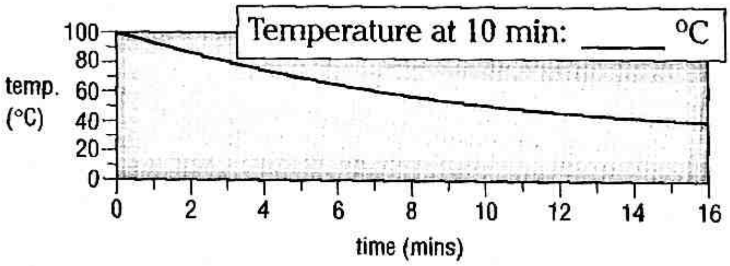
Graph 1



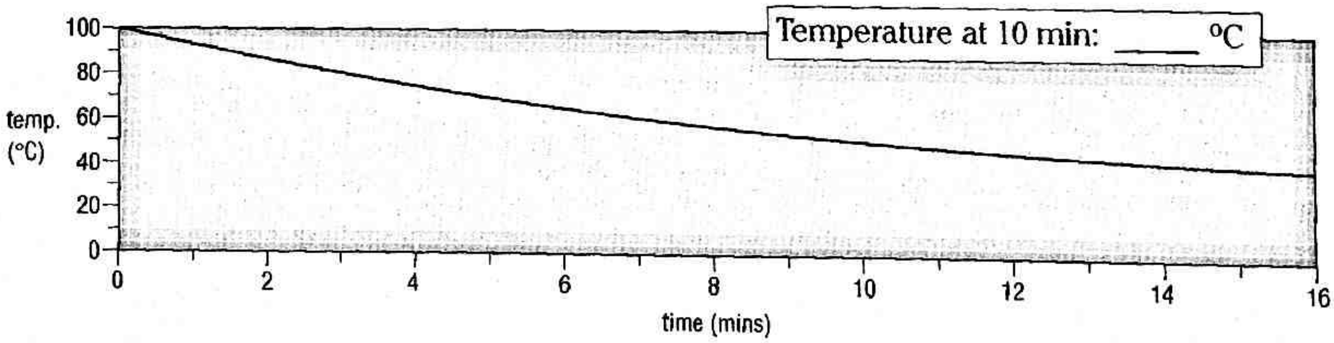
Graph 2



Graph 3



Graph 4



1 Which graph do you think shows the water cooling the quickest? Graph number _______.

2 For each graph, read carefully the temperature of the water at 10 minutes.
Put your answers in the box on each graph.

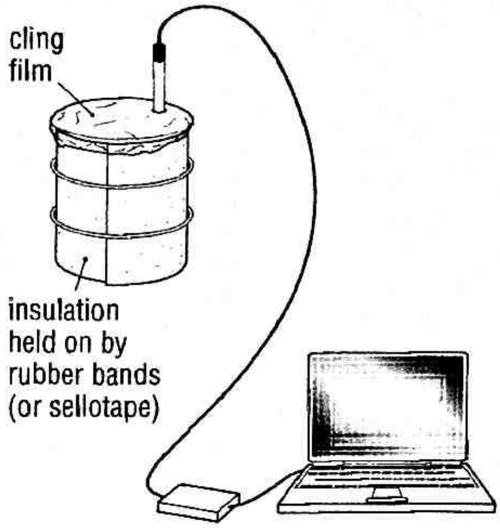
3 Which graph really has the coolest water at the end? Were you right in your suggestion in question 1?

8I2 Keeping warm

HOMEWORK SHEET Handling data

Lauren and Mohammed are going on a mountaineering holiday.
They know the weather can change quickly on a mountain – one minute it is sunny, and the next it is cold and raining.

They decided to test some materials to see how well they kept the body heat in.
They tested the materials when they were dry, and then when they were wet.



They wrapped each material round a beaker of very hot water. The beaker was covered with a lid of cling-film.

