Answers

A Level Biology – Bridging Booklet

Activity 1

1. Depending on the organism, or fitness level, s or ms

2. cm

3. km

4. μm

5. g or kg

6. g

7. m^3

Activity 2

1. 6000 kg

2. 4 g

3. 0.5 ml

4. 1.5 m^3

5. 120 days

6. 2 °C

7. 150 μm

8. 0.1 mm

9. The total length of each of the hairs on your head

Activity 3

1. Width of a field
2. Height of a tree
3. Length of a human digestive system
4. Height of an elephant
5. Length of DNA strand
6. Length of a nerve cell
7. Length of a heart
8. Length of a finger
9. Length of a mosquito
10. Width of a hair
11. Width of a red blood cell
12. Size of a virus
13. Length of a water molecule
14. Width of a sodium ion

Answers Units, measurements and standard form quiz

1 **Rewrite the following using prefixes:**

12000 g	12kg	2
0.005m	5mm	2
0.000087V	87µV	2

2 **What do the following units represent?**

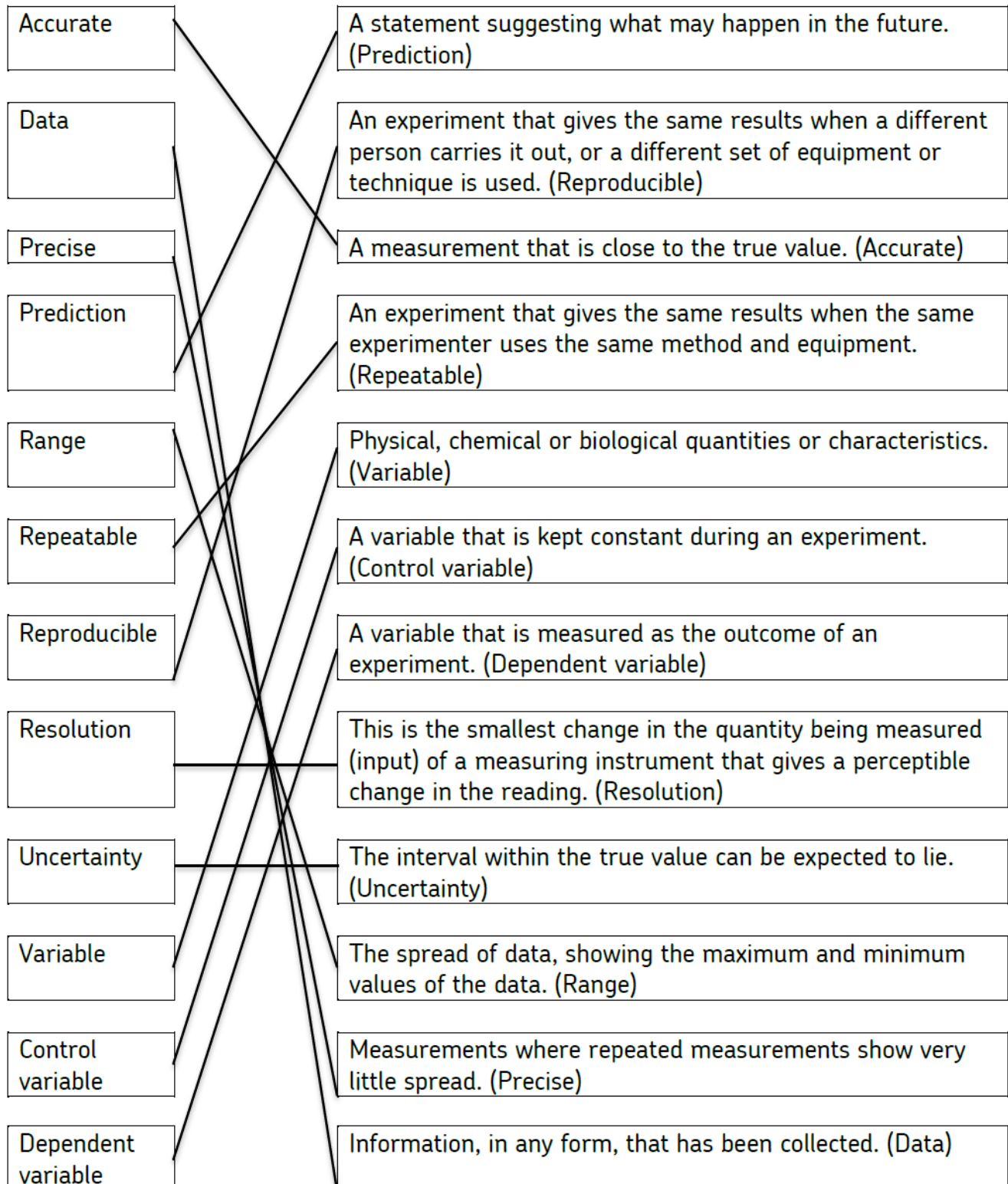|		
gcm^{-3}	grams per centimetre cubed	2
Jkg^{-1}	joules per kilogram	2
mm^3s^{-1}	millimetres cubed per second	2
$kgm^{-2}y^{-1}$	kilograms per metre squared per year	2

