

Problem Solving

Level E

Pages 78 - 98

Strategies

Pages 78 – 82 - ‘Draw a picture, make a model’ (consolidate strategy)	Unit E4
Pages 83 & 84 - ‘Look for a pattern’ (consolidate strategy)	Unit E5
Pages 85 – 88 - ‘Guess, check and improve’ (consolidate strategy)	Unit E6
Pages 89 – 92 - ‘Be systematic’ (consolidate strategy)	Unit E7
Pages 93 & 94 - ‘Work backwards’ (consolidate strategy)	Unit E8
Pages 95 – 98 - ‘Take a simpler case, make a table, spot a pattern’ (consolidate strategy)	Unit E9

‘Unit’ refers to the Programme of Study

Make a model cereal box

Problem Solving
draw a picture, make a model
(Level E) page 78

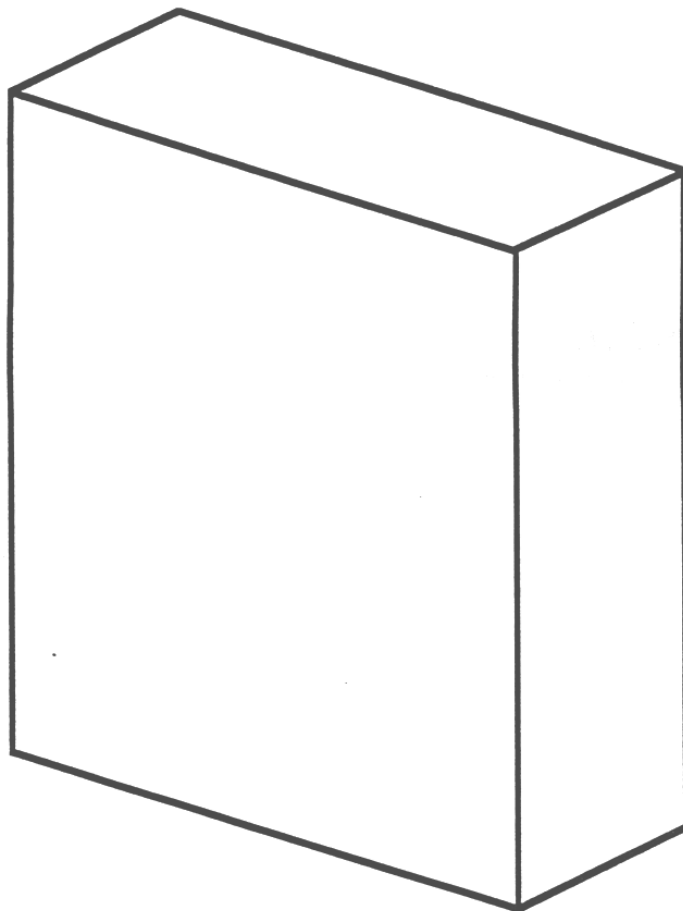
Get a cereal box, some card, scissors,
a ruler, and glue or sellotape.

Make a quarter size model of your cereal box.

Your cereal
box is a three
dimensional
object.

It has a
length,
breadth and
a height.

Your quarter
size model
will need to
be quarter
size in three
directions.



How many of your quarter size
models would fit into your original
cereal box?

(there should be more than 4)