They used a temperature-sensor and a computer to measure the temperature every 2 minutes for 20 minutes. They used 4 materials. Here are their results:

Dry materials:

	Time (mins):	0	2	4	6	8	10	12	14	16	18	20
Temperature (°C)	no insulation	82.1	77.7	74.3	71.0	68.1	65.5	62.9	60.5	58.5	56.5	54.7
	bubble wrap	82.1	79.0	76.4	73.5	71.3	68.9	66.9	64.7	62.5	61.2	59.6
	cotton wool	82.0	79.8	77.9	75.7	74.2	72.4	70.9	69.2	67.4	66.4	65.1
	shiny foil	82.0	78.7	75.3	71.9	69.0	66.3	64.0	61.4	59.2	57.7	55.9

Wet materials:

	Time (mins):	0	2	4	6	8	10	12	14	16	18	20
Temperature (°C)	no insulation	82.1	73.8	69.2	65.5	61.9	58.8	56.0	53.4	51.1	48.8	46.8
	bubble wrap	82.1	78.0	74.9	71.7	69.0	66.6	64.8	63.0	60.9	59.2	56.6
	cotton wool	82.2	71.9	69.1	66.6	63.9	61.5	59.3	57.3	55.4	53.6	52.0
	shiny foil	82.0	76.2	72.4	69.2	66.5	64.0	61.4	59.2	57.0	55.0	53.3

1 Which of the 'dry' materials was best? Why do you think this is?

2 Which of the 'wet' materials was best? Why do you think this is?

3 Which material would you choose to make an emergency blanket for a mountaineer?

4 Why did they put cling-film lids on each beaker?

5 Why was the beaker with no insulation included in the investigation?

6 How could the investigation be improved?

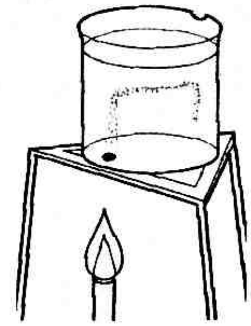
<u>Mark scheme</u>
You will receive 1 mark for correctly answering questions 3, 4 and 5.
You will receive 2 marks for correctly answering questions 1 and 2.
You will receive 3 marks for correctly answering question 6.

Maximum = 10 marks

8I3 Convection currents

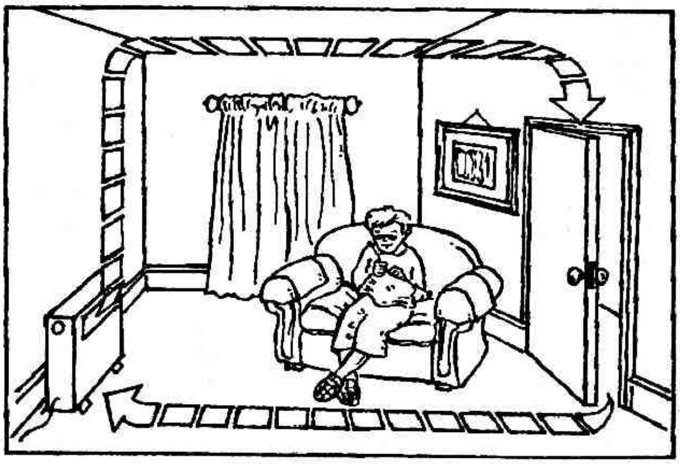
Extension Sheet

1 Cut out and paste these statements into the correct sequence.



A The water expands because it is hotter.
B The less-dense water rises (because it is lighter than the cold water around it).
C The water gets warmer (its temperature rises).
D As the warmer water rises, cold water takes its place, and the cycle continues.
E Because the water has expanded to a bigger volume, the density of the water is ***less***.
F This cycle is called a convection current. It can also happen in any fluid (liquids and gases).
G The heat energy of the Bunsen flame is conducted through the glass beaker.

2 Use this to write your own explanation of a convection current in ***air***, in a room with an electric heater.



8I3 A summer breeze

Extra Help

Name ______________________ **Class** ______________________

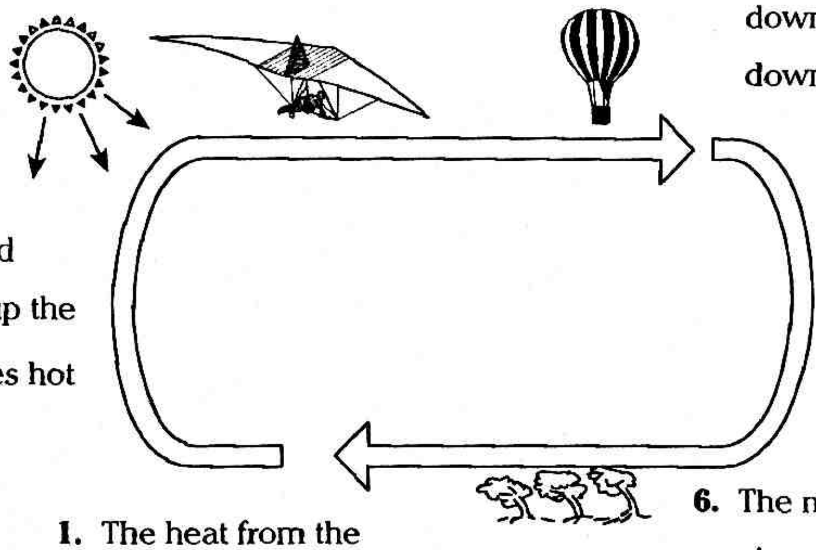
- In the diagram below use
  - a red crayon to colour the arrow for the warm air.
  - a blue crayon to colour the arrow for the cooler air.
- Fill in the spaces on the diagram below using the words in the box.