3 **Rewrite the following in standard form:**

1942kg	1.942×10^3kg	2
0.007m	7×10^{-3}m	2
0.000002A	2×10^{-6}A	2
0.034s	3.4×10^{-2}s	2

14.5MJ	1.45×10^4MJ	2
178846km	1.78846×10^8m	2
440mm	4.40×10^{-1}m	2

4 **Find values for:**

Wavelength of red light	630-740nm	2
Diameter of a nucleus	6-10µm	2
Mass of the earth	5.9742×10^{24} kg	2

Activity 4

Join the boxes to link the word to its definition.

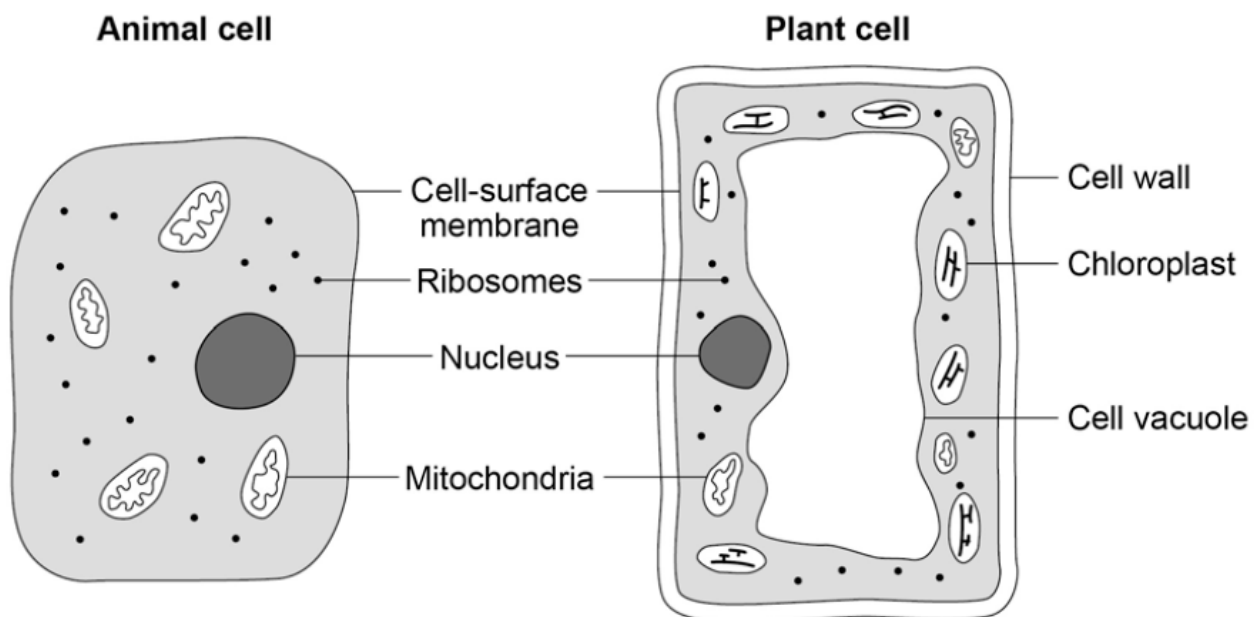| Word	Definition
Accurate	A statement suggesting what may happen in the future. (Prediction)
Data	An experiment that gives the same results when a different person carries it out, or a different set of equipment or technique is used. (Reproducible)
Precise	A measurement that is close to the true value. (Accurate)
Prediction	An experiment that gives the same results when the same experimenter uses the same method and equipment. (Repeatable)
Range	Physical, chemical or biological quantities or characteristics. (Variable)
Repeatable	A variable that is kept constant during an experiment. (Control variable)
Reproducible	A variable that is measured as the outcome of an experiment. (Dependent variable)
Resolution	This is the smallest change in the quantity being measured (input) of a measuring instrument that gives a perceptible change in the reading. (Resolution)
Uncertainty	The interval within the true value can be expected to lie. (Uncertainty)
Variable	The spread of data, showing the maximum and minimum values of the data. (Range)
Control variable	Measurements where repeated measurements show very little spread. (Precise)
Dependent variable	Information, in any form, that has been collected. (Data)

