AQA
Realising potential

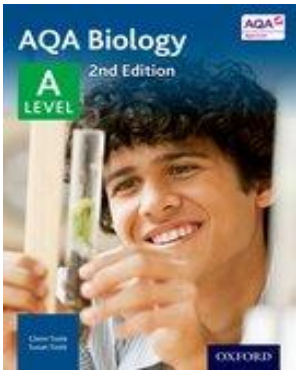
PINNER
HIGH SCHOOL

Lesson activity: GCSE to A-level progression
A level Biology (code: 7402)

Specification at a glance

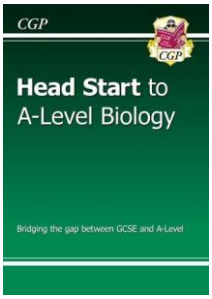
The specification is a useful reference document for you. You can download a copy from the AQA website. The here. Alternatively you can search for the specification code **7402**.

We will be following the Oxford University Press textbook throughout the course (ISBN: 978-0-19-835177-1)



If you finish this booklet early it would be beneficial for you to begin pre-reading of chapter 1: Biological molecules – this will help prepare you for our return back to school in September.

There is also a brilliant book by CGP available for purchase online. It recaps all the crucial topics you'll need to remember from GCSE, with crystal-clear study notes and examples, plus practice questions to test your understanding. It also included introductions to some of the key topics you'll meet at A-Level. You may also wish to work through this if you complete this booklet with time to spare.



If you have any questions related to A-level biology please contact Miss L Buss (Head of Biology) by email at: lbuss@pinnerhighschool.org

Transition activities

The following activities cover some of the key skills from GCSE science that will be relevant at AS and A-level. They include the vocabulary used when working scientifically and some maths and practical skills.

The booklet has been produced so that it can be completed electronically or you can print them out.

The activities are **not a test**. Try the activities first and see what you remember and then use textbooks or other resources to answer the questions. **Don't** just go to Google for the answers, as actively engaging with your notes and resources from GCSE will make this learning experience much more worthwhile.

The answer booklet guides you through each answer. It is not set out like an exam mark scheme but is to help you get the most out of the activities.

If you complete this work early, my suggestion would be to begin pre-reading of the Biological Molecules chapter, or work through additional practice questions from the Head Start to A-level Biology book.

Activity 1 Scientific vocabulary: Designing an investigation

Link each term on the left to the correct definition on the right.

Hypothesis	The maximum and minimum values of the independent or dependent variable
Dependent variable	A variable that is kept constant during an experiment
Independent variable	The quantity between readings, eg a set of 11 readings equally spaced over a distance of 1 metre would give an interval of 10 centimetres
Control variable	A proposal intended to explain certain facts or observations
Range	A variable that is measured as the outcome of an experiment
Interval	A variable selected by the investigator and whose values are changed during the investigation

Activity 2 Scientific vocabulary: Making measurements

Link each term on the left to the correct definition on the right.

True value	The range within which you would expect the true value to lie
Accurate	A measurement that is close to the true value
Resolution	Repeated measurements that are very similar to the calculated mean value
Precise	The value that would be obtained in an ideal measurement where there were no errors of any kind
Uncertainty	The smallest change that can be measured using the measuring instrument that gives a readable change in the reading

Activity 3 Scientific vocabulary: Errors

Link each term on the left to the correct definition on the right

Random error	Causes readings to differ from the true value by a consistent amount each time a measurement is made
Systematic error	When there is an indication that a measuring system gives a false reading when the true value of a measured quantity is zero
Zero error	Causes readings to be spread about the true value, due to results varying in an unpredictable way from one measurement to the next

Activity 4 Units

What would be the most appropriate unit to use for the following measurements?

1. The time between heart beats
2. The diameter of a cheek cell
3. The distance that a migratory bird travelled each year
4. The thickness of a DNA helix
5. The mass of a rabbit
6. The mass of iron in the body
7. The diameter of a glucose molecule

Activity 5 Converting data

Re-write the following.