rise	**cool**	**Sun**	**gliders**	**wind**	**warms**

4. Hot air currents help balloons and g _ _ _ _ _ _ _ to stay in the air.

3. The hot air currents r _ _ _ _ from the ground.

5. The air currents c _ _ _ _ down and fall back down to earth.



2. The hot ground w _ _ _ _ _ up the air. This makes hot air currents.

1. The heat from the S _ _ _ warms up the ground.

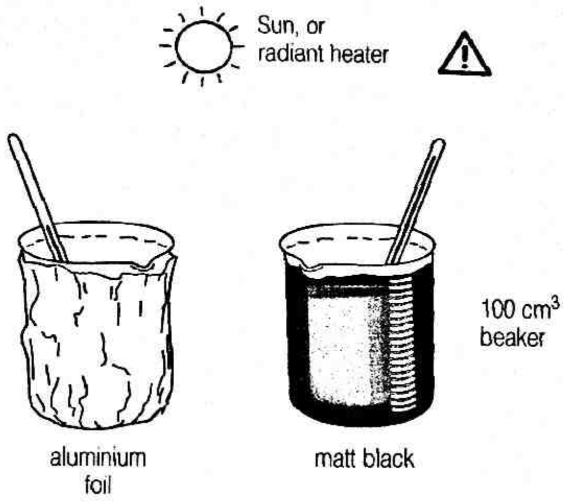
6. The movement of these air currents makes a w _ _ _ _.

8I3 The colours of cars

Help Sheet

Think about:

- You can use two 100 cm^3 beakers as the 2 cars.
- You can use thermometers or temperature-sensors with a data-logger.
- One beaker can be covered with aluminium foil (or painted with 'silver' paint).
  The other beaker can be covered with dull black paper (or painted with matt black paint).
- You can put the ***same*** amount of cold water in each beaker. How will you make sure they are equal amounts?
- You can put both beakers in bright sunshine.
  If the Sun is not shining, you will have to use a radiant heater like an electric fire. ! Take care !
  The beakers must be placed at the same distance from the heater.
- What else must you do, to make it a ***fair test***?
- You can take the temperatures every 10 minutes.
  You can record your results in a table like this:



Time (mins)	*Shiny beaker (°C)*	*Black beaker (°C)*
0		
10		
20		

Questions

1 Which beaker warms up more quickly?

2 Where does the energy come from?

3 Which is the better absorber of radiant energy – black or silver?

4 Why are houses in hot countries often painted white?

5 If pieces of black paper and white paper are laid on snow in sunshine, what is likely to happen?

6 If the arctic or antarctic snow was covered in black soot, what would happen?

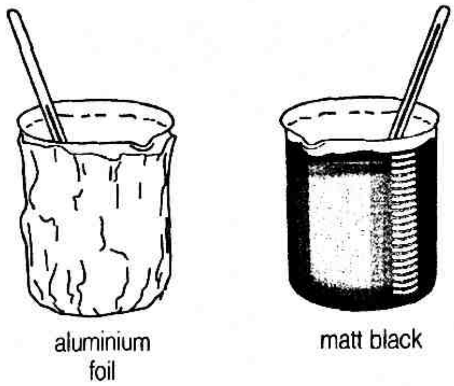
8I3 Colour of cars – results

Extra Help

Name ______________________ **Class** ______________________

- Put your results in this table:

Time (mins)	*Temperature of shiny beaker (°C)*	*Temperature of black beaker (°C)*
0		
10		
20		
30		
40		
50		
60		



- Which beaker warms up more quickly?

____

- Where does the energy come from?