Activity 5

Structure	Function
Cell–surface membrane	Provide a selectively permeable membrane for the control of passage of substances and protect the cell contents from the surroundings
Chloroplast	Photosynthesis
Cell vacuole	To hold materials and wastes and help maintain turgor pressure
Mitochondria	Aerobic respiration
Nucleus	Contains genetic material to regulate all cell activities
Cell wall	Provide rigidity, tensile strength, structural support, protection against mechanical stress and infection
Chromosomes	Contain genes and ensure accurate replication during cell division
Ribosomes	Translation of mRNA

Draw the structure of a plant cell and an animal cell.

On each cell, add labels showing each of the structures in the table, if they exist.

Animal cell — Cell-surface membrane, Ribosomes, Nucleus, Mitochondria

Plant cell — Cell wall, Chloroplast, Cell vacuole

Activity 6:

Complete the table.

	Photosynthesis	Aerobic respiration
Which organisms carry out this process	Plants, algae and some bacteria	All living organisms
Where in the organisms does the process take place?	Chloroplasts (cytoplasm in bacteria)	Cytoplasm (glycolysis) and mitochondria. Anaerobic cytoplasm only
Energy store at the beginning of the process	Sun	Glucose
Energy store at the end of the process	Glucose	In cells
Reactants needed for the process	Carbon dioxide and water/hydrogen sulfide	Glucose and oxygen/sulfur Anaerobic glucose only
Products of the process	Glucose and oxygen	Carbon dioxide, water and ATP Anaerobic in humans, lactic acid and ATP, in plants/fungi, ethanol, carbon dioxide and ATP
Overall word equation	carbon dioxide + water → glucose + oxygen	glucose + oxygen → carbon dioxide (+energy) Anaerobic; In humans,

		glucose $\rightarrow$
		energy)
		In plants/fungi,
		glucose $\rightarrow$ etha
		carbon dioxide (+ energy)
Balanced symbol equation for the overall process	$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 38ATP$
		Anaerobic;
		In humans,
		$C_6H_{12}O_6 \rightarrow 2C_3H_6O_3$ (+ energy)
		In plants/fungi,
		$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ (+ energy)

Which of the answers for aerobic respiration would be different for anaerobic respiration? Add these answers to the table in a different colour.