1. 0.00224 metres in millimetres
2. 104 micrograms in grams
3. 6.2 kilometres in metres
4. 10 micrograms in nanograms
5. 70 decilitres in litres
6. 10 cm^3 in litres

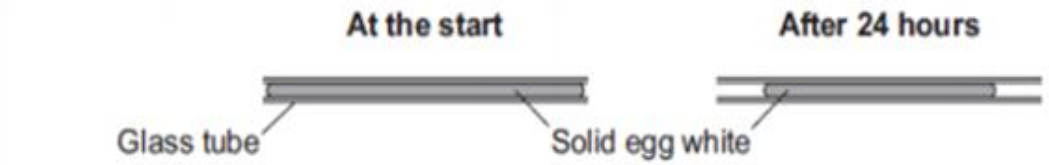
Activity 6 Investigating how temperature and pH affect enzymes

Egg white is made of protein. The students were investigating how temperature and pH affect the digestion of protein

The students carried out the following procedure:

- Filled six narrow glass tubes with fresh egg white
- Boiled the tubes so the egg white became solid
- Placed each tube into a different beaker containing human protease enzyme at different pH values at room temperature and 3 in neutral pH but at different temperatures for 24 hours
- Measured the length of solid egg white in each tube after 24 hours

The diagram shows the investigation.



The results were recorded in the tables below:

pH	Original length of solid egg white (cm)	Final length of solid egg white (cm)	% change
4	6.0	5.6	
7	6.0	3.8	
9	6.0	5.8	

Temperature (°C)	Original length of solid egg white (cm)	Final length of solid egg white (cm)	% change
15	6.0	5.7	
35	6.0	3.8	
55	6.0	5.3	

1. State a hypothesis for this investigation.

2. The students predicted that the enzyme would be most effective in conditions similar to those found in the human body. Was their prediction correct?

3. Identify the independent and dependent variables in this investigation.

4. Suggest the control variables for this investigation.

5. Describe the difference between repeatable and reproducible.

6. What would be the most likely resolution of the ruler you would use in this investigation.

7. Suggest how repeating the investigation would be an improvement.

8. Calculate the % change for each result in this investigation. Show your answers to 3 significant figures.

Activity 7 Mean mode median and scatter graphs

A student investigated an area of moorland where succession was occurring. The student used quadrats to measure the area covered by; different plant species, bare ground and surface water.
They did this at every 10 meters along a line transect. The student also recorded the depth of soil at each quadrat. Their results are shown in the table.

	Area covered in each quadrat A to E in cm^2				
	A	**B**	**C**	**D**	**E**
Bog moss	55	40	10	–	–
Bell heather	–	–	–	15	10
Sundew	10	5	–	–	–
Ling	–	–	–	15	20
Bilberry	–	–	–	15	25
Heath grass	–	–	30	10	5
Soft rush	–	30	20	5	5
Sheep's fescue	–	–	25	35	30
Bare ground	20	15	10	5	5
Surface water	15	10	5	–	–
Soil depth / cm	3.2	4.7	8.2	11.5	14.8

