

There is no formula sheet for 0610, and there is not much arithmetic either – which is exactly why these marks are the easiest on the paper to lose. Almost all of it comes down to three things: convert the units first, divide by the right number, and write the unit on the answer. 0610 ; ,

Units first – this is where most of the marks go

1 mm = 1000 μm . A ruler measurement in millimetres and a cell size in micrometres cannot go into the same fraction until one has been converted.

$$1 \text{ mm} = 1000 \mu\text{m},$$

1 cm = 10 mm, and $1 \text{ cm}^3 = 1 \text{ ml}$. Volumes in an experiment are almost always cm^3 .

$$1 \text{ cm} = 10 \text{ mm}; 1 \text{ cm}^3 = 1 \text{ ml}.$$

Give the answer to the same accuracy as the data – usually two or three figures – and round only at the END, never part-way through.

A magnification has NO unit and is written with a multiplication sign: $\times 300$, not “300 times bigger” and not “300 mm”.

$$, \quad \times 300$$

Magnification and size

Magnification – magnification = image size $\div$ actual size. Both must be in the SAME unit before you divide.

Actual size – actual size = image size $\div$ magnification. This is the same formula rearranged; a triangle with image on top, actual and magnification below, is enough to get it right every time.

Image size – image size = actual size $\times$ magnification.

Using a scale bar – measure the drawn length of the scale bar in mm, and divide it by the real length the bar stands for. That number is the magnification of the whole drawing.

Surface area to volume ratio – surface area $\div$ volume, written as “ $x : 1$ ”. It gets SMALLER as an organism gets bigger, which is why large organisms need a transport system and a gas exchange surface.

| A cell is drawn 45 mm across. Its real width is 0.15 mm. Find the magnification.

$$\text{Magnification} = \times 300.$$

Commentary: Both measurements are already in mm, so no conversion is needed

$$\text{Commentary: } \text{Magnification} = 45 \div 0.15 = \times 300$$

| A drawing has a magnification of $\times 500$ and a structure on it measures 30 mm. Find the real size in micrometres.

$$\text{The real size is } 60 \mu\text{m}.$$

Commentary: Actual size = $30 \div 500 = 0.06$ mm

Commentary: Convert: $0.06 \times 1000 = 60$ μm

I Compare the surface area to volume ratio of a cube of side 1 mm with one of side 4 mm.

The small cube is 6 : 1 and the large one is 1.5 : 1 – the bigger the object, the smaller the ratio.

Commentary: Side 1 mm: surface area = $6 \times 1^2 = 6$, volume = $1^3 = 1$, so 6 : 1

Commentary: Side 4 mm: surface area = $6 \times 4^2 = 96$, volume = $4^3 = 64$, so $96 \div 64 = 1.5 : 1$

Rates and changes

Rate – amount of change $\div$ time taken. The unit comes out of the working – bubbles per minute, cm^3 per second – and is part of the answer.

Rate from a graph – the gradient: change in $y \div$ change in x . Draw the triangle on the graph and label both sides; the examiner marks the triangle as well as the number.

Percentage change – (final value – starting value) $\div$ starting value $\times 100$. Divide by the STARTING value, and keep the minus sign when the value has fallen – that sign is worth a mark in an osmosis experiment.

Percentage of a total – part $\div$ whole $\times 100$.

I A potato chip has a mass of 5.2 g at the start and 4.5 g after an hour in a sugar solution. Find the percentage change in mass.

The mass changed by -13.5% – a loss, so water left the cells by osmosis and the solution was more concentrated than the cell contents.

Commentary: Change in mass = $4.5 - 5.2 = -0.7$ g

Commentary: Percentage change = $-0.7 \div 5.2 \times 100$

Commentary: = -13.5% (to 1 decimal place)

I A plant releases 36 bubbles of oxygen in 3 minutes. Find the rate of photosynthesis.

The rate is 12 bubbles per minute.

Commentary: Rate = $36 \div 3$

Commentary: = 12 bubbles per minute

Handling a set of results

Mean (average) – total of the values $\div$ number of values. Take the mean of the REPEATS at each setting; that is what repeating is for.

Anomalous result – a value that does not fit the pattern of the others. Identify it, leave it OUT of the mean, and say that you did.

Range – largest value – smallest value. A wide range means the repeats disagree and the mean is less reliable.

Always say how many repeats were taken and that a mean was used. Reliability marks are given for that sentence, not for the arithmetic.

Ecology and energy

Efficiency of energy transfer – energy passed on $\div$ energy taken in $\times 100$. It is small – often under 10% – because most energy is lost in respiration, as heat, and in undigested material.

Population estimate from quadrats – mean number per quadrat $\times$ total area $\div$ area of one quadrat. Quadrats must be placed at RANDOM for the estimate to be fair.

| A trophic level takes in 25\,000 kJ and passes 2000 kJ to the next. Find the efficiency of energy transfer.

Efficiency is 8%; the rest is lost in respiration, as heat, in waste and in the parts not eaten.

Commentary: Efficiency = $2000 \div 25\,000 \times 100$

Commentary: = 8%

Where these marks are lost

Mixing millimetres and micrometres inside one division. Convert first, every time – it is the single commonest error in IGCSE Biology.

mm μm ,

Dividing by the final value instead of the starting value in a percentage change. Look at the words “percentage change IN mass” – the change is measured against what you started with.

Dropping the minus sign. A 13.5% loss and a 13.5% gain are opposite conclusions about which solution was more concentrated.

Writing a unit on a magnification, or leaving the unit off a rate. Neither can be rescued by the rest of the answer.

Including an obvious anomaly in a mean without saying so. Spotting it and excluding it is itself worth a mark.