Equal areas

Problem Solving
draw a picture, make a model
(Level E) page 79

You need at least
* a sheet of A3 paper
* a ruler
* a pair of compasses

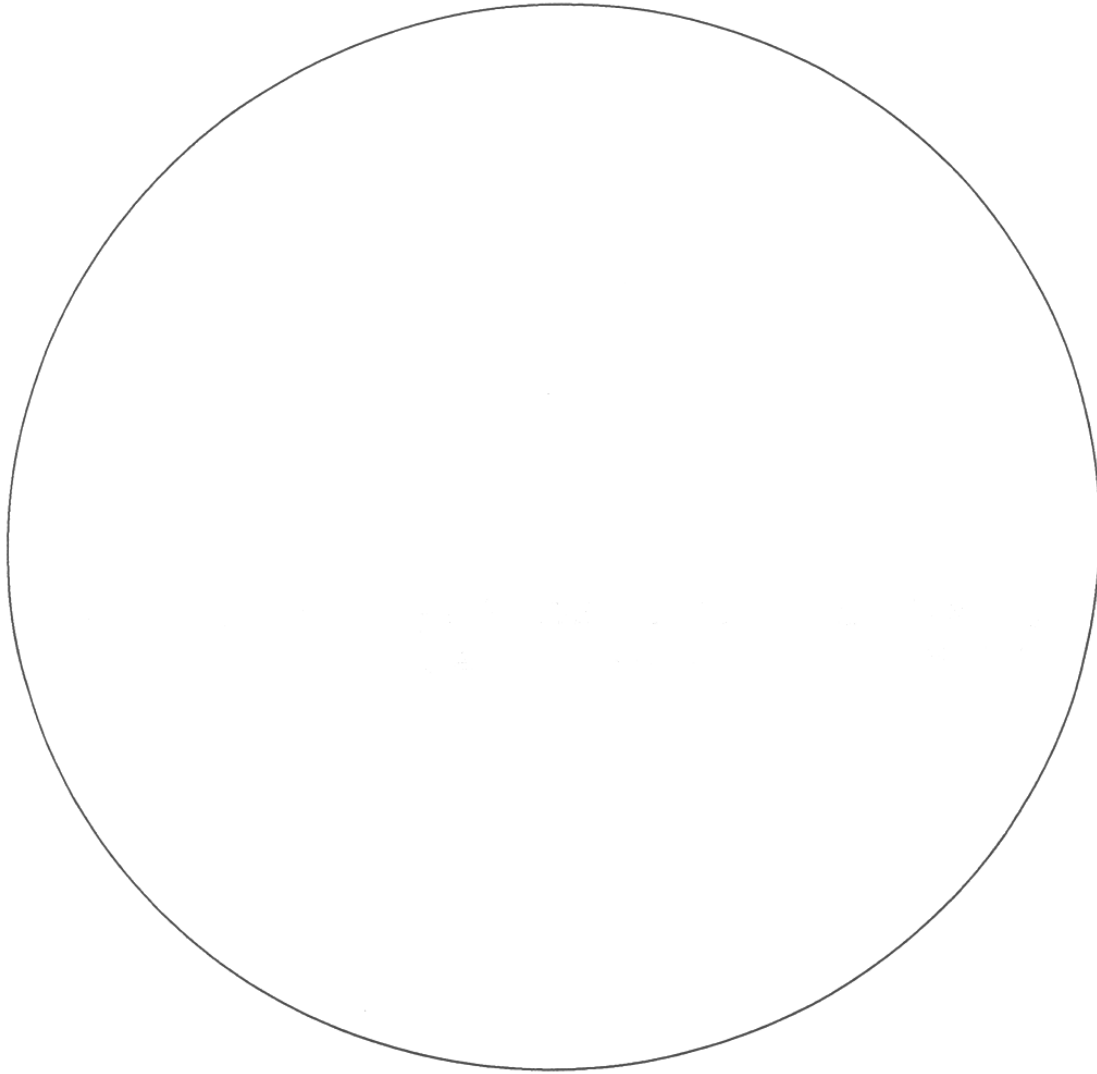
**This page,
which is in the shape
of a rectangle,
has a certain area.**

**Can you draw a
square
which has the
same area
as this rectangle?**

**Can you draw a
circle
which has the
same area
as this rectangle?**

Circle to square

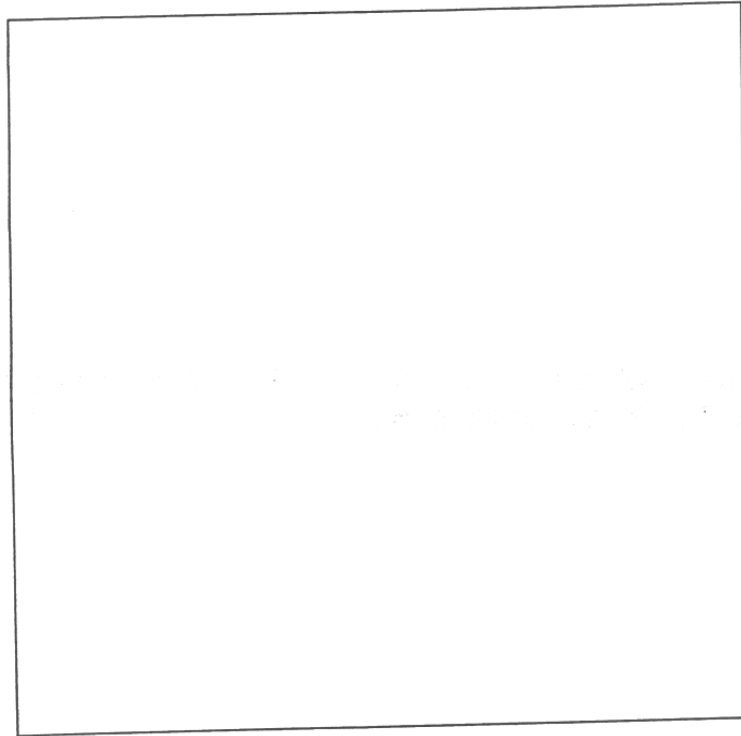
Problem Solving
draw a picture, make a model
(Level E) page 80



Draw a square which has the same area as this circle.

Square to circle

Problem Solving
draw a picture, make a model
(Level E) page 81



Draw a circle which has the same area as this square.

