THE STRIVING

MUSLIM ACADEMY

Islamic and Academic Education

YEARS 7 TO 9 · SCIENCE

Analysis, evaluation and measurement

SI units and prefixes, choosing the right chart, random against systematic error, and what a pattern proves.

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2 sets · a hint on every question

Written for a parent teaching at home. No training assumed, and nothing else to buy.

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SI units, and why they are agreed

Read this, then answer the questions on it.



SI UNITS, AND WHY THEY ARE AGREED

A measurement without a unit is not a measurement. The SI units are an international agreement so that a number written in one laboratory means the same in another.

The base units you need are the metre for length, the kilogram for mass, the second for time, the ampere for current and the kelvin for temperature. Other units are defined from these: a newton is a kilogram metre per second squared, so the unit of force comes from the definition of force rather than from convention.

Prefixes scale them by powers of ten: milli is a thousandth, centi a hundredth, kilo a thousand, mega a million. Mixing prefixes without converting is the commonest arithmetic mistake in school science, and it is why you write the unit down at every line rather than only at the end.

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Error, and saying how sure you are

Read this, then answer the questions on it.



ERROR, AND SAYING HOW SURE YOU ARE

Two kinds, and they need different answers.

Random error scatters readings either side of the true value. Repeating and taking a mean reduces it, which is the only reason repeating works.

Systematic error shifts every reading the same way: a balance that reads 0.2 g with nothing on it, a ruler starting from the end rather than the zero mark. Repeating does not help at all, because the mean of ten shifted readings is shifted. You find it by checking the instrument against something known.

Then express the uncertainty. A ruler marked in millimetres gives a reading good to about half a millimetre, so write 84.0 plus or minus 0.5 mm rather than 84 mm and hope.

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How each one is answered

Mark it together. Where a question asks for a list, the order does not matter.



UNITS, PREFIXES AND ARITHMETIC

1. Change 2.5 metres into millimetres.

1. 1 m = 1000 mm.
2. 2.5 × 1000 = 2500.
3. So 2.5 m = 2500 mm.

Answer: **2500 mm**

2. Change 450 grams into kilograms.

1. 1 kg = 1000 g.
2. 450 ÷ 1000 = 0.45.
3. So 450 g = 0.45 kg.

Answer: **0.45 kg**

3. A trolley of mass 2 kg accelerates at 3 metres per second squared. Give the force in newtons, and say what a newton is in base units.

1. 2 × 3 = 6, so the force is 6 N.
2. Since force is mass times acceleration, a newton is a kilogram metre per second squared.

Answer: **6 N, and a newton is a kilogram metre per second squared**

4. A pupil adds 30 cm to 2 m and writes 32. Say what is wrong and give the right answer in metres.

1. 30 cm is 0.3 m, not 30 m.
2. 2 + 0.3 = 2.3.
3. So the answer is 2.3 m. The error is adding numbers in different units, which is why the unit is written at every line.

Answer: **2.3 m, and the mistake was adding centimetres to metres without converting**

CHARTS, ERROR AND WHAT A PATTERN SHOWS

1. You have the heights of 40 pupils. Say which chart you would draw and why it has no gaps between the bars.

1. Height is continuous: 142 cm and 143 cm have values between them.
2. So it goes in a histogram.
3. The bars touch because the data is continuous; gaps would say there is nothing in between, which is false.

Answer: **a histogram, with no gaps because height is continuous and values exist between the bars**

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SAMPLE PAGES

You have read a few pages. The pack is longer.

What you are holding is a short sample, taken from different parts of the pack so that you can see how a week is planned and what a child is actually asked to do, before you decide.

The complete pack, and the rest of the academic materials, are on our website: schemes of work for a parent teaching at home, and practice packs for the skills children get stuck on.

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Members of the homeschool community do not buy these. If you have joined the community, the pack for the term you are working on is given to you at no cost.

Our Islamic Education classes are free. These packs are part of what pays the teachers who teach them.