GCSE → A Level Biology transition

Answers to maths skills practice questions

1 Numbers and units

1 **a** 1 kJ = 1000 J, so 4 500 000 J = 4 500 000/1000 kJ = 4500 kJ
  b 1 MJ = 1000 kJ, so 4500 kJ = 4.5 MJ

2 1 m = 10^9 nm (there are a billion nanometre in a metre)

  9.0×10^{-8} m = $9.0 \times 10^{-8} \times 10^9$ nm = $9.0 \times 10^{-8+9}$ nm = 9.0×10 nm = 90 nm

  1.20×10^{-7} m = $1.20 \times 10^{-7} \times 10^9$ nm = $1.20 \times 10^{-7+9}$ nm = 1.20×100 nm = 120 nm

  Range = 90 nm to 120 nm

3 **a** 10^{11} **b** 10^{12}
  c 1000 + 1000 = 2000   **d** 100 − 0.01 = 99.99

4 **a** 10^1 or 10   **b** 10^{-3} or 0.001
  c 10^6 or 1 000 00   **d** $100^2 \div 100$ = 100 or 10^2

5 **a** 4 mm   **b** 130 s
  c 31 300 µl   **d** 0.000 104 mg

6 **a** 57 µm   **b** 8.6 L or 8.6 dm^3
  c 68 s   **d** 0.09 mm

2 Decimals, standard form, and significant figures

1 0.0214 cm^2 0.0218 cm^2 0.03 cm^2 0.034 cm^2

2 12.03 cm   12.901 cm   22 cm   22.003 cm   22.25 cm

3 **a** 3.06×10^3 kJ   **b** 1.4×10^5 kg
  c 1.8×10^{-4} m   **d** 4×10^{-6} m

4 **a** 1×10^2 **b** 1×10^4
  c 1×10^{-2} **d** 2.1×10^7

5 Give the following as decimals.
  a 1 000 000   **b** 4 700 000 000
  c 1 200 000 000 000 **d** 0.000 796

6 **a** 7600 g / 7640 g   **b** 28 m / 27.5 m
  c 4.3 g / 4.33 g   **d** 6.0×10^2 m / 5.00×10^2 m

7 1.2×10^4 g

3 Working with formulae

1 *M*?   *I* = 6.6 mm   *O* = 165 µm
  Change to same units: either both mm or both µm or both m: 165 µm = 0.165 mm
  M = *I*/*O* = 6.6/0.165 = × 40

2 Area = 0.5 × 2 cm × 9 cm = 9 cm^2

3 Area = π r^2 = π × $(0.7 \, \mu m)^2$ = π × $(0.7 \times 10^{-6}$ m$)$ × $(0.7 \times 10^{-6}$ m$)$ = 1.5 μm^2

4 $N_0 = 24$

7 days = 7 × 24 hours = 168 hours

so n = 168 ÷ 20 = 8.4

N_t = 24 x 28.4   = 8107 cells

5 N = 96 + 4 + 22 + 3 = 125 animals found

so $$D = 1 - \sum \left(\frac{n}{N} \right)^2$$

$$D = 1 - \left(\left(\frac{96}{125} \right)^2 + \left(\frac{4}{125} \right)^2 + \left(\frac{22}{125} \right)^2 + \left(\frac{3}{125} \right)^2 \right)$$
inner brackets:

indices: $D = 1 - \left(0.768^2 + 0.032^2 + 0.176^2 + 0.024^2 \right)$

addition: D = 1 − 0.6224 = 0.3776 = 0.38 (2.d.p)

6 $O = 0.1\,mm$ $I = ?$ $M = 50$ $I = M × O = 50 × 0.1\,mm = 5\,mm$

7 Area = 5.3 cm² radius? $A = \pi r^2$

5.3 = πr^2 $r^2 = \dfrac{5.3}{\pi}$ = 1.687 $r = \sqrt{1.687}$ = 1.3 cm

Or $A = \pi r^2$ $r^2 = \dfrac{A}{\pi}$ $r = \sqrt{\dfrac{A}{\pi}}$ $r = \sqrt{\dfrac{5.3}{\pi}}$ = 1.3 cm

8 $7.25 × 10^{-6}$ m (7.25 µm)

