Introduction

Many of the issues covered here are of topical interest, and you may wish to look at them in some depth. The use of mathematics to predict future levels of pollution is a key aspect in environmental control. Some of these worksheets indicate this whilst others give pupils opportunities to estimate.

In terms of the National Curriculum, a variety of aspects of the Attainment Targets **Number** and **Handling Data** are covered. The particular *Yearly Programmes of Study* in the National Numeracy Framework are given in the chart below.

Topic	Sheet number	National Numeracy Framework reference
Introduction	**0**	
Surveys	**1**	6/E1
Energy	**2**	6/E1
Pollution	**3**	6/E1 and 6/C3
How hot is it?	**4**	4/B3 and B4
Making comparisons	**5**	6/E1
Water	**6**	6/E1
People	**7**	6/E1 and 6/C3
Eating the earth	**8**	6/C3 and 6/B6
School survey sheet	**9**	6/E1
Temperature scales	**10**	
Solutions		

The **environment** is the space in which you exist. Its size can vary: it depends on how much you want to deal with at any particular time.

You might want it to be no bigger than the room you are in, or perhaps the building. You might wish to take in more by thinking of the district in which you live or the complete town. On a larger scale, you might want to consider the environment as a complete country or the world.

Once we know what our environment is we can start to find out about it. Usually this is done by a **survey**.

Start with a small environment – *your classroom*.

Activity 1

Make a survey of your environment and record ten facts about it, such as the number of chairs, tables, people, etc.

Then do a survey to find out something about the the people in your environment. Just find out one thing about them such as their hobby or likes or dislikes (colour, pop group, school meal, etc.).

Write a sentence or two about the results of your survey.

Activity 2

Fill in a copy of the School Survey on Sheet 9 as far as you can.

Write some comments on the answers given in your survey.

It is not always possible to count every single thing in an environment and so we often need to **estimate** how many there are.

Activity 3

Try estimating how many of these things there are in **your school.**

chairs, tables, doors, light switches, power points

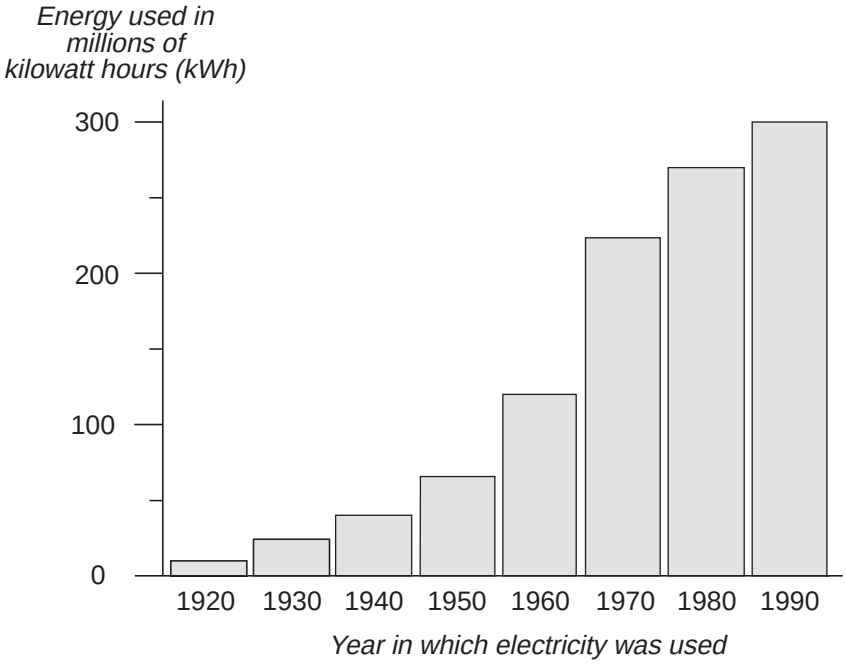
When using estimated figures, you must always make it clear that they are approximations and are not exact.

Energy, in many different forms, is very important to us.

Our bodies need energy in the form of food to stay alive.

We use energy in the form of heat to keep us warm, cook our food, work our materials and so on.