____

____

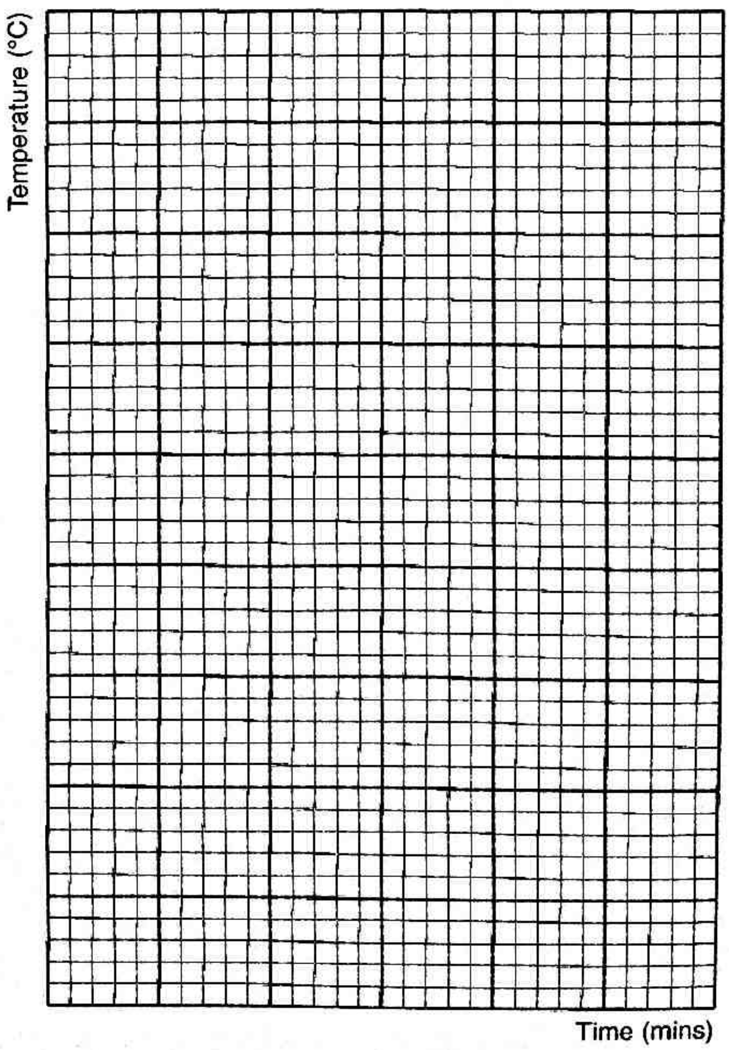
- Which beaker absorbs the most energy?

____

- Which surface absorbs heat quicker, a dark one or a shiny one?

____

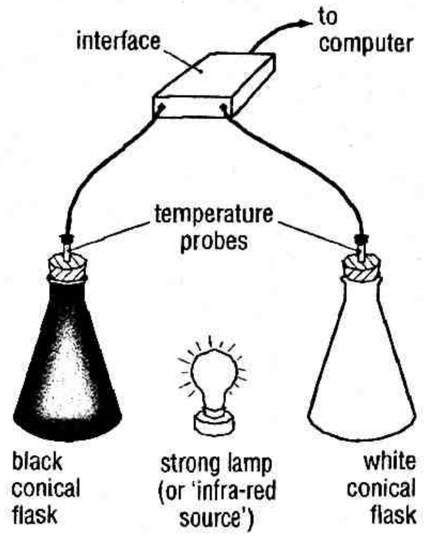
- Now plot a graph for each set of results. Both lines should be on the same grid.



8I3 Interpreting data

Sc1 Skill Sheet 66

A teacher demonstrates an investigation to show the effects of radiation on differently coloured surfaces.



He uses 2 sealed conical flasks, one white and the other black, each filled with water. They each have a temperature probe (connected to a data-logger) inserted through the lid.

For the first 10 minutes of the investigation the flasks are exposed to an infra-red heat source. After it is turned off the datalogger continues to collect temperatures for a further 10 minutes.

The results collected by the datalogger are in the table below:

