

Examination Terminology

In Biology, questions come in a range of different forms. It is essential that you understand what information the question is asking for.

There are usually two sections to questions in Biology:

- The first part will provide you with some background knowledge or information; it is the **stem** of the question.
- The second part contains the **instructions**; what you need to do to answer the question.

It is very important that you read the instructions part carefully and provide the information that the examiner requires. Do not give the information that you want to tell the examiner just because you may know it very well. It is very common to assume you know what the question is about, when it is actually asking something different, especially when under pressure in exam conditions.

Exam questions will contain key words used to introduce the question. If you know what these key words/terms mean, you will have a much greater chance of providing the correct answer.

The following terms are widely used in Biology exam questions, and give guidance as to the type of answer needed. Make sure you familiarise yourself with these terms and are able to apply them when answering the exam questions.

Term	Description/Understanding
Analyse	Use data from an experiment, usually from a graph or table, to draw valid conclusions
Annotate	On a diagram, drawing or graph, add brief notes to give an explanation
Apply	Use of previous knowledge, equations, theories or principles to explain a different or new situation
Calculate	Use figures from tables or graphs to work out an answer; show all stages of working out (steps used to reach an answer)
Compare	Usually, explain similarities or differences between two or more sets of data, objects or situations
Construct	Usually, convert information provided into a graph, table or pyramid
Contrast	Show the differences between different conditions
Define	Give a <i>precise</i> answer, normally the exact meaning of a biological term
Describe	Give a full, detailed account with <i>all</i> the relevant information
Discuss	Provide an answer that includes a range of views, or various factors that could have an impact on a biological process
Evaluate	Look at all the implications and limitations
Explain	Give a reason, using biological knowledge or scientific information
Identify	Look for the answer from a number of different possibilities, often from tables or graphs

(Continued)

Examination Terminology

Term	Description/Understanding
Illustrate	Give an answer with clear examples with comparisons highlighted
List	The answer does not need an explanation; it could be a sequence of names or brief answers
Name	Concise answer required, usually one word
Predict	Give estimated or expected values, or write down what you think may happen
State	You will need to give a specific name, term or numerical value, which usually does not need any further explanation
Suggest	Give any other biological possibilities or a valid logical explanation
Summarise	Give a brief, concise or exact account; avoid too much detail

It is advisable to become familiar with these terms and to look through past exam papers from your specific exam board to see which terms are frequently used.

Add further terms to the above list as you come across them.

Questions

Answer the following questions by paying particular attention to the terms used within the questions. Refer to the table above to make sure you understand what is asked of you.

- 1 Explain what is meant by 'activation energy'.
- 2 State the function of the nucleus and mitochondria.
- 3 Name the process by which plants convert light energy into chemical energy.
- 4 Describe how you would carry out a test to find out if a solution contained glucose.
- 5 Briefly describe the 'lock and key' model for enzyme action.
- 6 Suggest a limitation to the 'lock and key' model of enzyme action.
- 7 Compare the structure of plant and animal cells.
- 8 Lactose is present in milk. It is broken down by lactase into glucose and galactose. This is shown by the following equation:

$$\text{lactose} + \text{water} \xrightarrow{\text{lactase}} \text{glucose} + \text{galactose}$$
Name the type of reaction shown in the equation.
- 9 List three different substances required for healthy nutrition.
- 10 State the name given to small circles of DNA in prokaryotic cells.

Units and Abbreviations

Why are units important in Biology?

In Biology you will be making many observations and measurements that need appropriate units; it is therefore important that a universal system is followed. *Le Système International d'Unités* (abbreviated to SI) is a metric system that is used in science. It ensures that all scientists work in the same standard units.

The table below shows the common measurements you will come across in Biology.

Name	Unit	Symbol
area	square metre	m ²
concentration	moles per cubic decimetre	mol dm ⁻³
energy	Joule	J
length	metre	m
mass	kilogram	kg
pressure	Pascal	Pa
temperature	degree centigrade	°C
time	second	s
volume	cubic decimetre	dm ³

What do prefixes mean?

