

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 不提供公式表; 计算题不多, 但失分极易 – 先统一单位, 再计算, 最后写单位。

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 mm = 1000 μm , 同一算式内必须统一单位。

1 cm = 10 mm, and 1 cm³ = 1 ml. Volumes in an experiment are almost always cm³.

1 cm = 10 mm; 1 cm³ = 1 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.

只在最后一步四舍五入。

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

放大倍数无单位, 写作 $\times 300$ 。

Magnification and size

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

Actual size 实际大小 — 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 图像大小 — image size = actual size $\times$ magnification.

Using a scale bar 利用比例尺 — 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 表面积与体积之比 — 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.

Magnification = $\times 300$.

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

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.

The real size is 60 μm .

$$\text{Actual size} = 30 \div 500 = 0.06 \text{ mm}$$

$$\text{Convert: } 0.06 \times 1000 = 60 \text{ } \mu\text{m}$$

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.

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

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

Rates and changes

Rate 速率 — 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 由图像求速率 — 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 百分比变化 — (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 占总数的百分比 — 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.

$$\text{Change in mass} = 4.5 - 5.2 = -0.7 \text{ g}$$

$$\text{Percentage change} = -0.7 \div 5.2 \times 100$$

$$= -13.5\% \text{ (to 1 decimal place)}$$

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

The rate is 12 bubbles per minute.

$$\text{Rate} = 36 \div 3$$

$$= 12 \text{ bubbles per minute}$$

Handling a set of results

Mean (average) 平均数 — 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 异常值 — 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 极差 — 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.

说明重复次数并取平均, 是可靠性得分点。

Ecology and energy

Efficiency of energy transfer 能量传递效率 — 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 样方法估算种群数量 — 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.

$$\text{Efficiency} = 2000 \div 25\,000 \times 100$$

$$= 8\%$$

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 与 μm 混用, 是最常见的错误。

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.

百分比变化的分母是初始值。

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

不要漏掉负号。

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

放大倍数不写单位, 速率必须写单位。

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

异常值应剔除并说明。