Time (min)	Temperature (°C)		Time (min) continued	Temperature (°C)		Time (min) continued	Temperature (°C)		Time (min) continued	Temperature(°C)	
	Black	White		Black	White		Black	White		Black	White
0.0	22.5	22.5	5.2	31.3	27.2	10.2	40.3	33.8	15.2	35.4	29.9
0.2	22.6	22.6	5.4	31.6	27.4	10.4	40.6	34.0	15.4	35.1	29.7
0.4	22.8	22.8	5.6	32.0	27.6	10.6	40.9	34.2	15.6	34.7	29.5
0.6	23.1	23.0	5.8	32.4	27.8	10.8	41.1	34.3	15.8	34.3	29.4
0.8	23.4	23.2	6	32.8	28.0	11	41.2	34.3	16	34.0	29.2
1	23.7	23.4	6.2	33.1	28.2	11.2	41.2	34.2	16.2	33.6	29.0
1.2	24.0	23.5	6.4	33.4	28.3	11.4	41.1	34.1	16.4	33.3	28.8
1.4	24.4	23.7	6.6	33.8	28.5	11.6	41.0	34.0	16.6	32.9	28.6
1.6	24.8	23.9	6.8	34.2	28.7	11.8	40.8	33.9	16.8	32.5	28.4
1.8	25.2	24.1	7	34.5	29.0	12	40.6	33.8	17	32.2	28.3
2	25.6	24.3	7.2	34.9	29.3	12.2	40.4	33.6	17.2	31.9	28.2
2.2	25.9	24.5	7.4	35.3	29.6	12.4	40.2	33.4	17.4	31.5	28.0
2.4	26.3	24.7	7.6	35.7	29.9	12.6	39.9	33.2	17.6	31.2	27.9
2.6	26.7	24.9	7.8	36.0	30.2	12.8	39.6	32.9	17.8	30.9	27.8
2.8	27.1	25.0	8	36.4	30.5	13	39.3	32.6	18	30.5	27.6
3	27.4	25.2	8.2	36.8	30.8	13.2	39.0	32.3	18.2	30.2	27.4
3.2	27.8	25.4	8.4	37.1	31.1	13.4	38.7	32.0	18.4	29.9	27.3
3.4	28.1	25.6	8.6	37.4	31.4	13.6	38.3	31.7	18.6	29.6	27.2
3.6	28.4	25.8	8.8	37.7	31.7	13.8	37.9	31.4	18.8	29.4	27.1
3.8	28.7	25.9	9	38.1	32.0	14	37.5	31.1	19	29.2	26.9
4	29.0	26.1	9.2	38.5	32.3	14.2	37.2	30.9	19.2	29.0	26.7
4.2	29.4	26.3	9.4	38.9	32.6	14.4	36.8	30.7	19.4	28.8	26.6
4.4	29.7	26.5	9.6	39.3	32.9	14.6	36.4	30.5	19.6	28.6	26.4
4.6	30.1	26.7	9.8	39.7	33.2	14.8	36.2	30.3	19.8	28.4	26.3
4.8	30.5	26.9	10	40.1	33.5	15	35.8	30.1	20	28.2	26.2
5	30.9	27.1									

continued ...

Interpreting data (continued)

Name ______________________________ **Class** ______________________

The data given in the table on the other page is straight from the data-logger. As data-loggers record their temperatures far more often than we can with a thermometer, there are 201 temperature results in the table altogether.

1 Do you think that you need to have this much information to plot an accurate graph?

Explain your answer. ____

____

2 Decide how much of this information you need and then plot a graph below with a line of best fit of the results from the radiation investigation:

3 Look at your line of best fit for the black beaker. At what time does it reach its hottest temperature? ____________

4 Does the white beaker reach its hottest temperature at a similar time ?____________

5 Using your scientific knowledge of radiation and the results above, explain which beaker gets hottest and ***why***. ____

