

COMPARING MASS



These images are not shown to the same scale. An elephant is much bigger and heavier than a cat or a car.

Can you arrange these things in order from lightest to heaviest?

Can you estimate the mass of each of these things?

How many oranges do you think you would need to balance an elephant in the scales?

Now try matching the list of objects below to their masses. You could cut out the cards.

A1 Car	A2 10 year old girl	A3 Orange	A4 Cat	A5 Elephant
A6 Truck	A7 One year old baby	A8 Paperback book	A9 Man	A10 Phone
M1 200 g	M2 6000 kg	M3 260 g	M4 4500 g	M5 70 kg
M6 115 g	M7 1400 kg	M8 9 kg	M9 30 kg	M10 2700 kg

Help

Work with a partner. Find 3 objects that can be weighed such as an apple, a brick and bottle of water.

Handle the objects one by one, estimate the weights and both of you should write down your estimates.

Then actually weigh the objects and check your estimates.

You may need to ask for some help in reading the scales.

Extension

Make up some more questions like the oranges and elephant question and work out the answers. Then challenge another learner or the whole class to work on these questions.

Here is a recipe for 12 chocolate chip cookies. What quantities would you need to make enough for your class?

125g butter, softened
 100g light brown sugar
 125g caster sugar
 1 egg, lightly beaten
 1 teaspoon vanilla extract
 225g self-raising flour
 ½ teaspoon salt
 200g chocolate chips

1. Preheat the oven to 180°C, gas mark 4
2. Cream butter and sugars. Once creamed, combine in the egg and vanilla.
3. Sift in the flour and salt, then the chocolate chips.
4. Roll into walnut size balls, for a more homemade look, or roll into a long, thick sausage shape and slice to make neater looking cookies.
5. Place on ungreased baking paper and bake for just 10 minutes.
6. Take out of the oven and leave to harden for a minute before transferring to a wire cooling rack.

NOTES FOR TEACHERS

SOLUTION

M6 115 g	M1 200 g	M3 260 g	M4 4500 g = 4.5 kg	M8 9 kg
A10 Phone	A3 Orange	A8 Paperback book	A4 Cat	A7 One year old baby
M9 30 kg	M5 70 kg	M7 1400 kg	M10 2700 kg	M2 6000 kg
A2 10 year old girl	A9 Man	A1 Car	A6 Truck	A5 Elephant

An average sized orange weighs 200 grams so 5 oranges weight 1 kilogram.

As a large African elephant weighs 6000 kg it takes 30 thousand orange to balance an elephant in the scales.

Diagnostic Assessment This should take about 5–10 minutes.

- Write the question on the board, say to the class:
“Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 fingers for D”.
- Notice how the learners responded. Ask a learner who gave answer A to explain why he or she gave that answer and DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.
- Then do the same for answers B, C and D. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.
- Ask the class again to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers.** It is important for learners to explain the reason for their answer otherwise many learners will just make a guess.
- If the concept is needed for the lesson to follow, explain the right answer or give a remedial task.



Find the difference in mass between the potatoes and the cabbage.

A
1 kg 750 g

B
749 g

C
350 g

D
250 g

D. is the correct answer.

Common Misconceptions

A. The student has added the mass together, rather than subtracting.

B. The student has not converted the units before subtracting.

C. The student may have miscalculated when subtracting.

A White Rose Maths Diagnostic Question <https://diagnosticquestions.com>

Why do this activity?

This activity gives an opportunity for learners to talk about the masses of some familiar objects and to get some feeling for their comparative sizes. Each one of these examples is only a representative of like objects with a range of masses so averages can be discussed in this context.

The activity could be accompanied by work on data collection. The class could all weigh themselves and work out their average weight for the class and draw a graph of their weights. Another possibility might be to weigh some common objects or to discuss the quantities in a recipe and do some cooking.

Intended learning outcomes

- Learners will use measuring instruments such as bathroom scales and kitchen scales (analogue and digital) and balances to find the masses of common objects.
- They will estimate, measure, record, compare and order the masses in grams (g) and kilograms (kg).
- They will solve problems involving mass to include calculations, solving problems in context, converting between grams and kilograms and conversions involving fractions.

Generic competences

In doing this activity students will have an opportunity to:

1. apply knowledge and skills;
2. solve and interpret problems in a variety of situations.

Suggestions for teaching

If possible take some kitchen scales and bathroom scales into the classroom and organise the learners to weigh some common objects and to weigh themselves. Before weighing the objects you can discuss with the class which one is the lightest and which the heaviest, arrange them in order and try to estimate their masses.

If the learners all weigh themselves then the class can make a table of results, perhaps grouping the masses for example <20 kg; 20 kg $<$ mass ≤ 25 kg; 25 kg $<$ mass ≤ 30 kg; 30 kg $<$ mass ≤ 35 kg and draw a bar chart. They could also work out the mean mass.

You might like to discuss with the class the masses of some objects that they might know about such as that of a newborn baby? You can also discuss the typical range of masses. Perhaps discuss health issues related to obesity or social issues related to being underweight and to poverty and malnutrition.

Then show the picture and ask the question as given. Give the learners time to discuss their answers either in pairs or small groups. You could give them the table to cut out the 20 small cards so that they can arrange them in pairs, or simply record the pairs such as M6 – A10; M1 – A3 etc.

Key questions

Which of those two objects do you think is the lighter?

Which of those two objects do you think is the heavier?

Do you think that it is best to give that mass in grams or in kilograms? Why?

Follow up

“How Heavy? Is a similar learning activity involving smaller masses

<https://aiminghigh.aimssec.ac.za/years-4-10-how-heavy/>

Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA, to Years 4 to 12 in the UK and up to Secondary 5 in East Africa. New material will be added for Secondary 6.

For resources for teaching A level mathematics see <https://nrich.maths.org/12339>

Note: The mathematics taught in Year 13 (UK) and Secondary 6 (East Africa) is **beyond** the school curriculum for Grade 12 SA.

	Lower Primary or Foundation Phase Age 5 to 9	Upper Primary Age 9 to 11	Lower Secondary Age 11 to 14	Upper Secondary Age 15+
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6