9 $a = \dfrac{\left(\dfrac{34}{100} \right) × 135}{2} = 22.95$

10 cardiac output = stroke volume x heart rate

stroke volume = $\dfrac{2.7}{77}$ = 0.035 dm³

11 Substitute in the known values: $0.84 = \dfrac{\text{biomass transfer}}{25} × 100$

Rearrange the equation to give: $\text{biomass transfer} = \dfrac{0.84}{100} × 25$ = 0.21 kg

4 Magnification

1 **a** ×120   **b** ×600

2 ×26 000

3 0.88 µm

5 Percentages and uncertainty

1 **a** $\dfrac{2240}{3600000}$ × 100 = 0.06%   **b** $\dfrac{480}{3600000}$ × 100 = 0.013%

2 5.88%

3

Sucrose conc. / mol dm⁻³	Initial mass / g	Final mass / g	Mass change / g	Percentage change in mass

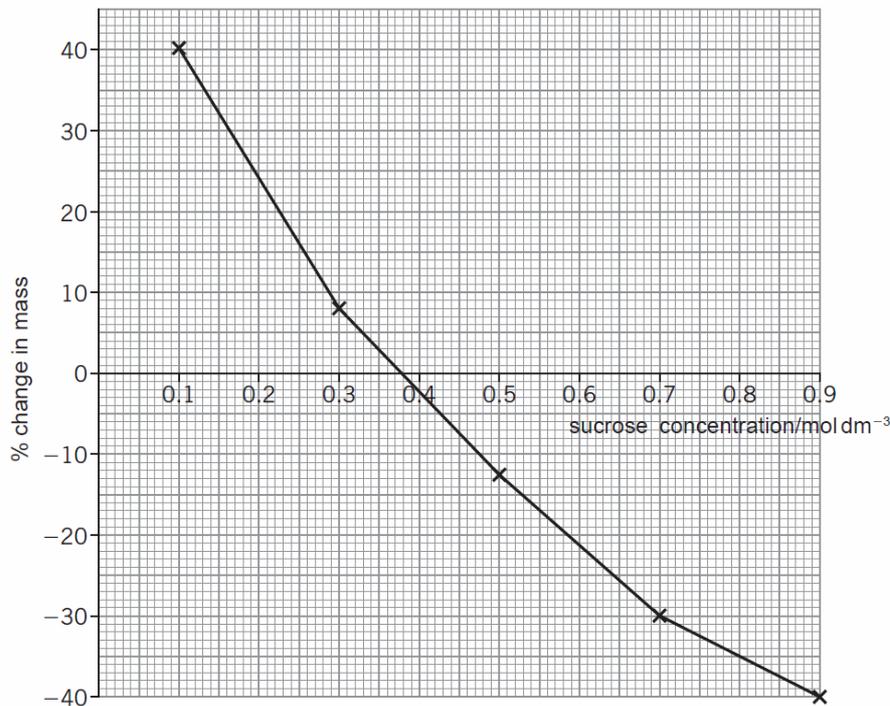| 0.9 | 1.79 | 1.06 | −0.73 | −40.8% |
0.7	1.86	1.30	−0.56	−30.1%
0.5	1.95	1.70	−0.25	−12.8%
0.3	1.63	1.76	+0.13	+8.0%
0.1	1.82	2.55	+0.73	+40.1%

4   **a** 1 cm³   **b** 0.005 s   **c** 0.05 °C

5

Measurement made	Equipment used	Absolute error	Relative error
Length of a fluid column in a respirometer is 6 mm	mm scale	0.5 mm	$\dfrac{0.5}{6} \times 100 = 8.3\%$
Volume of a syringe is 12 cm³ of liquid	0.5 cm³ divisions	0.25 cm³	$\dfrac{0.25}{12} \times 100 = 2.1\%$
Change in mass of 1.6 g	balance with 2 d.p.	0.005 g	$\dfrac{0.005 \times 2}{1.6} \times 100 = 0.6\%$

6 Scatter graphs and lines of best fit

Change in mass against sucrose concentration

1

2   **c**   Table 1: Strong correlation. Positive at the start. As light intensity increases, the increase in the rate of photosynthesis decreases (so the graph levels off).

Table 2: Strong correlation. Negative at the start. As time increases, the rate of the decrease of the concentration decreases (so the graph levels off).