____

____

6 Explain which beaker cools down faster using your scientific knowledge of radiation.

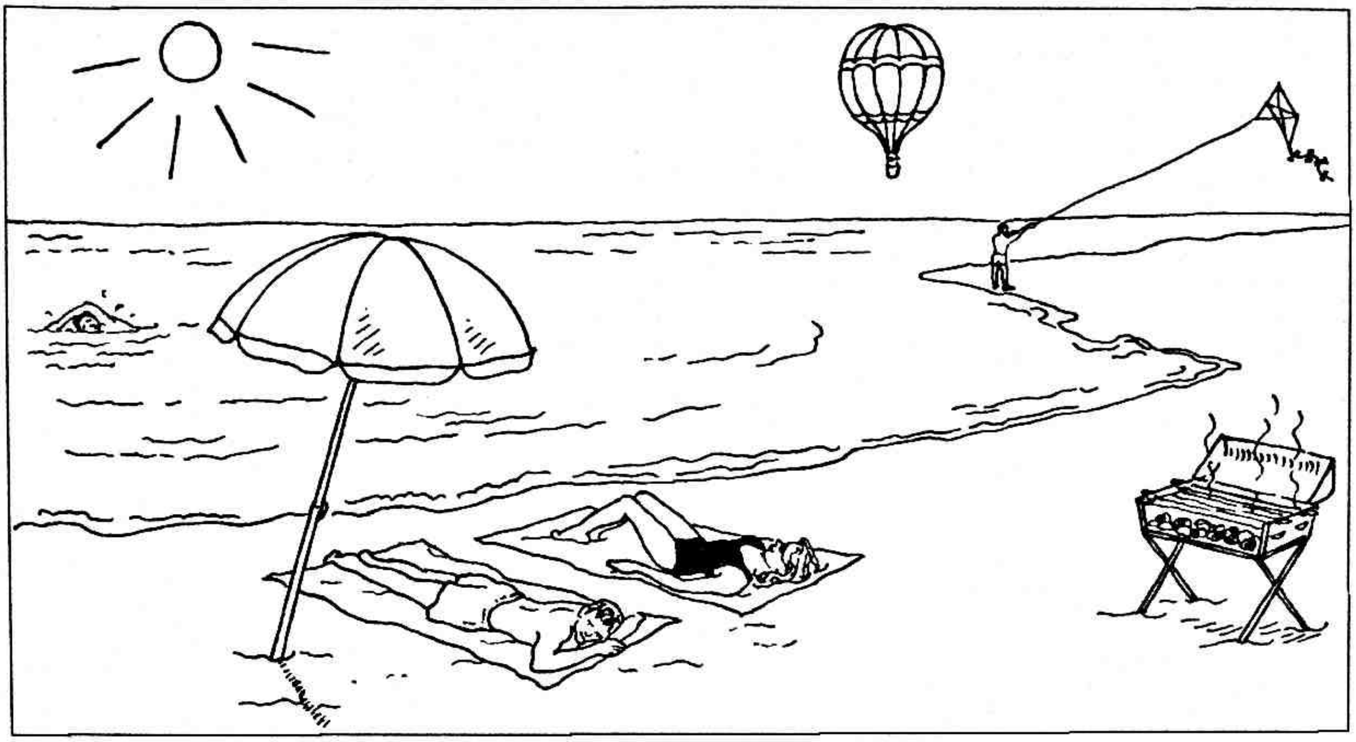
____

____

8I3

Conduction, convection, radiation

Help Sheet

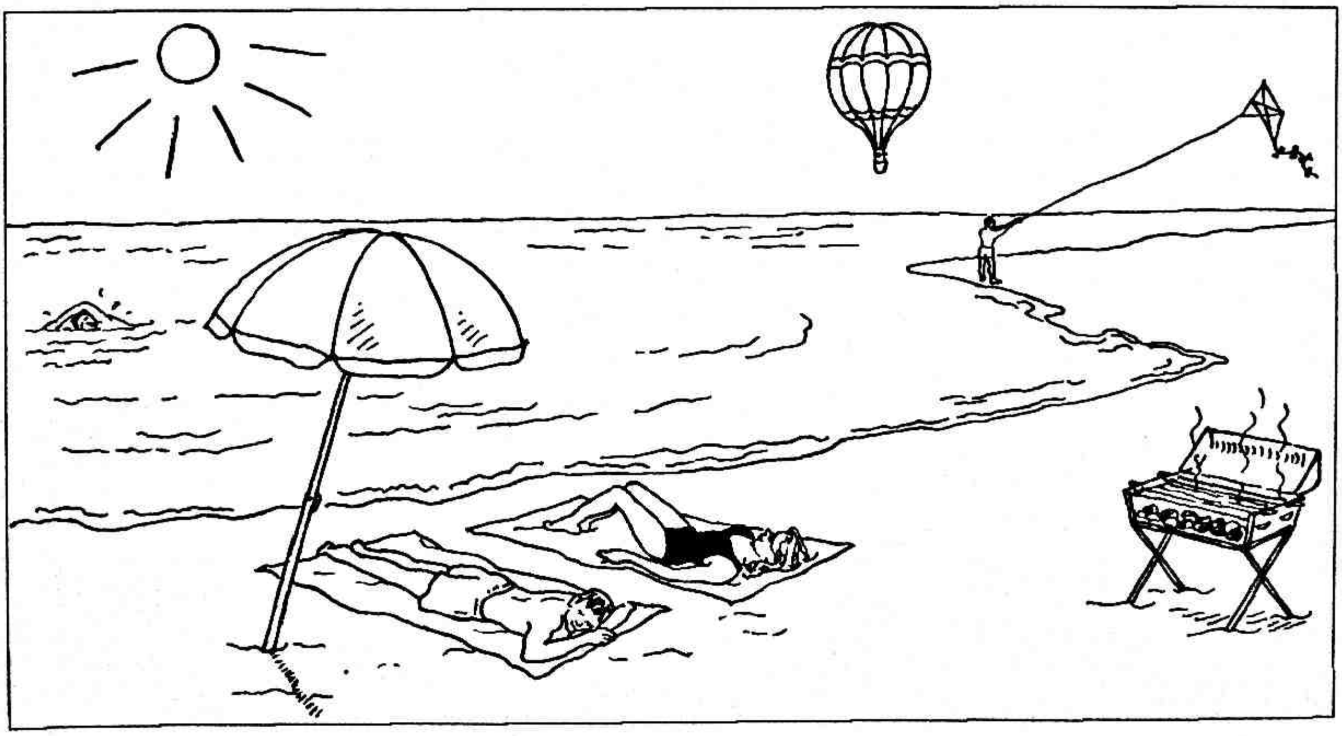


Look at the picture, and identify as many examples as you can of conduction, convection, radiation. List and explain each one briefly.

8I3

Conduction, convection, radiation

Help Sheet



Look at the picture, and identify as many examples as you can of conduction, convection, radiation. List and explain each one briefly.