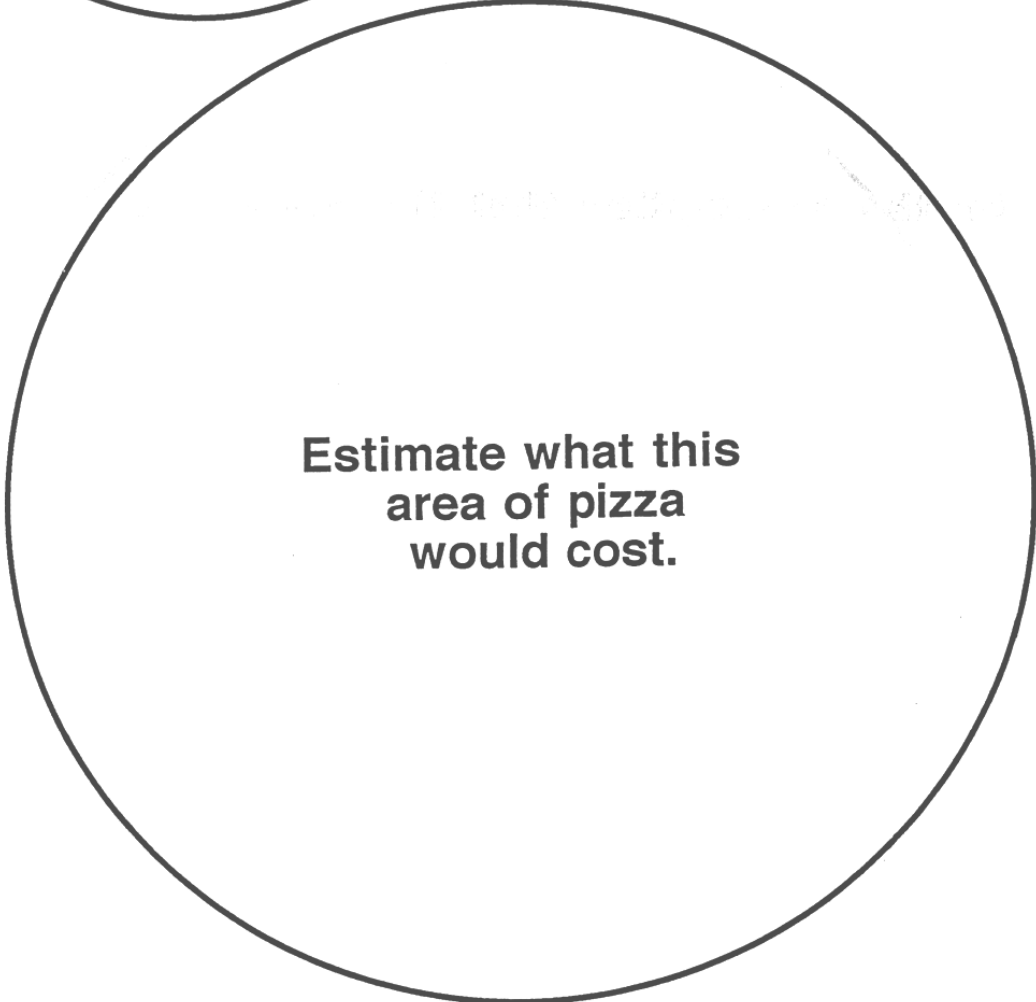
What would this pizza cost?

Problem Solving
draw a picture, make a model
(Level E) page 82



**This area of pizza
costs £1.25**

**These two pizzas each
have the same thickness
and toppings, but they
have different areas.**



**Estimate what this
area of pizza
would cost.**

Keep the patterns going

Copy them into your jotter;

