IGCSE Biology

Worked Solutions ·

Biology loses more marks to arithmetic and to loose wording than to missing knowledge. These are the calculations 0610 sets every session and the structured answers examiners reward, written out in full: the working visible, the units carried, and a note saying where each mark actually sits.

,

Magnification and scale

A drawing of a palisade cell is 96 mm tall. The real cell is 0.08 mm tall. Calculate the magnification of the drawing. [2]

Magnification $= \dfrac{\text{image size}}{\text{actual size}} = \dfrac{96}{0.08} = 1200$, so the drawing is $\times 1200$.

Commentary: Both lengths must be in the SAME unit before dividing. Converting one of them is the method mark, and mixing mm with µm is the commonest way to lose it.

Commentary: Magnification has no unit. Writing '×1200 mm' is wrong and is penalised.

An electron micrograph is printed at ×15 000. A mitochondrion on it measures 30 mm long. Calculate the real length in micrometres. [3]

Actual size $= \dfrac{\text{image size}}{\text{magnification}} = \dfrac{30}{15\,000} = 0.002$ mm. Since 1 mm = 1000 μm, the real length is $0.002 \times 1000 = 2$ μm.

Commentary: Rearranging the formula the right way is a mark on its own – multiplying by the magnification instead of dividing is the trap, and it gives an absurd 450 000 mm.

Commentary: The unit conversion is the third mark. Answers correct in mm but not converted lose it.

Percentages, rates and data handling

A potato cylinder has a mass of 4.80 g before immersion and 5.28 g after. Calculate the percentage change in mass. [3]

Change in mass $= 5.28 - 4.80 = 0.48$ g. Percentage change $= \dfrac{\text{change}}{\text{original}} \times 100 = \dfrac{0.48}{4.80} \times 100 = 10\%$. The mass has increased, so the answer is +10%: water has entered the cells by osmosis, so the solution outside was less concentrated than the cell sap.

Commentary: Divide by the ORIGINAL mass, never the final one. That is the method mark and it is the mark most often lost.

Commentary: State the sign or the direction. A bare '10%' does not say whether water entered or left, and the interpretation mark needs it.

In an investigation, 60 cm^3 of oxygen was produced by pondweed in 4 minutes. Calculate the rate in cm^3 per minute, and state one variable that must be controlled. [3]

Rate $= \dfrac{\text{volume}}{\text{time}} = \dfrac{60}{4} = 15$ cm^3/min. A controlled variable could be the temperature of the water, the concentration of carbon dioxide, or the species and mass of pondweed.

Commentary: Carry the unit through the division. Rate answers with no unit score the method mark only.

Commentary: A controlled variable must be something that would change the rate if it varied. 'The same student' is not one.

Genetics

Two heterozygous tall pea plants (Tt) are crossed. Draw the genetic diagram and state the expected ratio of phenotypes. [4]

Parents are Tt × Tt. Gametes are T and t from each parent. The Punnett square gives TT, Tt, Tt, tt. TT, Tt and Tt are all tall because T is dominant, and tt is short. The genotype ratio is 1 TT : 2 Tt : 1 tt, and the phenotype ratio is 3 tall : 1 short.

Commentary: Show parental genotypes, gametes, offspring genotypes and then phenotypes. Each layer carries a mark; jumping straight to 3:1 scores one of four.

Commentary: Circle or clearly separate the gametes. An examiner cannot award the gamete mark for letters buried inside the square.

A man with blood group AB and a woman with group O have children. State the possible blood groups of the children and explain why none can be group O. [4]

The man is I^AI^B and the woman is I^OI^O. The man's gametes carry I^A or I^B; hers all carry I^O. So the children are I^AI^O (group A) or I^BI^O (group B), in a 1 : 1 ratio. None can be group O, because group O requires two I^O alleles and every child receives either I^A or I^B from the father.

Commentary: I^A and I^B are codominant and both are dominant to I^O – say so, because the explanation mark is for the allele reasoning, not the list of groups.

Transport, water and the structured answer

Explain how water moves from the soil into a root hair cell. [3]

The soil solution is a dilute solution with a high water potential; the cell sap inside the root hair cell is a concentrated solution with a lower water potential. Water therefore moves down the water potential gradient, from the soil into the cell, by osmosis across the partially permeable cell membrane.

Commentary: Three separate marks: the gradient (which side is more dilute), the word osmosis, and the partially permeable membrane. Naming osmosis alone scores one.

Commentary: Never write that water moves 'to where there is more salt'. Examiners want concentration of WATER, or water potential, not of solute.

Describe and explain the effect of increasing temperature from 20 °C to 60 °C on the rate of an enzyme-controlled reaction. [4]

From 20 °C the rate increases, because the molecules have more kinetic energy, so there are more frequent successful collisions between enzyme and substrate. The rate reaches a maximum at the optimum temperature, around 37 °C for a human enzyme. Above the optimum the rate falls sharply, because the high temperature breaks bonds in the enzyme's tertiary structure, so the active site changes shape and the substrate no longer fits: the enzyme has been denatured.

Commentary: 'Describe AND explain' is two jobs. Describe the shape of the curve, then give the reason for each part; answering only one halves the marks.

Commentary: Denatured, not 'killed'. An enzyme is not alive, and the word killed is not credited.

Commentary: The active site CHANGES SHAPE – saying the enzyme 'dies' or 'stops working' without the shape change misses the explanation mark.

A food chain contains 12 000 kJ of energy in the producers and 120 kJ in the secondary consumers. Calculate the percentage of energy transferred from producers to secondary consumers, and explain why so little is transferred. [4]

Percentage $= \dfrac{120}{12\,000} \times 100 = 1\%$. So little passes on because energy is lost at each trophic level: in respiration as heat, in undigested material in faeces, and in excretory products such as urea. Not all of an organism is eaten either, so only a small fraction of the energy at one level reaches the next.

Commentary: The calculation carries two marks and the explanation two. Give at least two named losses, not just 'energy is lost'.

Commentary: Heat from RESPIRATION is the mark; 'heat from the sun' is not.