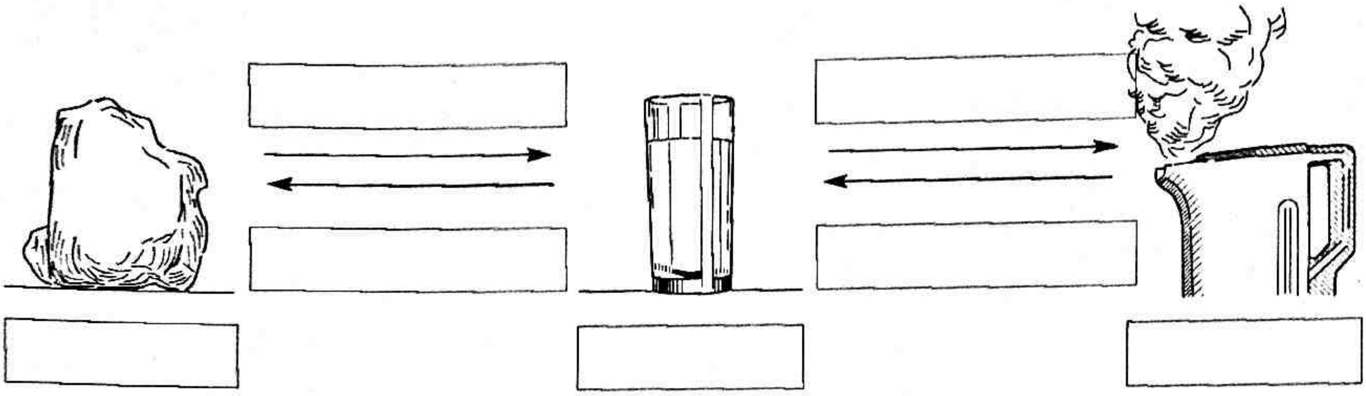
8I4 Changing state

Help Sheet

- Cut out the boxes below and stick them in the correct places on the diagram. Stick the completed diagram in your book.

boil (or evaporate) | melt | freeze | condense

liquid | solid | gas



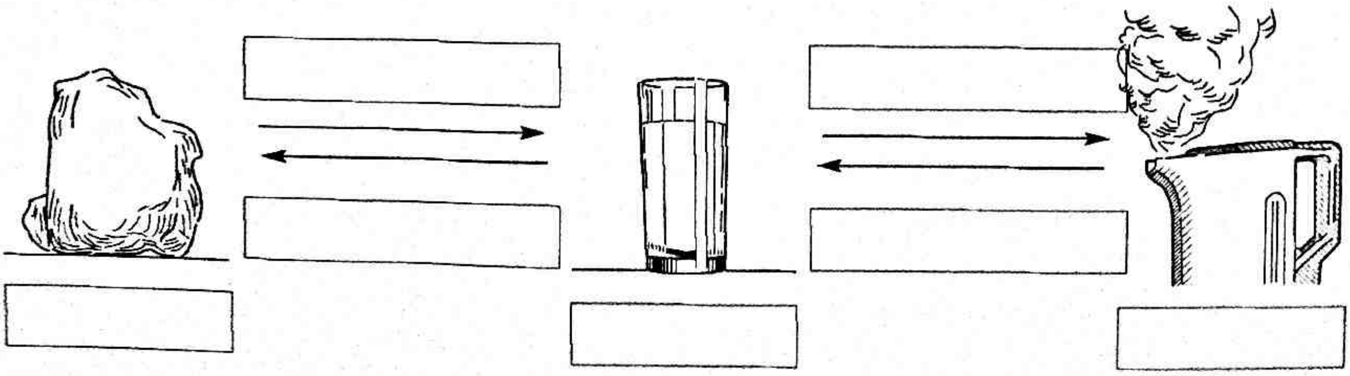
8I4 Changing state

Help Sheet

- Cut out the boxes below and stick them in the correct places on the diagram. Stick the completed diagram in your book.