Problem Solving
look for a pattern
(Level E) page 83

22, 19, 16, 13,,,,,,,,,

1.005, 1.004, 1.003,,,,,,,,

- 51, - 44, - 37, - 30,,,,,,,,

55ml, 110ml, 165ml, 220ml,,,,,,,

0.055L, 0.11L, 0.165L, 0.22L,,,,,,,

$\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$,,,,,,,,

$\frac{1}{16}$ $\frac{2}{16}$ $\frac{3}{16}$ $\frac{4}{16}$

175, 190, 205, 220,,,,,,,,

0.175, 0.19, 0.205, 0.22,,,,,,,

08:05, 08:40, 09:15, 09:50,,,,,,,

£5, £6.35, £7.70, £9.05,,,,,,,

80, 69, 58, 47,,,,,,,,

$\frac{1}{20}$, $\frac{1}{10}$, $\frac{3}{20}$, $\frac{1}{5}$,,,,,,,,

$\frac{1}{20}$ $\frac{2}{20}$ $\frac{3}{20}$ $\frac{4}{20}$

904g, 920g, 936g, 952g,,,,,,,

0.904kg, 0.92kg, 0.936kg, 0.952kg,,,,,,,

1, 4, 9, 16, 25,,,,,,,,

60ml, 55ml, 50ml, 45ml,,,,,,,

0.06L, 0.055L, 0.05L, 0.045L,,,,,,,

$\frac{1}{40}$, $\frac{1}{20}$, $\frac{3}{40}$, $\frac{1}{10}$,,,,,,,,

$\frac{1}{40}$ $\frac{2}{40}$ $\frac{3}{40}$ $\frac{4}{40}$

920mm, 935mm, 950mm, 965mm,,,,,,,

0.92m, 0.935m, 0.95m, 0.965m,,,,,,,

07:30, 08:25, 09:20, 10:15,,,,,,,

Keep the patterns going

Copy them into your jotter

Problem Solving
look for a pattern
(Level E) page 84

90, 78, 66, 54,,,,,,,,

0.994, 0.995, 0.996, 0.997,,,,,,

- 47, - 40, - 33, - 26,,,,,,

830ml, 855ml, 880ml,,,,,,

0.83L, 0.855L, 0.88L,,,,,,

$\frac{1}{50}$, $\frac{1}{25}$, $\frac{3}{50}$, $\frac{2}{25}$,,,,,,

$\frac{1}{50}$ $\frac{2}{50}$ $\frac{3}{50}$ $\frac{4}{50}$

1035g, 1030g, 1025g,,,,,,

1.035kg, 1.03kg, 1.025kg,,,,,,

08:24, 08:39, 08:54, 09:09,,,,,,

\$5, \$5.95, \$6.90, \$7.85,,,,,,

120, 105, 90, 75,,,,,,

$\frac{1}{36}$, $\frac{1}{18}$, $\frac{1}{12}$, $\frac{1}{9}$,,,,,,

$\frac{1}{36}$ $\frac{2}{36}$ $\frac{3}{36}$ $\frac{4}{36}$

1012g, 1010g, 1008g,,,,,,

1.012kg, 1.01kg, 1.008kg,,,,,,

2, 5, 11, 23, 47, 95,,,,,,

265mm, 240mm, 215mm, 190mm,,,,,,

0.265m, 0.24m, 0.215m, 0.19m,,,,,,

$\frac{1}{80}$, $\frac{1}{40}$, $\frac{3}{80}$, $\frac{1}{20}$,,,,,,

$\frac{1}{80}$ $\frac{2}{80}$ $\frac{3}{80}$ $\frac{4}{80}$

970mm, 975mm, 980mm, 985mm,,,,,,

0.97m, 0.975m, 0.98m, 0.985m,,,,,,

07:30, 08:45, 10:00, 11:15,,,,,,

Make the sums correct

Problem Solving
guess, check and improve
(Level E) page 85

Make these sums correct by using only
0.25, 1.5, 2.25, 8, 10, 100 or 1000.

$$\square \times \square = 2$$

$$\square \times \square = 12$$

$$\square - \square = 7.75$$

$$\square \div \square = 0.008$$

$$\square \times \square = 250$$

$$\square + \square = 2.5$$

$$\square \div \square = 0.225$$

$$\square - \square = 99.75$$

$$\square - \square = 0.75$$

$$\square \times \square = 150$$

$$\square + \square = 3.75$$

$$\square \div \square = 0.025$$

Make these sums correct by using only
0.16, 1.6, 4, 10, 100 or 1000.

$$\square + \square = 5.6$$

$$\square \times \square = 1.6$$

$$\square - \square = 9.84$$

$$\square \div \square = 0.0016$$

$$\square \times \square = 1600$$

$$\square + \square = 1.76$$

$$\square \div \square = 0.016$$

$$\square - \square = 2.4$$

$$\square \times \square = 6.4$$

$$\square \div \square = 0.004$$

$$\square - \square = 1.44$$

$$\square \div \square = 2.5$$

What do these weigh?

Problem Solving
guess, check and improve
(Level E) page 86

1



These spheres weigh 25 grams altogether



These spheres weigh 20 grams altogether

What does a  weigh?

What does a  weigh?

2



These spheres weigh 20 grams altogether

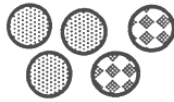


These spheres weigh 22 grams altogether

What does a  weigh?

What does a  weigh?

3



These spheres weigh 22 grams altogether



These spheres weigh 13 grams altogether

What does a  weigh?

What does a  weigh?

4



These spheres weigh 130 grams altogether



These spheres weigh 85 grams altogether

What does a  weigh?

What does a  weigh?

5



These spheres weigh 19 grams altogether



These spheres weigh 16 grams altogether

What does a  weigh?

What does a  weigh?

6



These spheres weigh 34 grams altogether

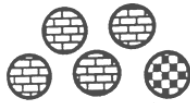


These spheres weigh 62 grams altogether

What does a  weigh?

What does a  weigh?

7



These spheres weigh 33 grams altogether



These spheres weigh 42 grams altogether

What does a  weigh?

What does a  weigh?

8



These spheres weigh 225 grams altogether



These spheres weigh 105 grams altogether

What does a  weigh?


What does a  weigh?


What do these cost?


Problem Solving
guess, check and improve
(Level E) page 87

1

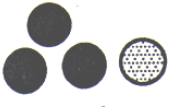
These spheres cost £6 altogether



What does a  cost?


What does a  cost?


These spheres cost £11 altogether




2


These spheres cost £11.50 altogether



What does a  cost?

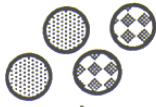
What does a  cost?


These spheres cost £8 altogether




3

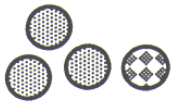
These spheres cost £36 altogether



What does a  cost?

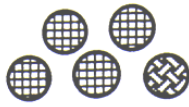
What does a  cost?


These spheres cost £34 altogether




4

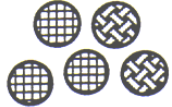
These spheres cost £7.50 altogether



What does a  cost?


What does a  cost?


These spheres cost £10 altogether




5


These spheres cost £13 altogether



What does a  cost?


What does a  cost?


These spheres cost £11.50 altogether




6


These spheres cost £1 altogether



What does a  cost?

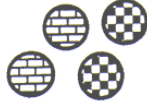
What does a  cost?