A prefix can be used for units. This is usually a multiplier for that unit, such as 'kilo', which is 1,000 multiples of the unit – you could have kilometre, kilograms and kilojoules, for example.

Below is a list of the units (some with prefixes) you will need to know.

Name	Symbol
kilometre	km
metre	m
centimetre	cm
millimetre	mm
micrometre	μm
nanometre	nm

From the table above, you can see that nm is the smallest measurement used by the A-level biologist.

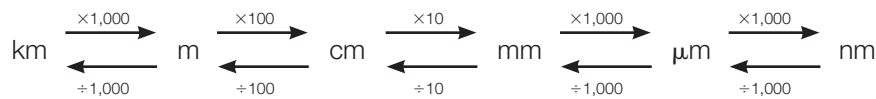
- To convert mm to μm, you need to multiply by 1,000.
- To convert μm to nm, you need to multiply by 1,000.

Units and Abbreviations

- To convert μm to mm, you need to divide by 1,000.
- To convert nm to μm , you need to divide by 1,000.

An easy way to remember whether you need to divide or multiply by 1,000 is to...

- 1 Look at the figure and decide if it needs to be made bigger or smaller.
- 2 Then look at the units it needs to be converted into.
- 3 If the figure needs to be made bigger... **MULTIPLY by 1,000 (or 100).**
- 4 If the figure needs to be made smaller... **DIVIDE by 1,000 (or 100).**



You will also need to be confident at recognising each of the units when they are written as **powers of ten** (length has been used in the following table to illustrate this).

Name of unit	Multiple or fraction of a metre
kilometre (km)	$10^3 = 1000\text{m}$
metre (m)	1m
centimetre (cm)	$10^{-2} = 0.01\text{m}$
millimetre (mm)	$10^{-3} = 0.001\text{m}$
micrometre (μm)	$10^{-6} = 0.000001\text{m}$
nanometre (nm)	$10^{-9} = 0.000000001\text{m}$

Task and Questions

Task

Complete the table below showing conversions between different units. Some have already been done for you, and these should help you to fill in the blanks.

Unit	m	cm	mm	μm	nm
Height of a rosebush		145			
Length of a fingernail			16		
Diameter of a liver cell				25	
Diameter of a cell membrane					10

