

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 1 000 000 d $100^2 \div 100 = 100$ or 10^2
- 5 a 4 mm b 130 s
 c 31 300 μ l d 0.000 104 mg
- 6 a 57 μ m b 8.6 L or 8.6 dm³
 c 68 s d 0.09 mm

2 Decimals, standard form, and significant figures

- 1 0.0214 cm² 0.0218 cm² 0.03 cm² 0.034 cm²
- 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 $M?$ $l = 6.6$ mm $O = 165$ μ m
 Change to same units: either both mm or both μ m or both m: $165 \mu\text{m} = 0.165$ mm
 $M = l/O = 6.6/0.165 = \times 40$

2 Area = $0.5 \times 2 \text{ cm} \times 9 \text{ cm} = 9 \text{ cm}^2$

3 Area = $\pi r^2 = \pi \times (0.7 \text{ }\mu\text{m})^2 = \pi \times (0.7 \times 10^{-6} \text{ m}) \times (0.7 \times 10^{-6} \text{ m}) = 1.5 \text{ }\mu\text{m}^2$

4 $N_0 = 24$

7 days = $7 \times 24 \text{ hours} = 168 \text{ hours}$

so $n = 168 \div 20 = 8.4$

$Nt = 24 \times 28.4 = 8107 \text{ cells}$

5 $N = 96 + 4 + 22 + 3 = 125 \text{ animals found}$

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: $D = 1 - (0.768^2 + 0.032^2 + 0.176^2 + 0.024^2)$

addition: $D = 1 - 0.6224 = 0.3776 = 0.38 \text{ (2.d.p)}$

6 $O = 0.1 \text{ mm}$ $l = ?$ $M = 50$ $l = M \times O = 50 \times 0.1 \text{ mm} = 5 \text{ mm}$

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

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

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

8 $7.25 \times 10^{-6} \text{ m}$ ($7.25 \text{ }\mu\text{m}$)

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

10 cardiac output = stroke volume x heart rate

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

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

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

4 Magnification

1 **a** $\times 120$ **b** $\times 600$

2 $\times 26\ 000$

3 $0.88 \text{ }\mu\text{m}$

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%

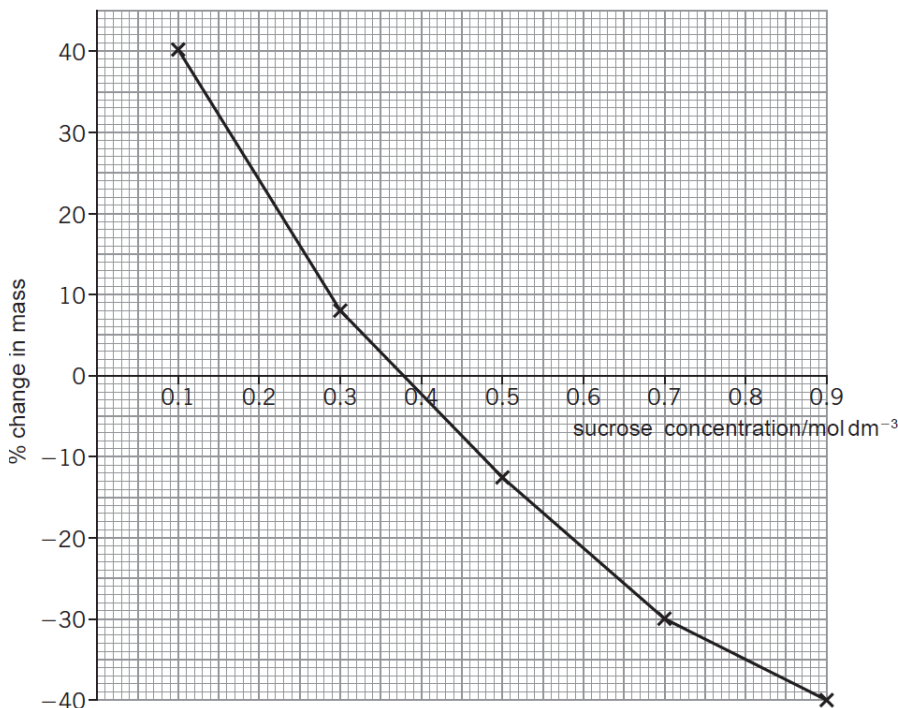
4 a 1 cm³ b 0.005 s c 0.05 °C

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	$\frac{0.5}{6} \times 100 = 8.3\%$
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

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).