These spheres cost £5 altogether




7

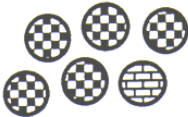
These spheres cost £2 altogether



What does a  cost?


What does a  cost?


These spheres cost £2 altogether




8


These spheres cost £8 altogether



What does a  cost?

What does a  cost?

These spheres cost £3.50 altogether



What would these cost?

Problem Solving
guess, check and improve
(Level E) page 88

1. A can of juice and a packet of crisps costs 45p altogether.
4 cans of juice and 2 packets of crisps cost £1.50 altogether.

What would it cost for 6 cans of juice?

2. In a shop, red marbles are more expensive than yellow marbles.
A red and a yellow marble cost 18p altogether, and
2 red and 3 yellow marbles cost 44p altogether.

What would it cost for 10 red marbles?

3. A pen is more expensive than a pencil.
A pen and a pencil cost 40p altogether, and
2 pens and 4 pencils cost £1.10 altogether.

What would it cost for 3 pens?

4. An orange and an apple cost 25p altogether, and
2 oranges and 3 apples cost 65p altogether.

What would it cost for 5 oranges?

5. A bottle of red juice and a bottle of clear juice cost 90p altogether.
2 bottles of red and 4 bottles of clear cost £2.60 altogether.

What would it cost to buy 10 bottles of red juice?

6. A mug holds more liquid than a cup.
Between them a mug and a cup can hold 350 ml altogether, and
2 mugs and 4 cups can hold 1 litre altogether.

How much liquid does a mug hold?

7. A golf ball and a tennis ball weigh 160 grams altogether, and
a golf ball and 5 tennis balls weigh 400 grams altogether.

What would 10 golf balls weigh?

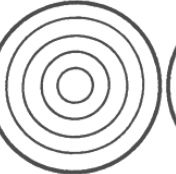
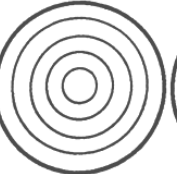
8. When a matchstick and a paper clip are placed end to end their
combined length is 5 cm. When 10 matchsticks and 35 paper clips are
placed end to end their total length comes to 1 metre.

How many paper clips would you need to make 1 metre?