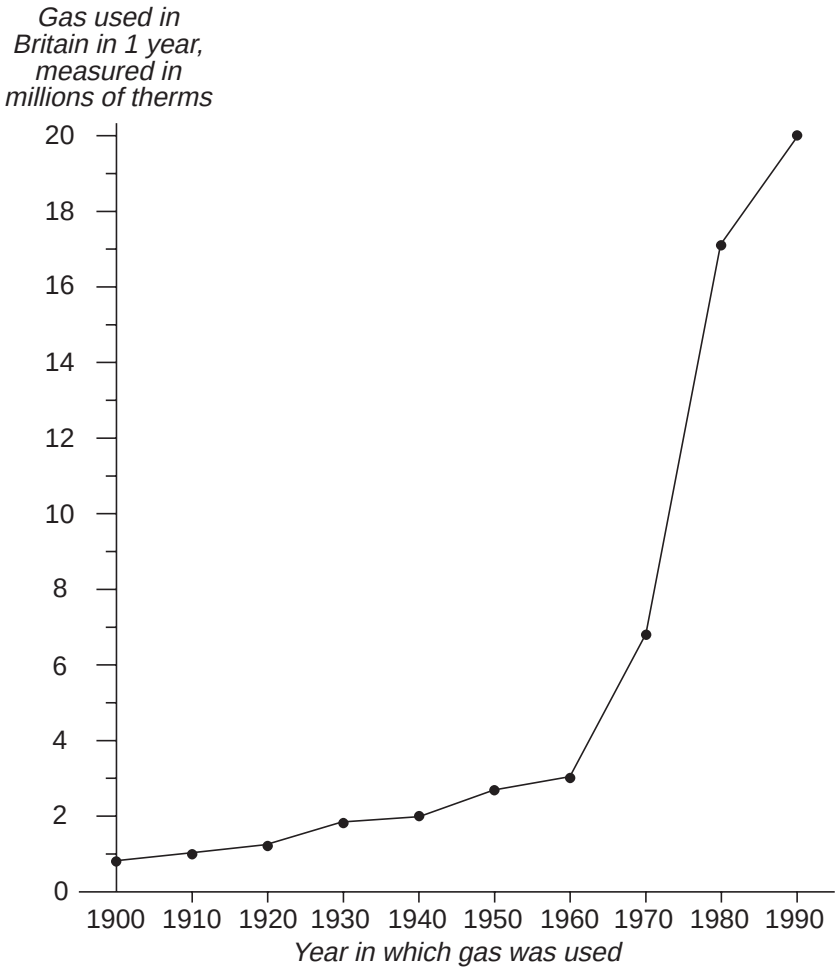
One form in which energy is brought to us is as **electricity**, and our need for that seems to be increasing all the time. The bar chart shows how much electricity was used in Britain in each of the years listed.



Activity 1

Show this information in a table, making a list of the eight years and putting the amount of electricity used beside each year.

Another way in which energy is delivered is as **gas**.



Activity 2

Make a table to show the information given in the chart on the right.

Read the newspaper cutting on the right.

This shows just one way in which the Earth is being polluted, but we need to know if the problem is getting worse or whether it has always been like this.

The first table below shows how many million metric tons of carbon have been put into the atmosphere *each year* named from 1860 onwards.

More greenhouse gas!

Latest figures show that the UK is putting 148 011 thousand metric tons of carbon dioxide into the atmosphere every year from fossil-fuel burning, cement production and gas flaring..

This creates the "greenhouse effect" which is causing the earth to warm up.

The total output of carbon dioxide from these sources in the 10 countries with the highest emissisions is 4 041 588 thousand metric tons of carbon per year.

It is hoped to reduce this total amount by 20% by the year 2000.

Activity 1

Make a chart or graph to show how the amount of carbon pollution has increased over the years.

Activity 2

Use your graph to make a good guess as to how much carbon might have been put into the atmosphere in the year 2000 if attempts to reduce it had had no impact.

World output of carbon pollution per year

1860	91	*in million metric tons of carbon*
1880	236	
1900	534	
1920	932	
1940	1299	
1960	2578	
1980	5297	
1990	6096	

Not all countries make the same amount of pollution.

It is difficult to compare them because each country is a different size from the others.

One way is to work out how much carbon they cause as pollution for **each person** in the country.

The table on the right shows this for some countries.

Activity 3

Make a chart or graph to show the information given in the table on the right.

Country	*Carbon output per person in tonnes per year*
Australia	16
Britain	7
China	4
France	8
Germany	10
India	1
Japan	6
USA	14

How hot is it?

Environment : 4

You will need to use sheet *Environment 10 :* Temperature Scales.