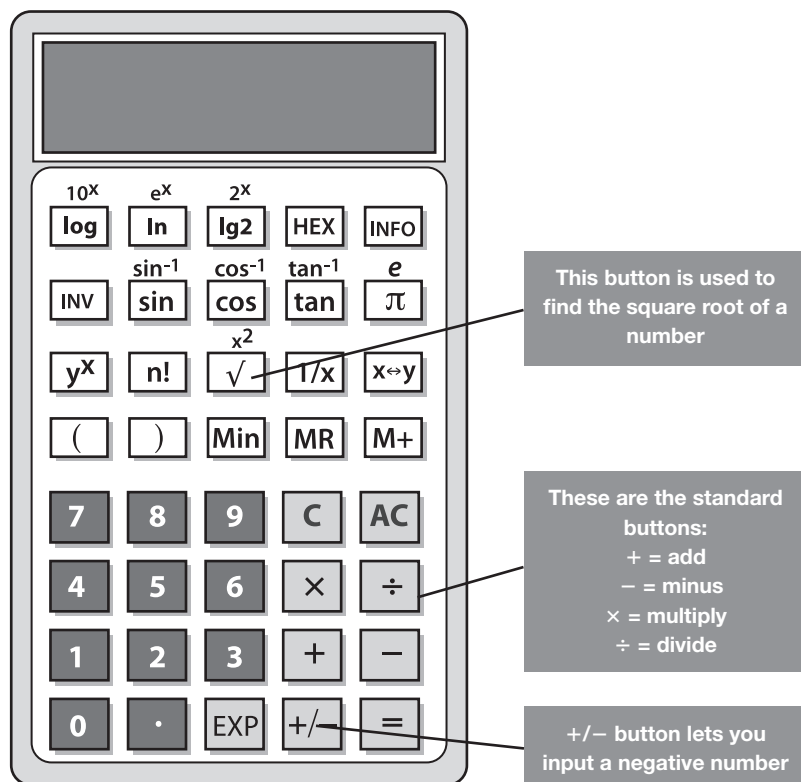
Units and Abbreviations

Questions

- 1 Convert $75\mu\text{m}$ into mm.
- 2 How many nm are there in 450mm?
- 3 Write $84\mu\text{m}$ in mm.
- 4 Susan uses an optical microscope to look at a liver cell that is 4mm in diameter.
 - a) How would she write this figure in cm?
 - b) How would she write this figure in μm ?
- 5 Write $180\mu\text{m}$ as mm.
- 6 Write 0.2mm in μm .
- 7 Convert 2.5m into μm .
- 8 George measures the size of the nucleus in a plant cell as 30mm. What is this value in nm?
- 9 The length of a salmon was measured as 0.5m. Convert this into μm .
- 10 A holly leaf was measured and had a diameter of 6.5cm.
 - a) What is its diameter in mm?
 - b) What is its diameter in m?
 - c) What is its diameter in nm?

Calculation Skills

You will be required to do some simple maths calculations in Biology, so you need to be confident about using a calculator. You should familiarise yourself with some of the functions on a scientific calculator. Not all calculators are identical – if in doubt, check the instructions that come with your calculator.



In Biology you may be expected to work out calculations using data from a table or a graph. You will need to be confident at calculating the following:

- **Mean** – this is the ‘average value’. To find the mean, you will need to add up all the data provided (ignoring anomalies if this is applicable), obtain an overall total, then divide it by the number of data points within the group. For example, the mean for 14, 10, 20, 16 and 15 would be calculated as follows:

$$\frac{14 + 10 + 20 + 16 + 15}{5} = 15$$

- **Calculating percentage (%)** – this gives you an idea of what proportion of a set of data falls into any particular group.

$$\frac{\text{Amount}}{\text{Total}} \times 100 = \text{percentage (\%)}$$

Worked example:

In a school 450 students took a Biology AS-level exam. Of these students, 58 obtained A*. What percentage of students taking the exam obtained an A*?

Answer: Number of students with A* = 58

Total number of students taking the exam = 450

$$\frac{58}{450} \times 100 = 12.88\%$$

Calculation Skills

- **Calculating percentage increases (%)** – this allows you to work out the percentage increase in results, usually from the beginning of an investigation to the end of the investigation.

$$\left[\frac{\text{total after increase}}{\text{total before increase}} \times 100 \right] - 100$$

Worked example:

Last year 101 students took up AS Biology. This year the figure was 135.

What is the percentage increase between the two years?

Answer: Total number of students after increase = 135

Total number of students before increase = 101

$$\left[\frac{135}{101} \times 100 \right] - 100 = 33.66\%$$

There is a 33.66% increase.

- **Calculating percentage decrease (%)** – this allows you to work out the percentage decrease in the figures you have at the end, such as in an investigation, compared to those you started with.

$$100 - \left[\frac{\text{total after decrease}}{\text{total before decrease}} \times 100 \right] = \text{percentage decrease (\%)}$$

Worked example:

In April this year, there were 167 snails in a pond. Four weeks later the number of snails had dropped to 84.

What is the percentage decrease in the number of snails during these four weeks?

Answer: Total number of snails after decrease = 84

Total number of snails before decrease = 167

$$100 - \left[\frac{84}{167} \times 100 \right] = 49.70\%$$

There is a 49.70% decrease.

Questions

- 1 Calculate the mean value for the following results:
105, 29, 78, 79, 95, 88, 74
- 2 Find out the mean height of boys in a class from the results below:
180cm, 140cm, 155cm, 144cm, 160cm, 188cm, 154cm, 172cm, 156cm

Calculation Skills

- 3 Calculate the mean length of snail shells from different locations.

