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 μm)^2 = π × (0.7 × 10^{-6} m) × (0.7 × 10^{-6} m) = 1.5 μm^2

4 N_0 = 24

7 days = 7 × 24 hours = 168 hours

so n = 168 ÷ 20 = 8.4

Nt = 24 x 28.4 = 8107 cells

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

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

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

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 $I = M \times O$ = 50 × 0.1 mm = 5 mm

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

5.3 = π r^2 $r^2 = \frac{5.3}{\pi}$ = 1.687 $r = \sqrt{1.687}$ = 1.3 cm

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

8 7.25 × 10^{-6} m (7.25 μm)

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

10 cardiac output = stroke volume x heart rate

stroke volume = $\frac{2.7}{77}$ = 0.035 dm^3

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

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

4 Magnification

1 **a** ×120 **b** ×600

2 ×26 000

3 0.88 μm

5 Percentages and uncertainty

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

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%

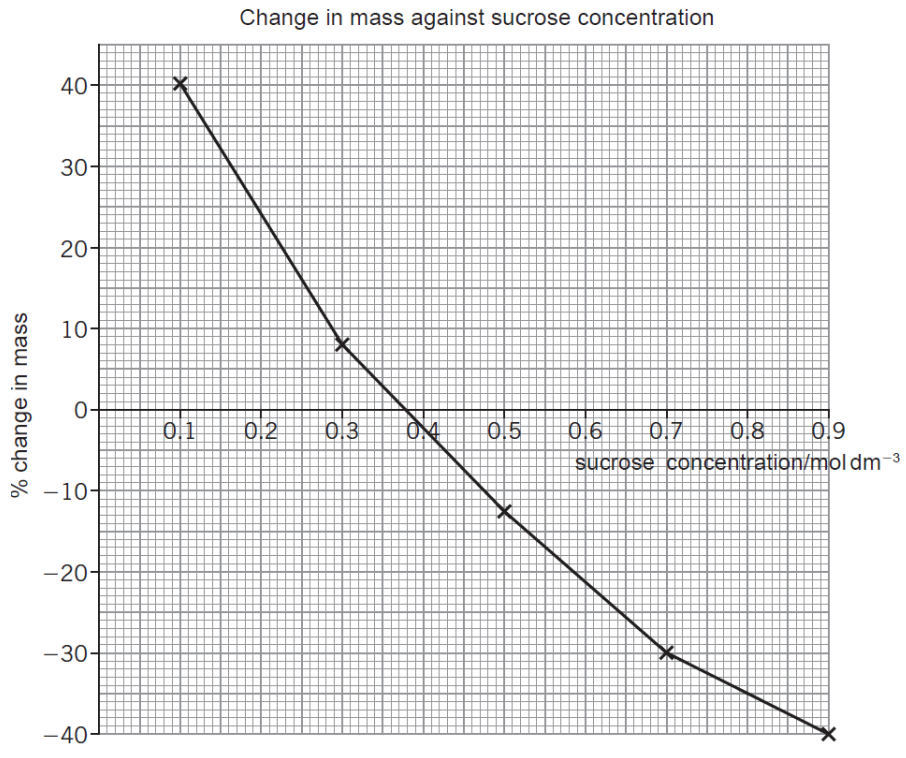
4 **a** 1 cm^3 **b** 0.005 s **c** 0.05 °C

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	$\frac{0.5}{6} \times 100 = 8.3\%$
Volume of a syringe is 12 cm^3 of liquid	0.5 cm^3 divisions	0.25 cm^3	$\frac{0.25}{12} \times 100 = 2.1\%$
Change in mass of 1.6 g	balance with 2 d.p.	0.005 g	$\frac{0.005 \times 2}{1.6} \times 100 = 0.6\%$

6 Scatter graphs and lines of best fit

1



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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).