Diffusion, Osmosis and Active Transport – Movement across a plasma membrane

1. What is diffusion?

   Diffusion is the random movement of a substance from a region of high concentration to a region of low concentration (i.e. down the concentration gradient).
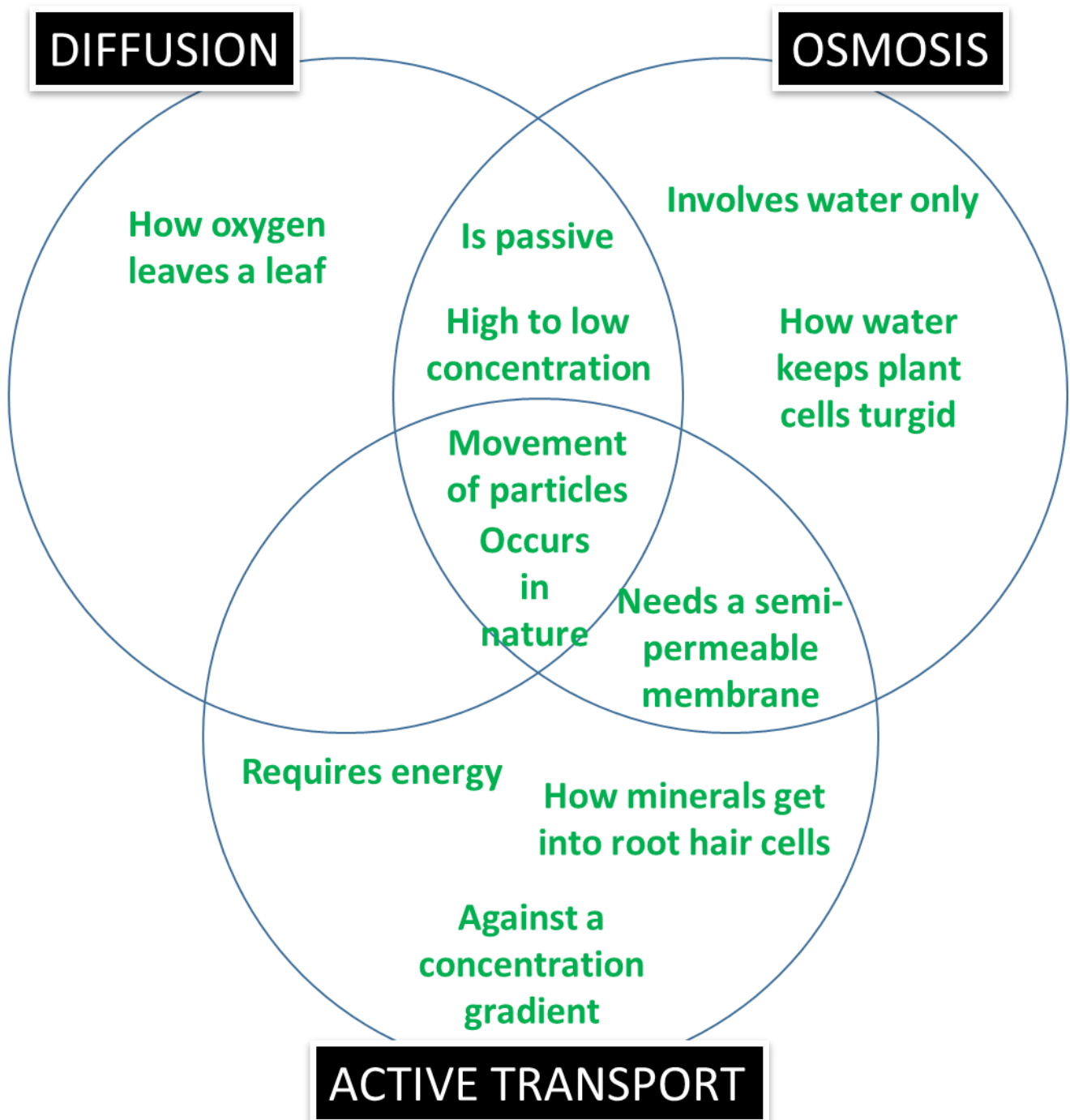
2. What is osmosis?

   Osmosis is the diffusion of water molecules, from a region where the water molecules are in higher concentration, to a region where they are in lower concentration, through a partially permeable membrane.

A dilute solution contains a high concentration of water molecules, while a concentrated solution contains a low concentration of water molecules.

3. What is active transport?

Active transport is the movement of a dissolved substance from a less concentrated area to a more concentrated area. This process requires energy.

DIFFUSION

OSMOSIS

How oxygen leaves a leaf

Is passive

High to low concentration

Involves water only

How water keeps plant cells turgid

Movement of particles
Occurs in nature

Needs a semi-permeable membrane

Requires energy

How minerals get into root hair cells

Against a concentration gradient

ACTIVE TRANSPORT

Osmosis

- Drinking a sports drink after exercise needs to ensure rapid rehydration.
- The effect of salt on slugs, salt causes water to leave slugs by osmosis, killing them.
- Potato pieces get heavier when put in pure water as they take up water by osmosis due to the water potential of potato cell cytoplasm being more negative than water.

Diffusion

- Gas exchange in the lungs – oxygen into blood down a diffusion gradient and carbon dioxide out down a diffusion gradient.
- Absorbing nutrients from food into the body down a concentration gradient when possible.
- Moving ions into cells by diffusion through channel/carrier proteins.

Active transport

- Drinking a sports drink after exercise contains glucose and amino acids that will be absorbed by active transport.
- Absorbing nutrients from food into the body against a concentration gradient if needed.
- Moving ions into cells by active transport, for example the Na+K+ ATPase pump to maintain the resting potential.