Location	Snail shell length/mm
1	44
2	34
3	27
4	30
5	49
6	23
7	33
8	43
Mean	

- 4 The table below shows the concentration of different ions inside algal cells and the concentration of the pond water in which they were found.

Ions	Concentration in the pond water/ mmol dm^{-3}	Concentration inside algal cell/ mmol dm^{-3}
Sodium	1.1	4.8
Chloride	2.5	6.2
Nitrate	2.5	7.4
Potassium	1.2	5.7

Calculate the percentage increase in the concentration of nitrate ions inside algal cells.

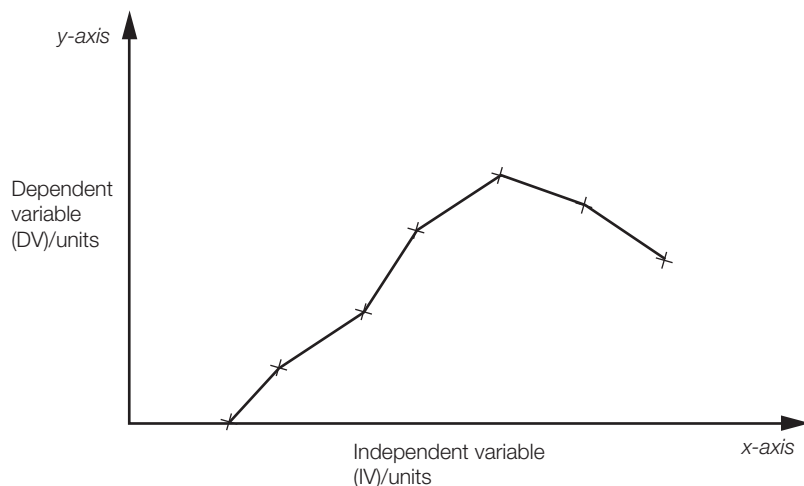
- 5 Over the course of a year, a hospital checked 745 children for asthma. Of those checked, 158 were found to be suffering from asthma. What percentage of the total number of children examined were found to have asthma?
- 6 In an AS Biology exam paper the total marks were 60. If student A obtained 45 marks, what percentage did this student obtain?
- 7 In an A2 Chemistry exam paper the total marks were 75. If student B obtained 53 marks, what percentage did this student obtain for the paper?
- 8 A blood cell with a diameter of $15.5\mu\text{m}$ was placed in concentrated salt solution for 24 hours. After this period the diameter measured was $8.9\mu\text{m}$. Calculate the percentage decrease in the diameter of the cell.

Graph Plotting Skills

There are different types of graphs that can be used to show data you may have obtained from a practical or investigation.

All graphs have some common features:

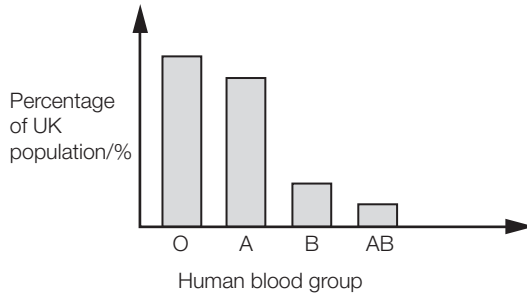
- 1 Axes** – make sure that you have the two axes the correct way around on your graph:
 - x-axis* – (on the bottom/horizontal) has the variable you are changing; it is called the **independent variable (IV)**;
 - y-axis* – (on the side/vertical) shows the variable you are measuring; it is called the **dependent variable (DV)**.
- 2** All axes must be labelled correctly with the appropriate **units**.
- 3** Graphs should contain a **title** indicating what the graph is showing.
- 4 Scale** – make sure that your scale is **uniform**, that is, always increases by a fixed amount, such as 0, 2, 4, 6, 8, 10 and not 0, 2, 5, 8, 10. It is usually much better to start the scales for each axis at 0. You should use at least half the available space on the graph paper.
- 5 Plotting** – make sure that you plot each reading or data point very carefully and accurately. You can use a dot with a circle around it (⊙) or a cross (x).
- 6 Curve** – it is easiest to join the data points with straight lines using a ruler, rather than trying to draw the lines using 'free hand' (beware – other science subjects may like you to draw curves using free hand).
- 7 Do not** extend the lines beyond the data points; this is called **extrapolating** and you should not do this unless specifically asked to do so.