Activity 1

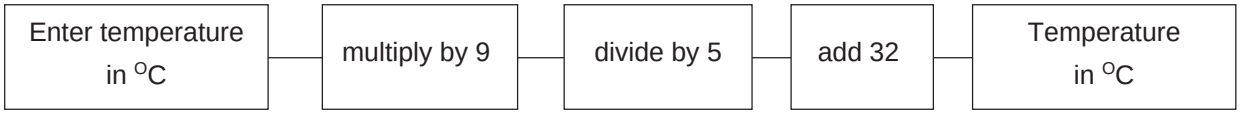
Find out the temperature outside today, and shade in the thermometer to show that temperature.
Draw a line on the thermometer to show what the temperature outside would be if it dropped by 40^{O} on the Celsius scale.
Write down what the temperature would be.

Activity 2

Cut out the four labels and stick them on so that they are pointing to the correct place on the thermometer.
You will have to make your own estimate where one of the numbers goes.

The Celcius scale (^{O}C) is now normally used for measuring temperatures, but the Farenheit scale (^{O}F) is still used by many people.

Use this flow diagram and a calculator to change ^{O}C into ^{O}F.



Enter 100^{O}C and check you get 212^{O}F as the answer.

Problems

1. Change the following temperatures into ^{O}F.

   (i) 80^{O}C (ii) 30^{O}C (iii) 57^{O}C (iv) –10^{O}C (v) – 40^{O}C.

2. For the four labels you have stuck on the thermometer, work out and write down the temperatures in ^{O}F.

Temperatures vary around the world. Some temperatures are shown on this table.

3. How much difference is there between the coldest temperature and hottest temperature in Cape Town?

4. What is the lowest and the highest temperature in Moscow in January? How much difference is there between them?

Range of average temperatures in ^{O}C

Place	*January*		*July*	
	From	*To*	*From*	*To*
Cape Town	15	25	10	20
London	0	10	10	20
Moscow	–15	–10	15	22
New York	–5	5	15	25
Singapore	25	35	25	35
Sydney	15	20	5	15

Making comparisons

Very often we need to make comparisons between numbers so we know how one relates to another.

For instance, CFC gas is believed to cause harmful holes in the ozone layer. The table shows how the amount of CFC has increased over the years. Using this information we can make statements like

*"In 1985 the amount of CFC gas in the atmosphere was almost **twice** what it was in 1975."*

CFC in the atmosphere	
Year	*Million of tonnes*
1960	1
1965	2
1970	4
1975	8
1980	11
1985	15

Activity 1

Write a statement similar to the one above, relating 1975 and 1965.
Then write another another about 1980 and 1970.

Activity 2

Recycling glass is increasing as shown by the number of councils which now run bottle banks.

Write some statements which, by making comparisons, show how the increase is changing.

Number of councils in Britain with bottle banks	
1977	5
1978	20
1979	30
1981	150
1985	350
1992	450

Activity 3

Steel is also recycled and the increase in this can be seen in the table which gives the number of collecting points for tin cans, which are sponsored by Corus (previously British Steel).

Write two sentences describing how the number of can banks has grown.

Number of can banks sponsored by Corus	
1990	200
1991	500
1994	1000
2000	2000

Vehicles on road in Britain	
Year	*Million*
1922	1
1928	2
1949	4
1961	10
1970	15
1983	20
1995	30

Activity 4

Lead in the atmosphere is harmful, particularly to children. Although the number of vehicles on the roads is increasing, the use of unleaded petrol has helped to bring down the amount of lead in the atmosphere.

Use the table on the left to write some sentences describing how the number of vehicles on the roads in Britain is increasing.

Water is essential to us – life would be impossible without it.

We seem to need a lot of it too!

The table on the right shows how many litres of water are used in one day by one person, on average.

Average amount of water used by one person in one day	*Amount in litres*
Washing and bathing	40
Toilet	30
Laundry	30
Drinking	10
Outside	10
Total	120

Activity 1

Show the information given in the table in either a bar chart or a pie chart.

How much water would an average family use in one week?

Problems

1. What fraction of all the water we use is for washing and bathing?
2. Which **two** uses **together** can take one half of the water?
3. By being careful it is not difficult to use 20% less water. How much water could the average person save in one day by being careful?
4. How much would be saved by that person in one year?

Try to find out how much water is used in, say, washing your hands, either under a running tap or by washing them in a wash-basin half-full of water.

Activity 2

Guess how many litres of water an ordinary bucket holds.
Get a bucket and a litre measure. Look at them both and make another guess.
Finally, use the measure and some water to find out exactly how much the bucket holds.

Activity 3

About how many buckets of water does the average person use in a day?

The population of the world is increasing all the time. The table on the right gives the world population (in billions) for various years.