Changing surface area or length

Activity 8

	Paternal alleles	
	H	h
Maternal alleles h	hH	hh
h	hH	hh

- Hh father has the disease
- hh mother is healthy
- hH children have the disease
- hh children have the disease
- As the disease is dominant, no individual can be a carrier.

|	Paternal alleles	
	F	f
Maternal alleles F	FF	Ff
f	fF	ff

- Both parents are carriers
- FF child is healthy
- Ff and fF children are carriers
- ff child has the disease

Activity 8 (continued)

1.   The first Punnett square shows that one in every **two** children from this couple will have Huntington's disease.

2.   The second Punnett square shows that there is a one in four chance that a child born to this couple will have cystic fibrosis.

3.   Three out of four children of the second couple will either be carriers or suffer from cystic fibrosis.

4.   The percentage of children who are sufferers on the diagram is not necessarily the same as the percentage of children each couple will have who are sufferers.

5.   Each time a child is born the chances of having a child with or without cystic fibrosis remains the same.

6.   A 50:50 chance is the same as a 0.5 probability.

Activity 9: Mean, media, mode and scatter graphs

1. 5 cm^2

2. 8.5 cm^2

3. 10 cm^2
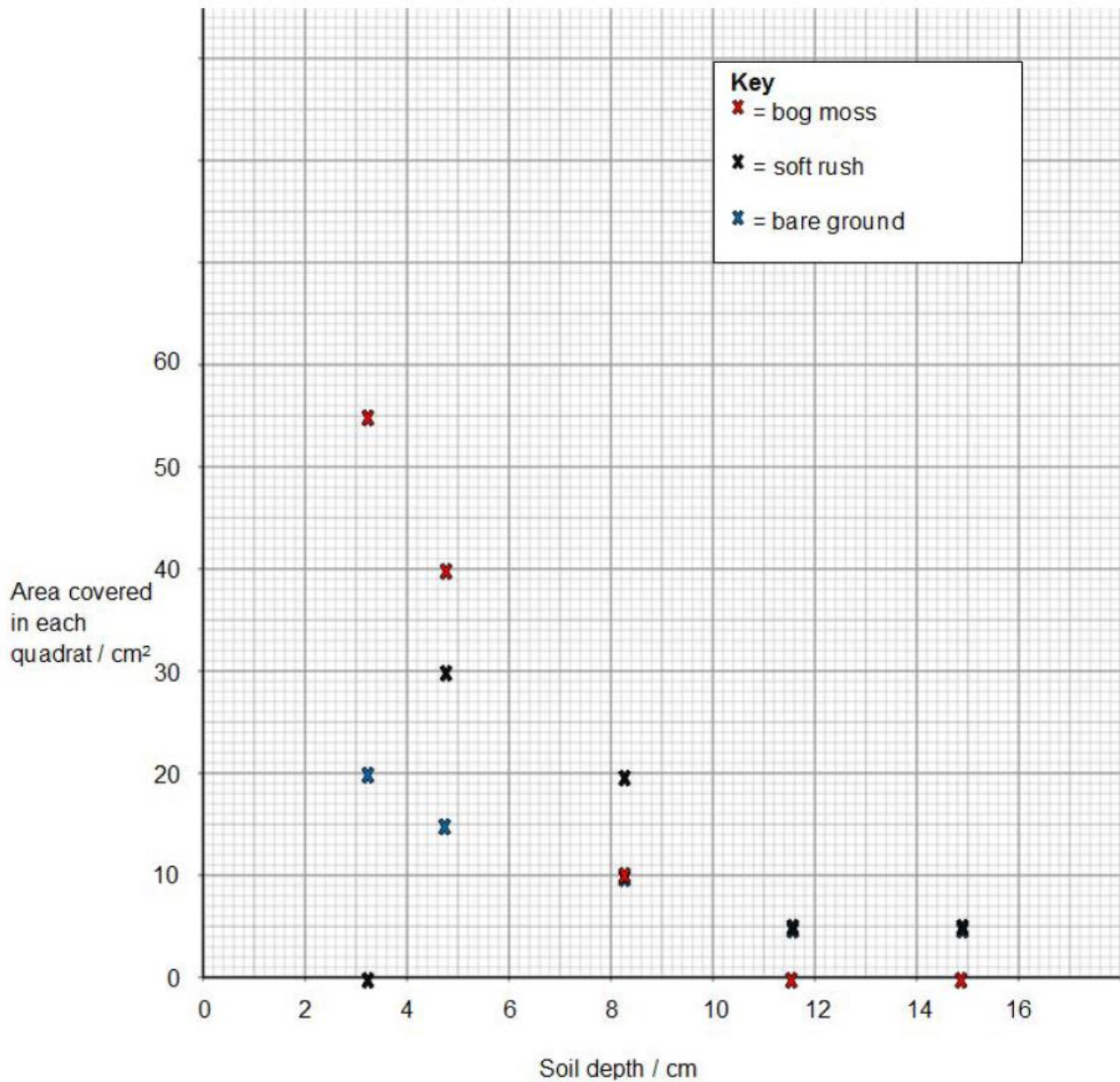
Note that some plots are obscured as plots are on the same coordinates.