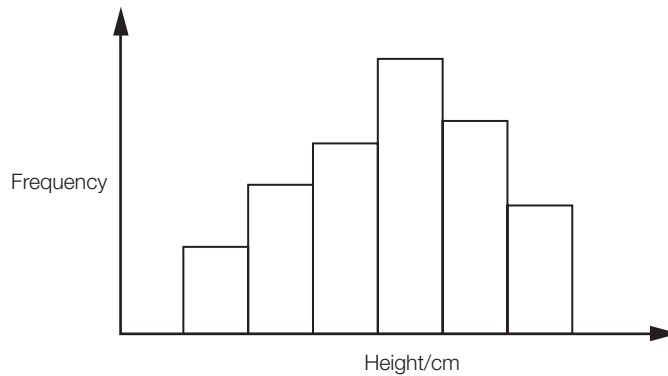
Graph Plotting Skills

What types of graph could you be asked to plot?

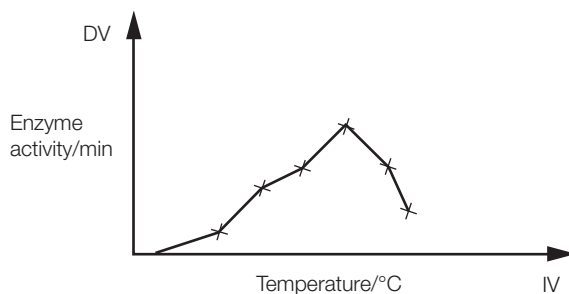
- A. Bar chart** – this type of graph is plotted when the IV is not numerical (that is, there are no numbers) but has **categories**, for example, human blood groups. The bars do not touch.



- B. Histogram** – this type of graph is used to show **frequency distribution** (effectively a tally chart) with continuous data/measurements for the IV. When plotting a histogram, the bars can be touching and the data is grouped into classes. For example, the height of students in a science group, 140–144cm, 145–149cm, 150–154cm etc.

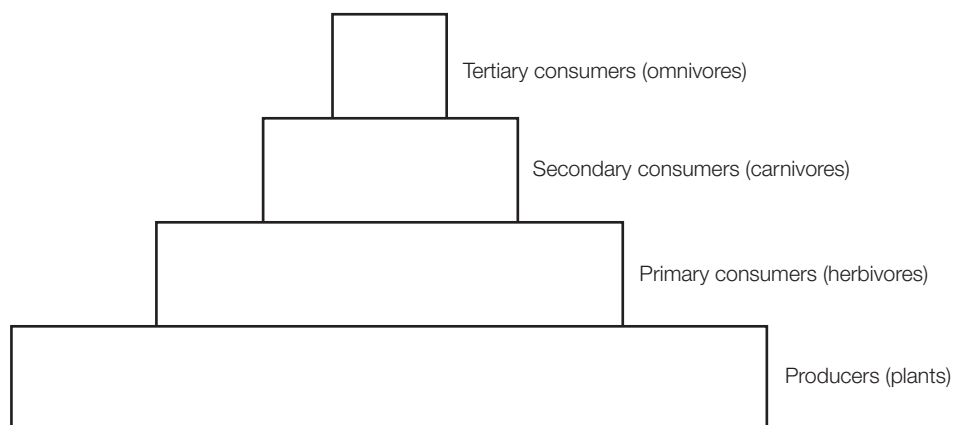


- C. Line graph** – this type of graph is plotted to show the relationship between two variables and indicates the effect of the IV on the DV – for example, the effect of temperature on enzyme activity.