Flags with 5 bits and 1 or 2 colours, all different



use 1 colour in all 5 bits



use 1 colour in 4 bits
and another colour in 1 bit



use 1 colour in 3 bits
and another colour in 2 bits



use 1 colour in 2 bits
and another colour in 3 bits

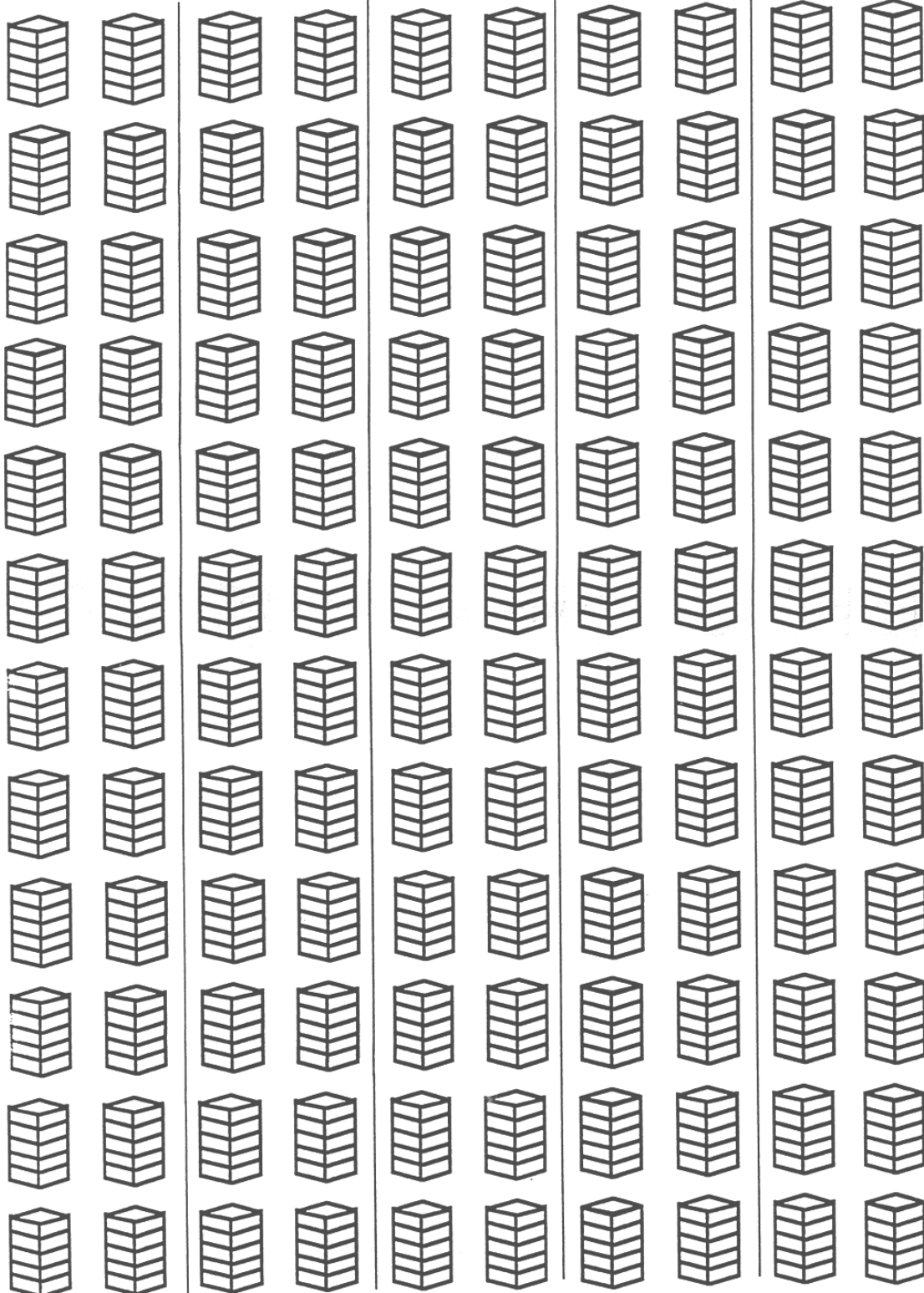


use 1 colour in 1 bit
and another colour in 4 bits

?

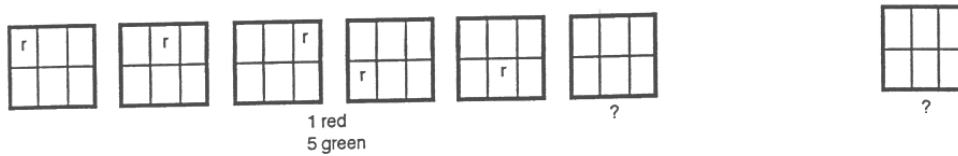
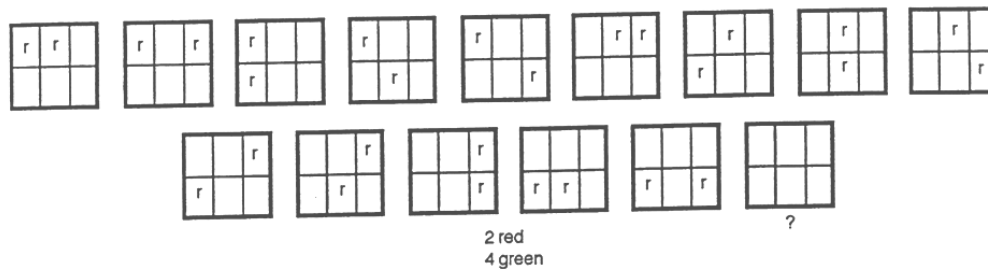
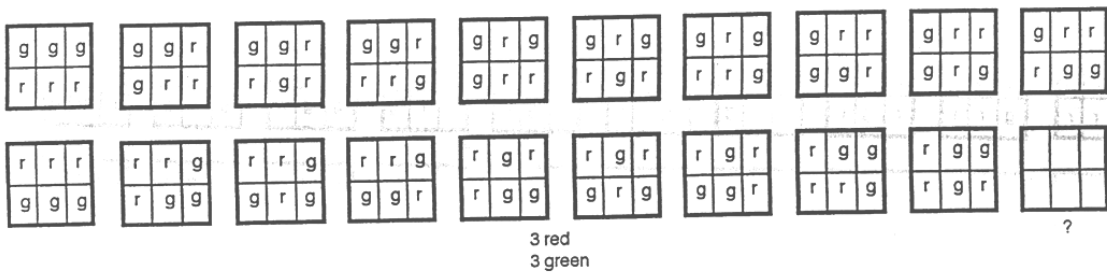
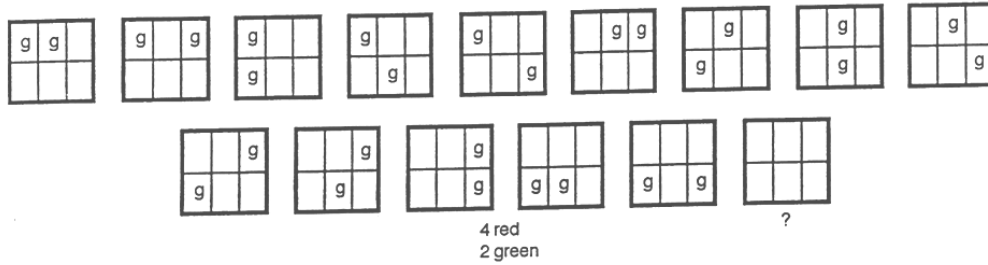
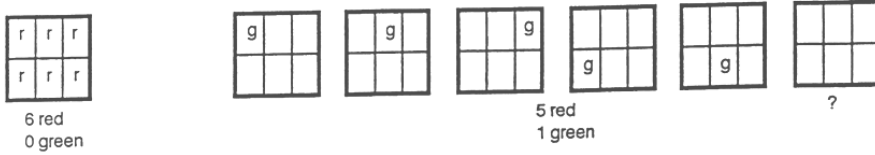
Colour the 120 towers using the same 5 colours each time
but make each tower different

Problem Solving
be systematic
(Level E) page 90



keep all the bottom cubes red

Red and green flags with 6 areas, all different



There are 64 possible different flags,
with 6 areas to colour and using up to 2 colours.