Year	*World population in billions*
1800	1.0
1900	1.6
1950	2.5
1960	3.0
1970	3.7
1980	4.4
1990	5.3
2000	6.1
A billion is 1000 million	

Activity 1

Make a graph to show how the world population has been growing.

Activity 2

Try to estimate from your graph what the world population might be in the year 2010.

Problems

1. At the present time the world population is growing at about 80 million every year. How many is that in 10 years?
2. How long would it take to increase by 1 billion?
3. The population of Great Britain is a little over 50 million.
   The length of the coastline is about 4000 km.
   If all the population stood side by side (shoulders touching) how far around the coast would they reach?
4. How much space do people take up?

Activity 3

Gather a group of people together and measure how much space they cover.
Try to work out how much space would be taken up by a thousand people.
Estimate how many people could be fitted into some open space in your school (playing-field, car-park, playground or similar).

Problems

5. How many schools of the size of yours would be needed for 1 million pupils?
6. Are you 1 billion seconds old?

Eating the Earth

Read the newspaper cutting on the right.

One of the difficulties with information like this is that it is not easy to see how big an amount like this is. One way, used often in newspapers, is to relate it to something more familiar.

Have you any idea how much air space there is in your present classroom? It is probably between 50 and 100 cubic metres.

How We Eat Our Earth!

Every year we use up more and more of the world on which we live. Three of the the main things we take out are iron, coal and oil.

At the present time in an average year we use up

Iron	900 million tonnes
Coal	4800 million tonnes
Oil	22000 million tonnes

All of these together mean that every year the planet on which we live has about 4000 million cubic metres taken away from it. How much longer can we go on like that?

Activity 1

Work out how many classrooms (at 100 cubic metres each) it would need to hold a year's supply of iron, coal and oil.

This still means some very large numbers are being used, so try to find out the size of some extra large space (school hall, sports centre or similar) and work out how many of those would be needed to hold a year's supply.

A change to the surface of the earth is made by all the trees cut down.
One estimate says that we lose 20 million hectares of trees each year.
How can we imagine an area that big?

An average school football pitch covers an area of about half a hectare.

An average English town of 100,000 people covers an area of about 5000 hectares.

Activity 2

Work out how many football pitches or how many towns could be fitted into the space cleared of trees each year.

Activity 3

Try to find out the area of your county and compare it with the area cleared of trees each year.

School survey sheet

Environment : 9

A. My name is _____ and my school is _____

B. The school has

_____ girls _____ boys a total of _____ pupils

_____ classes _____ teachers _____ classrooms

C. In my class there are

_____ girls _____ boys a total of _____ pupils

D. In my classroom there are

_____ tables _____ chairs _____ . . . . . .

E. In an average week I spend this amount of school-time on these subjects

English	_____ minutes	Science	_____ minutes	Mathematics	_____ minutes
History	_____ minutes	R.E.	_____ minutes	Geography	_____ minutes
Art	_____ minutes	Technology	_____ minutes	Language	_____ minutes
. . . . .	_____ minutes	. . . . .	_____ minutes	. . . . .	_____ minutes