- D. Ecological pyramid** – this type of graph is used in ecology when you may be asked to show different organisms in food relationships or different feeding levels. The pyramids always have plants or producers at the base and the consumers (these eat others organisms) above.

Graph Plotting Skills



The pyramid should always be **symmetrical** and the width of the bars **proportional** to the number of organisms, the biomass or the energy at each level.

Questions

- 1 Name the type of graph you would plot to compare the volume of juice produced from an orange, lemon, grapefruit and satsuma.
- 2 What type of graph would best show the results from an experiment looking at the relationship between substrate concentration and enzyme activity? What would the IV and DV be in this experiment?
- 3 What is at the base of ecological pyramids?
- 4 How would you present the results from an investigation looking at the hand-span measurements of a class of students?
- 5 Plot a labelled graph for the data below.

Temperature/°C	Volume of apple juice produced/cm ³
0	0.5
10	5.0
20	12.5
30	20.0
40	35.5
50	28.0
60	15.0

- 6 What type of graph would you plot to show how many students in your class are able to roll their tongue compared with how many cannot roll their tongue?

Graph Plotting Skills

- 7** Plot a graph showing the percentage of students from class 2HS obtaining each grade at AS-level Biology.

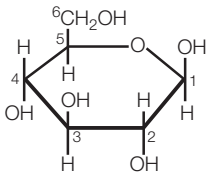
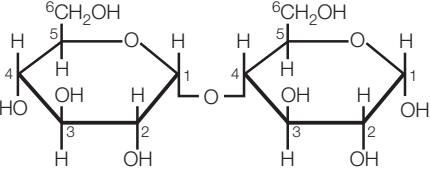
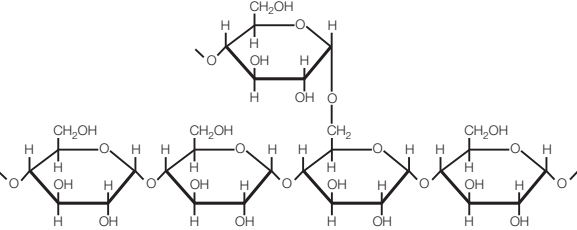
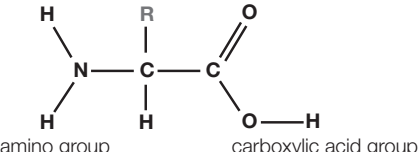
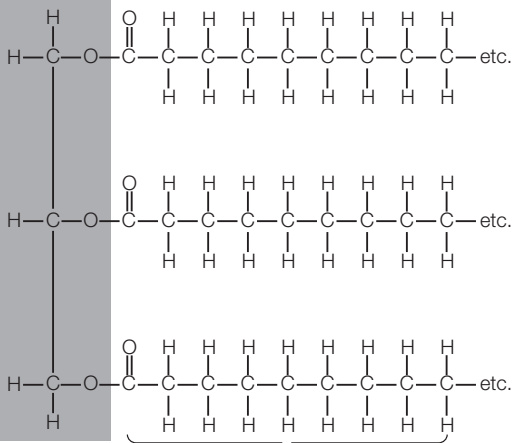
A=15%, B=22%, C=35%, D=20%, E=8%

- 8** Plot a graph using the data below, obtained for a photosynthesis experiment carried out at two different temperatures.

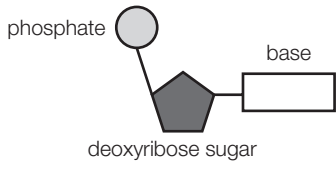
Time/minutes	Volume of oxygen produced/cm ³	
	At 20°C	At 30°C
0.0	0.0	0.0
5.0	2.0	5.5
10.0	4.0	10.0
15.0	6.5	15.0
20.0	10.0	22.0
25.0	13.0	27.5

In your Biology course you will need to be familiar and confident with certain formulae, structures and equations. These will help you to summarise biological information into the most important points.

Which biological molecules do I need to know?

