Reasoning in the classroom

Packing bottles

Support materials for teachers

Year 5

Llywodraeth Cymru
Welsh Government

Year 5 Reasoning in the classroom – Packing bottles

These Year 5 activities encourage learners to use a wide range of numerical skills to solve problems. They are fairly demanding for the year group so learners may need more support than usual, or you may wish to use them as extension activities.

Activity 1

Packing bottles
Learners work out the number of bottles that will fit into a box.
Includes:
- Packing bottles question
- Markscheme

Activity 2

Just one bottle
They are given facts about the energy saved when glass bottles are recycled. Then they work out the length of time a computer could be powered with the energy saved.
Includes:
- Explain and question – instructions for teachers
- Whiteboard – Just one bottle

Reasoning skills required

Identify

Learners choose their own strategies, including the use of a a calculator.

Communicate

They show their calculations and explain assumptions made.

Review

They consider how to check their answers to decide if they are reasonable.

Procedural skills

- **Simple proportion**
- **Multiplication and division**
- **Units of time**
- **Rounding**

Numerical language

- **Rounding**
- **Average**

Packing bottles

Activity 1 – Packing bottles

Outline

This activity requires learners to work out the number of bottles that could be packed in a box.
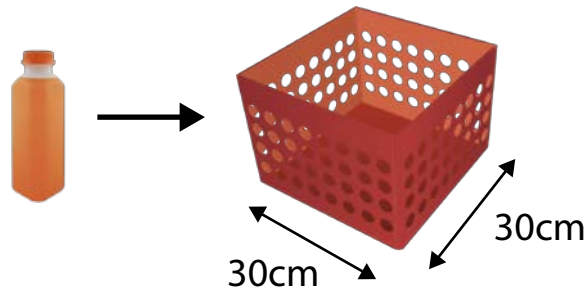
You will need

Q

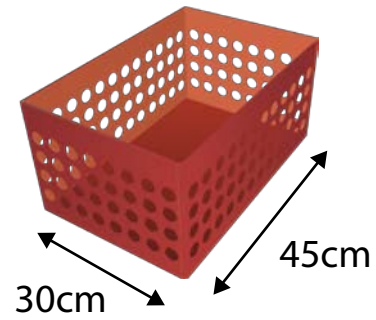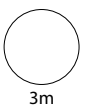**Packing bottles question**
One page for each learner

M

Markscheme

16 of these plastic bottles just fit in the small box.

How many of the bottles will fit in the bigger box?

	bottles

Activity 1 – Packing bottles – Markscheme

Marks	Answer
3m	**24**
Or 2m	Shows or implies that **6** bottles fit along the 45cm side of the bigger box
Or 1m	Shows understanding that the bottles fit in the smaller box in a 4 by 4 array

◄ **For 2m or 1m, accept unambiguous drawings**

Activity 1 – Packing bottles – Exemplars

24 bottles	**Correct; 3 marks** • This learner uses diagrams effectively. A picture is worth 1000 words!
Well, what I did was work out there are 4 bottles in the little box in each one so I know there are 4 bottles in the big box in each one but there are 6 together so then I did 4 + 4 = 8 + 4 = 12 + 4 = 16 + 4 = 20 + 4 = 24 so that is what my answer is. 24 bottles	**Correct; 3 marks** • This learner uses a halving strategy to work out the number of extra bottles that can be fitted into each row of the longer box, i.e. four bottles fit into 30cm so an extra two bottles will fit into the extra 15cm in the larger box. Halving and doubling are useful strategies when dealing with simple proportion.
30 ÷ 2 = 15 so two bottles is 15cm so it needs 2 more bottles to fit 45cm and 4 + 2 = 6 so 16 + 2 = 18 18 bottles	**Implies 6 bottles; 2 marks** • This learner shows understanding of simple proportion but has forgotten that two more bottles will be needed in each row.
bottles	**4 by 4 array; 1 mark** • Some understanding is shown, but this learner has focused so much on creating the artwork that they have not engaged with the question being asked.
16? bottles	**Incorrect; 0 marks** • This learner has tried to show the bottles in the small box, but has not engaged with its dimensions. Consequently they have not realised that the box is square-based.

Just one bottle

Activity 2 – Just one bottle

Outline

This activity is designed to carry on from **Activity 1 – Packing bottles**.

Learners calculate the energy saved from recycling glass bottles. Then they use their result to work out for how long this amount of energy would power a computer.

You will need

WB　　**Whiteboard – Just one bottle**

Activity 2 – Just one bottle

Explain

Tell learners that the first glass bottles were made about three and a half thousand years ago. In contrast plastic bottles were first used for soft drinks in about 1970. Ask learners to work in groups to give advantages and disadvantages of glass and plastic bottles. Discuss, then focus on recycling.

Now use the whiteboard to show **Just one bottle**.
(*Source – www.britglass.org.uk/infinitely-recyclable*)

If 331 glass bottles were recycled, the computer could be powered for much longer. Their task is to work out about how many days this would be. They will need to decide, in their groups, for how much of each day 'their' computer will need to be powered, e.g. 3 hours a day.

(*Note – interpreting a decimal on a calculator when changing units of time can be demanding. You may wish to suggest that learners find the number of minutes each day that their computer will need power before they work out the number of days. For example – the energy saved would power the computer for $331 \times 25 = 8275$ minutes. If their computer needs power for 180 minutes per day, there would be enough energy for $8275 \div 180 = 45.972...$ or just under 46 days.*)

Question

- What is a household? Does every household in the UK use exactly 331 bottles each year? What does average mean?

- What assumptions are you making about the time 'your' computer will be on for? So how many minutes each day will your computer need power?

- What calculations are you doing? Why is division better than repeated subtraction?

- If a calculator shows 12.5 hours, for example, what is that in hours and minutes? Why isn't it 12 hours and 5 (or 50) minutes?

- Have you rounded the number of days? How?

- How can you check that the number of days in your answer is about right?

Extension

- How many bottles would need to be recycled to power your computer for one year?

Fact 1 – The energy saving from recycling
one glass bottle would power
a computer for 25 minutes.

Fact 2 – Each year the average household in
the UK uses 331 glass bottles.