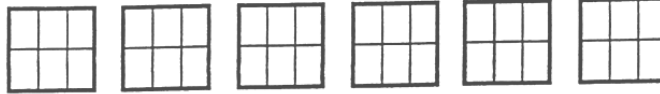
Do you realise that $2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$? ($2^6 = 64$)

Black and white flags with 6 areas, all different

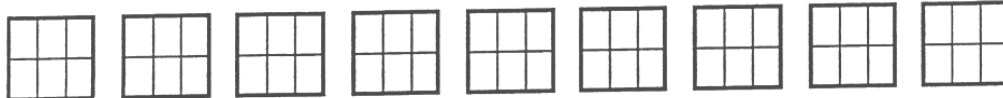
Problem Solving
be systematic
(Level E) page 92



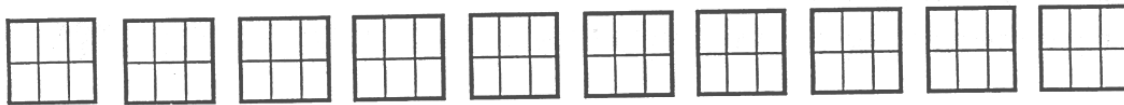
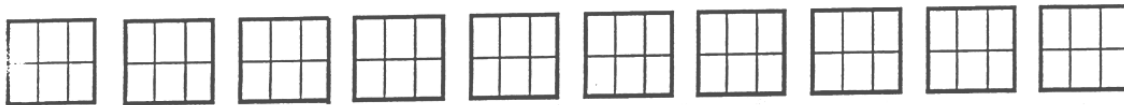
0 black
6 white



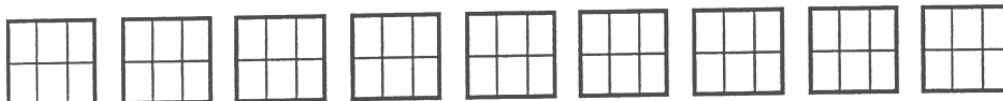
1 black
5 white



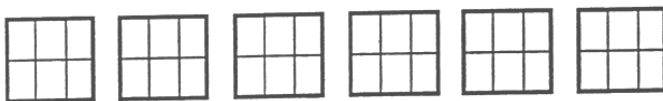
2 black
4 white



3 black
3 white



4 black
2 white



5 black
1 white



6 black
0 white

You will need to be systematic

What was the number?

Problem Solving
work backwards
(Level E) page 93

- A) I think of a number 'a', double it, and then subtract 5.
If my answer is 13.5 what is the number 'a'?
- B) I think of a number 'b', multiply it by 4, and then subtract 1.
My answer is 29. What is the number 'b'?
- C) I think of a number 'c', divide it by 3, and then subtract 4.
If my answer is 2.4 what is the number 'c'?
- D) I think of a number 'd', multiply it by 10, and then add 3.
My answer is 50. What is the number 'd'?
- E) I think of a number 'e', divide it by 5, add 1.5 and get an answer of 12.
What is the number 'e'?
- F) I think of a number 'f', quadruple it, and then subtract 1.
My answer is 13. What is the number 'f'?
- G) I think of a number 'g', quarter it, then add 2.5 and get an answer of 6.
What is the number 'g'?
- H) I think of a number 'h', multiply it by 10, and then subtract 5.
My answer is 32. What is the number 'h'?
- I) I think of a number 'i', multiply it by 100, and then add 3.
My answer is 152. What is the number 'i'?
- J) I think of a number 'j', halve it, and then add 3.
My answer is 11.6. What is the number 'j'?
- K) I think of some money '£k', double it, and then subtract £3.
My answer is £6.50. What is the amount of money '£k'?
- L) I think of a weight 'l grams', divide it by 4, and then subtract 20 grams.
My answer is 150 grams. What is the weight 'l grams'?
- M) I think of a volume 'm millilitres', multiply it by 10, and then add 10 ml.
My answer is 145 ml. What is the volume 'm millilitres'?

‘Working backwards’

(involving fractions)

Problem Solving
work backwards
(Level E) page 94

- A) Jenny had some money. She spent £10, and then a quarter of what she had left. She now had £6 left altogether. How much money did she have at the start?
- B) Bryce ate 400 grams of his cake at tea-time, then $\frac{1}{5}$ of what was left at supper-time. He now only had 200 grams of cake left. How heavy was his cake to begin with?
- C) Syd had lots of sweets after her birthday party. She ate 10, and sometime later she ate two-thirds of what was left. She now had 30 sweets left. How many sweets did she have to begin with?
- D) Louise had a bar of chocolate made up of small squares. She ate a quarter of the squares, then later she ate another 6 squares. She now had 12 squares left. How many squares did the chocolate bar have to begin with?
- E) In a primary 6 class 18 pupils go for school dinners, and two-fifths of the rest bring a pack lunch. The 6 remaining pupils all go home for lunch. How many pupils are there in the P6 class altogether?
- F) In a bag there are 20 red marbles and 25 blue marbles. Three-eighths of the rest of the marbles are yellow, and the remainder are green. If there are 10 green marbles in the bag how many marbles are there in the bag altogether?
- G) Sophie entered a sponsored run for charity. She ran 8km then got a stitch and walked for one third of the remaining distance. The stitch went away and she managed to run the last 4 km. How far was her sponsored run?
- H) Tessa spent £20 on a blouse, then two-thirds of what was left on a pair of shoes. She then had £5 left. How much did she have at the start?
- I) Ian spent two-thirds of his money on CD's and then another £4 on tapes. He then had £8 left. How much money did he have to start with?
- J) Half of a class are able to swim well, and three-quarters of the rest are able to swim a bit. Only 3 pupils are unable to swim at all. How many pupils are there in the class altogether?