Activity 9: Mean, media, mode and scatter graphs (continued)

4.   The two plant species favour shallow soils as the deeper the soil, the lower the area covered by bog moss, soft rush.

     The deeper the soil, the better vegetation grows as the deeper the soil the less area covered by bare ground.

5.   Not at all, the data set is far too small to make these conclusions and there is no repeat of the test. With no statistical analysis a degree of confidence cannot be placed on these correlations.

Activity 10: Analysing tables

1.   24.3%

2.   28.4%

3.   Men have a 49.6% decrease, women have a 43.8% decrease, so greater decrease in men.

4.   For men the fraction is $\frac{291}{941}$ or 0.309, for women the fraction is $\frac{423}{689}$ or 0.614

Activity 11: Analysing complex graphs

1.   2.6 dm^3

2.   13.5 km h^{-1}?

3.   Increased from 14 to 20 breaths per minute. A 42.9% increase.

4.   5 km h^{-1}

5.   0.15 dm^3

6. $y = 0.15x + 0.6$

Nucleic Acids Answers

1 **a** **i** deoxyribose   (*1 mark*)

       ii adenine

           cytosine

           guanine

           thymine   (*1 mark*)

  b uracil   (*1 mark*)

     thymine   (*1 mark*)

  c **i** covalent (bond)   (*1 mark*)

       ii hydrogen (bond)   (*1 mark*)

2 **a**

	nucleus	cytoplasm	
DNA	✓		(*1 mark*)
RNA	✓	✓	(*1 mark*)

  b

DNA	RNA	
contains thymine	contains uracil	(*1 mark*)
contains deoxyribose	contains ribose	(*1 mark*)
double stranded	single stranded	(*1 mark*)

  c DNA helicase unwinds the double helix   (*1 mark*)

     hydrogen bonds broken   (*1 mark*)

     each strand acts as a template   (*1 mark*)

     new / free, nucleotides form complementary base pairs   (*1 mark*)

     (base pairs form) A with T and G with C   (*1 mark*)

     DNA polymerase forms covalent bonds between pentose and phosphate   (*1 mark*)

     process continues for the entire molecule   (*1 mark*)

                                                         maximum 5 marks

3 **a**

statement	DNA	RNA	
hydrogen bonds hold the structure together	✓		(*1 mark*)
formed from nucleotides	✓	✓	(*1 mark*)
contains ribose		✓	(*1 mark*)

  b G G C A U C A U G   (*1 mark*)

  c **i** C G and A T are complementary   (*1 mark*)

          quantities of complementary bases must be equal   (*1 mark*)

       ii not double stranded / is single stranded / does not form base pairs   (*1 mark*)

4 **a** DNA helicase   (*1 mark*)

     DNA polymerase   (*1 mark*)

  b thymine / T = 29%   (*1 mark*)

     guanine / G = 21% **and** cytosine / C = 21%   (*1 mark*)

  c double stranded / anti-parallel strands   (*1 mark*)

     weak / easily broken, hydrogen bonds   (*1 mark*)

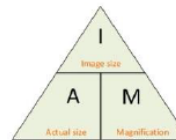   complementary base pairs / A-T **and** G-C   (*1 mark*)

Maths Skills for A Level Biology

Answers

Question 1

Answer: 30,000

Working Marks

1. scale is 30mm or 3cm.= 30000 μm
2. 30000/1 = 30,000

Tips

- Memorise and use the formula triangle.