boil (or evaporate) | melt | freeze | condense

liquid | solid | gas

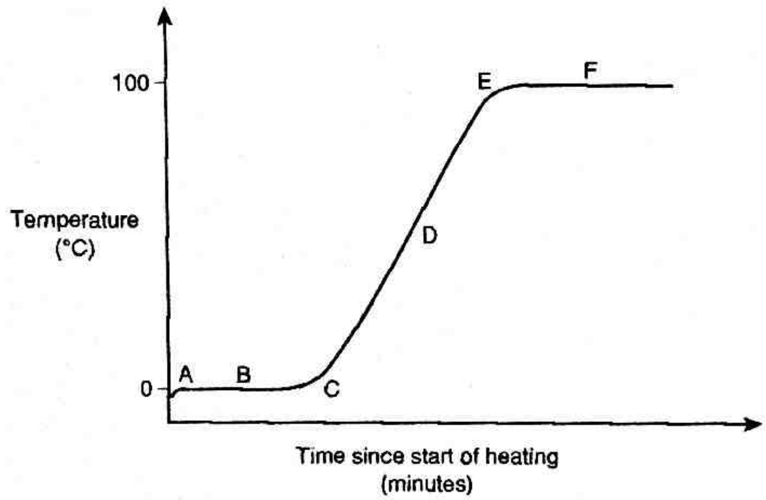


8I4 Changing state

HOMEWORK SHEET
Reading for information

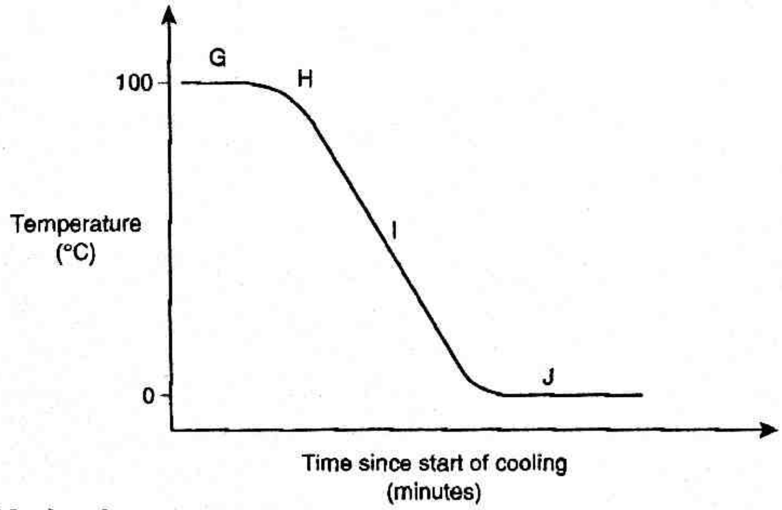
Imagine a beaker of pure ice with a thermometer in it. You heat the ice with a Bunsen burner. As the temperature increases, the ice molecules vibrate faster and faster. The kinetic energy of the molecules increases.
Eventually, the molecules have so much energy that they can break away from each other. They separate and move more freely. The solid melts, turning into a liquid.
While the melting is happening the temperature does not rise. The energy you are putting in is used to break the attractions between the molecules.
Once all the solid has become a liquid then the temperature begins to rise. It will continue to rise until the liquid begins to boil. The liquid water becomes a gas. While the water is boiling the temperature stays the same. The energy is used to break the attractions between the liquid molecules.
This energy is called latent heat.
A gas can lose energy and change state to become a liquid. This is called condensation.
A liquid can lose energy and change state to become a solid. This is called freezing.

1 The graph below shows what happens when ice is heated until it boils. Use the information in the passage above to label the parts of the heating curve for water.



labels to use
ice melting
water boiling
water gets hotter
ice starts to melt
water starts to boil
all ice turned into water

2 Use the information in the passage above to label the parts of the cooling curve for water.



labels to use
water freezing
steam condensing
all steam turned to water
water cools down

Mark scheme
You will receive 1 mark for each correct label on each graph.

Maximum = 10 marks