F. Of the pupils in my class,

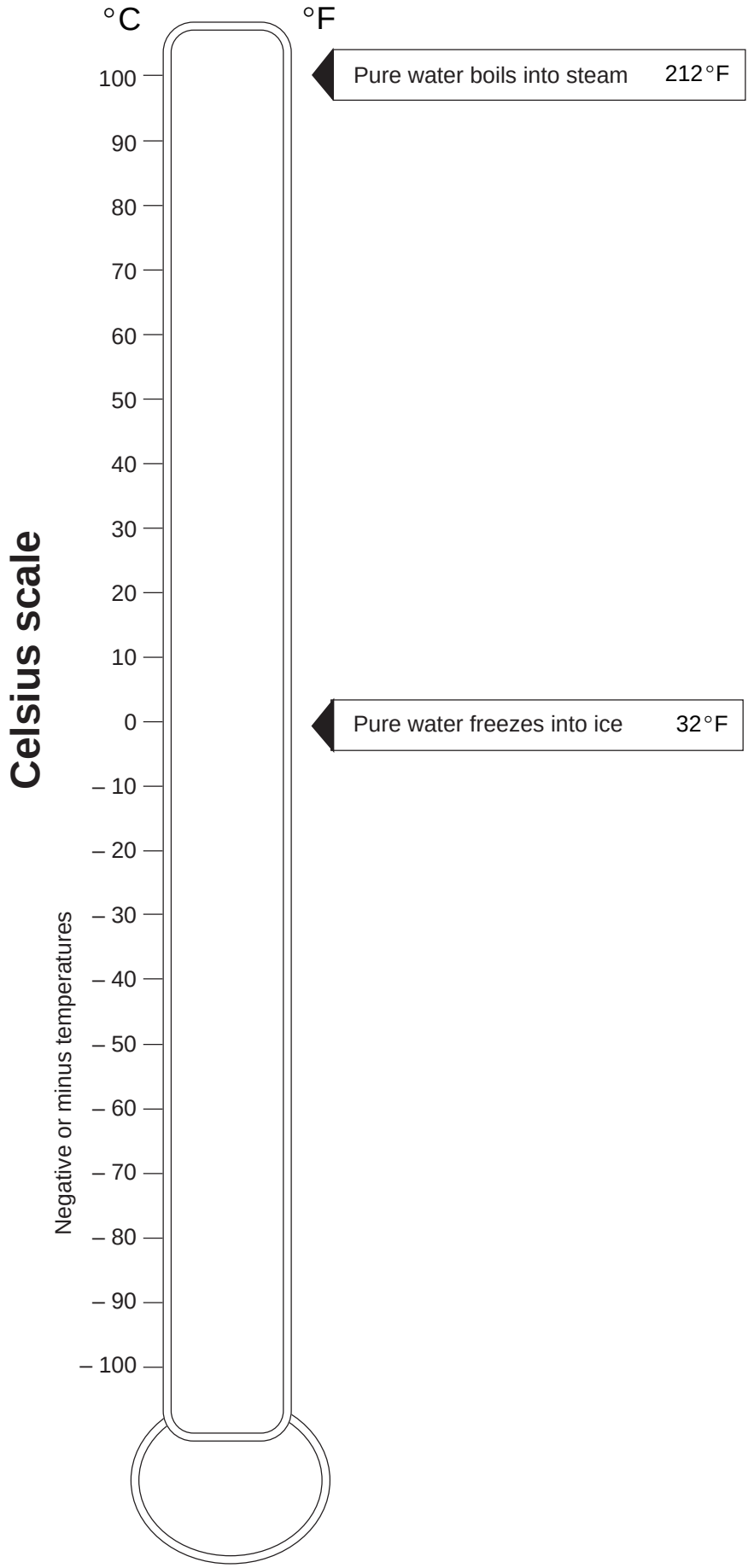
_____ walk to school _____ use the school bus _____ . . . . . .

_____ cycle to school _____ use a public bus _____ . . . . . .

_____ travel by car _____ travel by train _____ . . . . . .

Temperature scales

Environment : 10



Cut out the four labels below and stick them beside the thermometer scale so that their arrows point to the correct temperature.

Range of comfortable room temperatures °F

Normal human body temperature 37°C °F

Lowest recorded temp. (in Antarctica) – 90°C °F

Highest recorded temp. (in desert) 58°C °F

Sheet 2 **Activity 1**

1920	10
1930	25
1940	40
1950	65
1960	120
1970	230
1980	270
1990	300

Activity 2

1900	0.8
1910	1.0
1920	1.2
1930	1.8
1940	2.0
1950	2.7
1960	3.0
1970	6.8
1980	17.1
1990	20.0

Sheet 4 **Problems**

1. **(i)** 176°F 86°F **(ii)** 86°F **(iii)** 134.6°F
(iv) 14°F **(v)** −40°F

3. 15°F **4.** −15°F, −10°F, 5°F

Sheet 5 **Activity 1**

For example,
'In 1975, the amount of CFC was four times what it was in 1965.'
'In 1980, the amount of CFC was almost three times what it was in 1970.'

Activity 2

For example,
'In 1992, the number of councils with bottle banks was three times the number in 1981.'

Activity 3

For example,
'In 1994, the number of can banks sponsored was double the number sponsored in 1991.'
'In 1994, the number of can banks sponsored was five times the number sponsored in 1990.'

Activity 4

For example,
'The number of vehicles in 1995 was 3 times the number in 1961.'

Sheet 6 **Problems**

1. $\frac{1}{3}$ **2.** 'Toilet and 'Laundry'

3. 24 litres **4.** 8760 litres

Sheet 7 **Problems**

1. 800 million **2.** 13 years

3. Stretch about 6 times around the coast. (Assumes each person measures 0.5 m across the shoulders.)

6. No, 1 billion seconds is about 31.7 years.