- Always measure in mm and then the conversion to μm is simply multiply by 1000.

Question 2

Answer = 125%

Working marks

1. 11.25 grams
2. (6.25/5) x 100
3. 125%

Tips:

- Percentage increase, decrease, reduction and change can all be calculated using the equation: Percentage change = (Difference/Original) x 100.
- Look for patterns in the data, in this question because the increases in mass were consistent between each time interval, you could assume that at 12.5 minutes the mass was 11.25g i.e. half way between 10g and 12.5g.

Question 3

3a. Answer: 0.1-0.16 Billion Yr^{-1}

Working Marks:

1. Change in the population = 1-1.4 billion
2. 1.2/10 = 0.12

Tips:

- Use the equation for calculating the gradient of a line which is Change in the y axis values/ Change in the x axis Values.
- The units can be Billion Yr^{-1} or Billion/Yr

3b. Answer: 0.012-0.016 Billion Yr^{-1}

Working Marks

1. Tangent drawn on the graph with values obtained
2. Change in Y/ Change in X shown
3. Answer between 0.012-0.016

Tips

- Draw a line up from 1900 until you hit the curve, then at this point draw a tangent to the curve.
- Calculate the gradient of this tangent in the same way you did for question 3a.

Question 4

4a. Answer: 2:5

Working Marks

1. Strain A replicates 5 times, strain B replicates twice.
2. Ratio 5:2
3.

Tips

- Because the number of bacteria in each strain is equal at the beginning you have to focus on how many times each strain will divide during the time given. Convert the time to minutes to make it easier, so 1 hour 40 minutes is 100 minutes, meaning strain A must divide 5 times and strain B twice.

4b. Answer: 94%

Working Marks

1. 250 - 15 = 235
2. (235/250) x 100 = 94%

Tips

- This is a standard percentage. There are different ways to calculate a percentage, we would use (amount/total) x 100.

Question 5

5a. Answer: 99.98%

Working Marks

1. $8 \times 10^5 - 2 \times 10^2 = 799800$
2. $(799800 / 8 \times 10^5) \times 100 = 99.975$
3. 99.98%.

Tips

- Work out the number of healthy cells first.
- Calculate your percentage, then for 4 significant figures count the first 4 numbers along and look at the 5th number to decide whether to round up or keep it the same. In this example the 5 rounds the 7 up to an 8.

5b. Answer:

- $(0.5/15)$
- $(0.5/15) \times 100 = 3.3\%$

Tips

- The error will always be whatever the unit used is divided by 2 e.g. if it is correct to 1mm, then the error could be 0.5 either side of the measured value.
- Use the percentage error formula: (error/measurement) x 100.

Question 6

6a. Answer: How much members of a group within a data set differ from the mean value of the group.

6b. Answer: 164.7

Working Marks:

1. Mean = 394
2. $\sum(x - \bar{x})^2$ = 108520
3. 108520/4 = 27310
4. $\sqrt{27310}$ = 164.7

Tips

- Calculate the mean then add another column to the table for $(x - \bar{x})^2$
- $(x - \bar{x})^2$ Means the value in the table - the mean, then the answer squared e.g. for Item A 170-394= 224² = 50176. Complete this for each item in the table and then add them all together to give you $\sum(x - \bar{x})^2$.
- n is the number in the sample.
- Sub in your values into the equation to get the final answer.

Question 7

7a. Answer: 5000mm³

Tips

- To convert from cm^3 to mm^3 simply multiply by 1000. To convert mm^3 to cm^3 you would divide by 1000.

7b. Answer: 16

Working Marks

1. 60-70kg= 14 people
2. 70-75kg = 2 people
3. 16 people

Tips

- 'How many' means frequency and the frequency is the area of each bar.
- To calculate the area, multiple the difference on your X axis by the Y axis value e.g. 60-70kg is 10 x 1.4 = 14 people.

Question 8

8a. Answer: 150

Working Marks

1. 0.0015 x 100,000 = 150

8b. Answer: 65450μm

Working Marks

1. Volume= 4/3 πr^3 = 4/3 $\pi 250^3$
2. 65449846.95nm /1000
3. 65450 μm

Tips

- Radius is half the diameter = 250nm
- Memorise 4/3 πr^3
- To get from nm to μm divide by 1000. Practise these conversion and make sure you are confident with them.