A lot of introductions

Problem Solving
take a simpler case
make a table, spot a pattern
(Level E) page 95

How many handshakes would it take for everybody in your class to be introduced to each other?

Perhaps start with a simpler case, eg

2 people being introduced,

3 people being introduced,

You can then put your results into a table like this;

number of people

number of handshakes

2
3
4
5
6

?
?
?
?
?

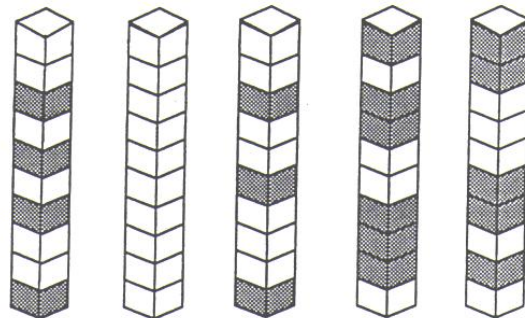


keep extending
the simpler cases
till you see a pattern

How many different towers?

Problem Solving
take a simpler case
make a table, spot a pattern
(Level E) page 96

These towers are each 10 cubes high and are built with only white and/or black cubes.



How many different towers of 10 cubes high could be built using only black and/or white cubes?

Perhaps start with simpler cases, eg
towers which are 2 cubes high using only white or black cubes
then
towers which are 3 cubes high using only white or black cubes
then
towers which are 4 cubes high using only white or black cubes

You can then put your results into a table like this.

height of towers

number of different towers

1 cube
2 cubes
3 cubes
4 cubes
5 cubes
6 cubes
7 cubes
8 cubes
9 cubes
10 cubes

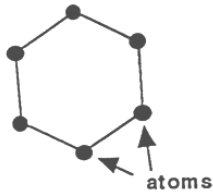
?
?
?
?
?
?
?
?
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?



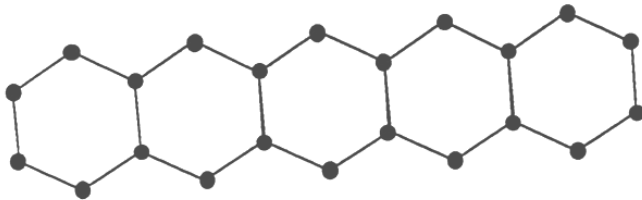
keep doing
simpler cases
till you see a
pattern

How many atoms?

Problem Solving
take a simpler case
make a table, spot a pattern
(Level E) page 97



This is a scientist's drawing of a molecule made up of 6 atoms joined together to form a hexagonal ring.



The scientist was able to join 5 molecules together to make a new compound, but she realised from her drawing that she didn't need as many atoms as she'd expected.

This is because some atoms are shared between molecules.

She had thought she would need 30 atoms, but actually only needed 22 atoms.

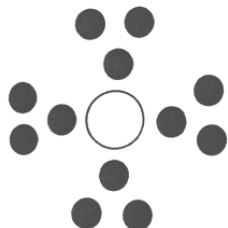
The scientist wants to develop a similar but much bigger compound with 100 molecules.

She needs to know how many atoms that such a compound will need.

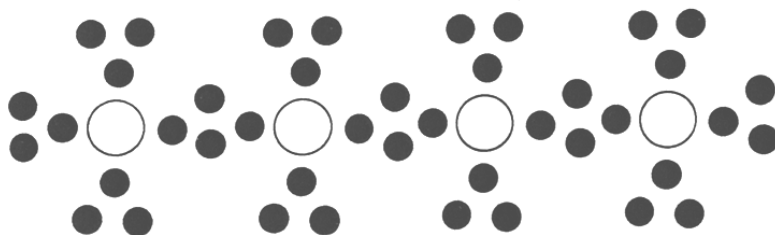
Can you take simpler cases, make a table and spot a pattern?

Help the scientist

Problem Solving
take a simpler case
make a table, spot a pattern
(Level E) page 98



A scientist developed a molecule which had 1 large atom connected to 12 smaller atoms, as shown in this diagram.



He was able to join 4 of these molecules together into a larger compound, as shown in the diagram above.

This new compound had 4 large and 42 small atoms.

Even though some of the smaller atoms were shared, he realised this new compound already needed 42 atoms.

His calculations suggested that if a compound had more than 200 small atoms it would be unstable and unsuitable.

Can you suggest the largest compound that can be made that would still be stable?

Perhaps you can take simpler cases, make a table and spot a pattern?