Name	Formula	Structure
Glucose	$C_6H_{12}O_6$	
Maltose	$C_{12}H_{22}O_{11}$	
Starch	$[C_nH_{2n}O_n] - H_2O$	
Amino acid	$NH_2CHRCOOH$	 <p>amino group carboxylic acid group</p>
Lipids	$C_3H_8O_3$ (glycerol) + 3 fatty acids	 <p>glycerol fatty acids</p>

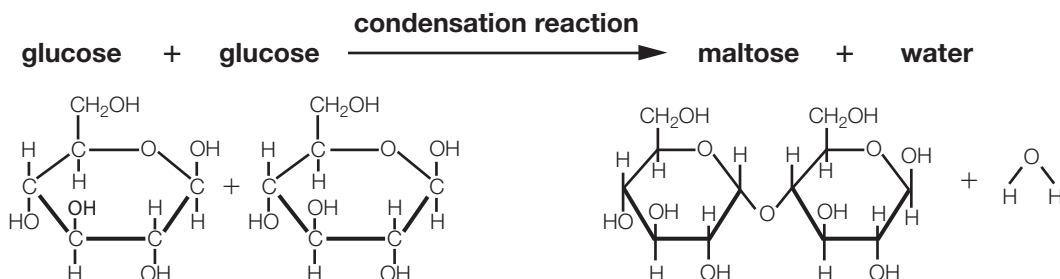
(Continued)

Name	Formula	Structure
Nucleotide	Phosphate, 5C sugar (pentose) + base	

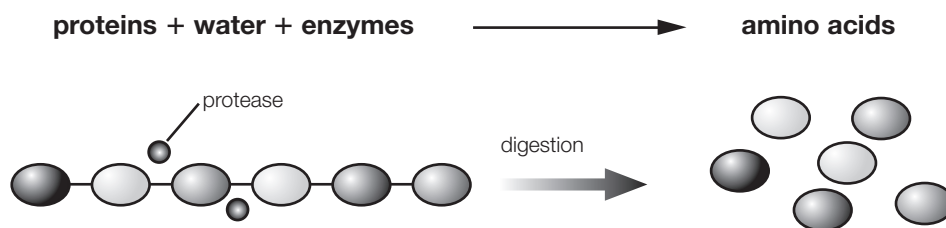
What reactions do I need to know?

There are a number of types of reactions you may be asked about in your exams, so it is very important that you know when to use these equations.

- **Condensation reaction** – this is when two monomers (single building units) are joined together by covalent bonds and water is released. Condensation reactions are involved when polymers are formed, as in protein synthesis. The bonds that join the molecules together have special names depending on which biological molecule is being made. An example is the formation of maltose from glucose monomers.



- **Hydrolysis reaction** – this type of reaction is involved in the breakdown of large polymers into single monomers. Large molecules are split using water (*hydro* = water and *lysis* = split). Water and enzymes are required during this reaction. For example, when proteins are digested, they are hydrolysed.



- **Photosynthesis**

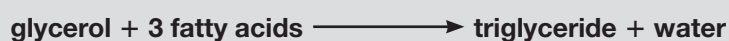


- **Respiration**



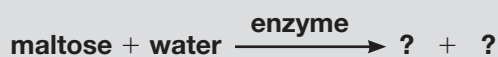
Questions

- 1 Name the type of reaction that involves the formation of polymers from monomers.
- 2 How is the bond broken between two amino acids?
- 3 Write the formula for maltose.
- 4 Draw the structure of glucose.
- 5 What type of reaction is involved when you digest bread?
- 6 Spot the type of reaction shown below:



You do not necessarily need to recognise the names of all the molecules present. Look for clues as to the general type of reaction occurring.

- 7 List the three molecules that make up a nucleotide.
- 8 What is removed during a condensation reaction?
- 9 When two amino acids join together through a condensation reaction, a water molecule is released. How many water molecules will be produced if you join eight amino acids in a chain?
- 10 Complete the reaction below:



- 11 Draw a diagram showing the general structure of an amino acid.