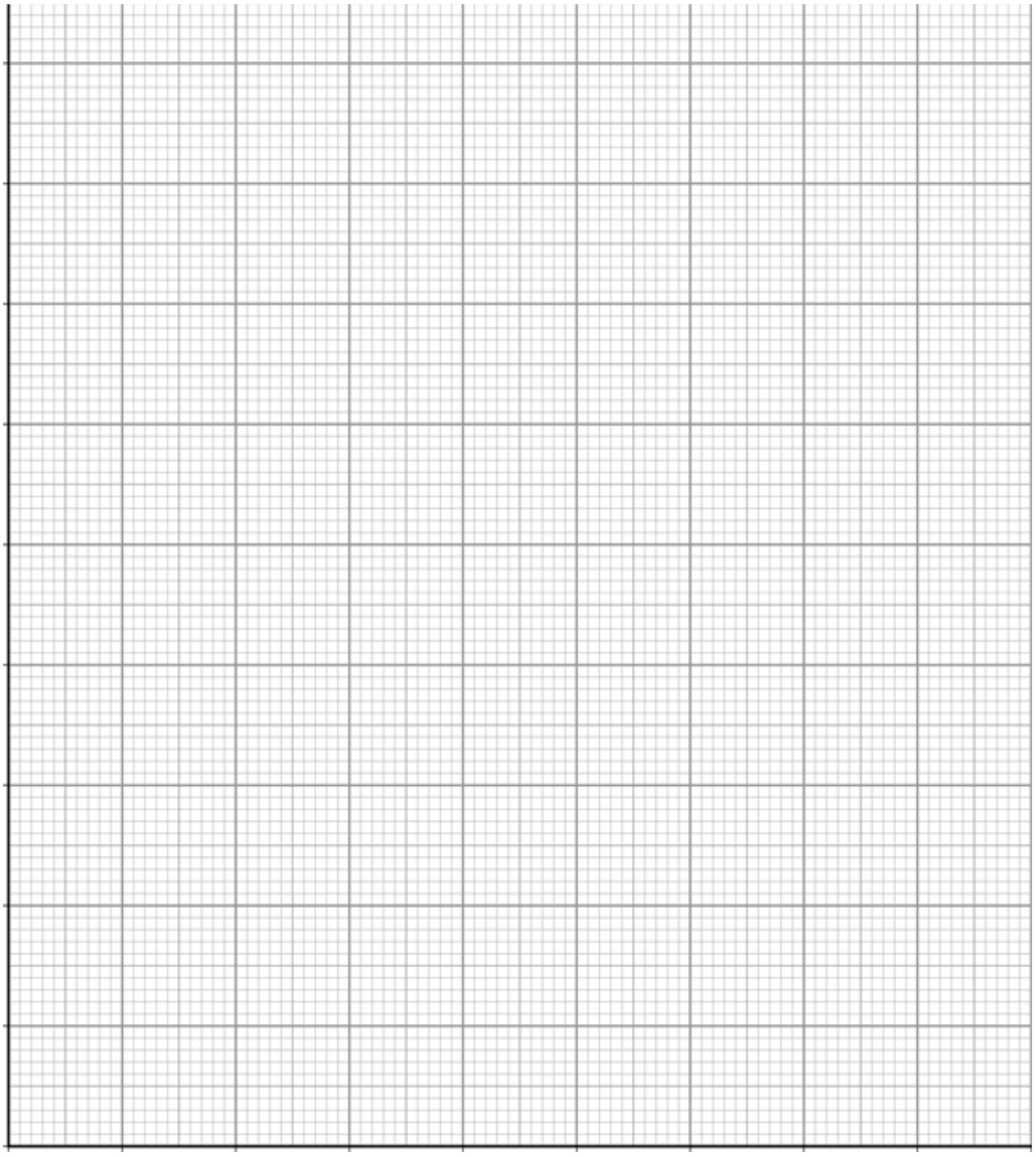
Calculate:

1. Calculate the mode area of soft rush in the sample.

2. Calculate the mean soil depth of the area of moorland sampled.

3. Calculate the median amount of bare ground in the sample.

4. Using the data in the table plot a **scatter graph** of the soil depth against the area covered by bare ground, soft rush and bog moss (use different colours or markers for each).



5. What conclusions can you draw from this graph?

6. Suggest how to improve the validity of these conclusions.

Activity 8 Data in tables

A patient with a leaking heart valve may have the valve replaced. A study compared two different types of replacement heart valve:

- mechanical valves
- biological valves from pigs.

The data used in the study was collected from female patients aged 50–69. **Table 4** shows the data.

Table 4

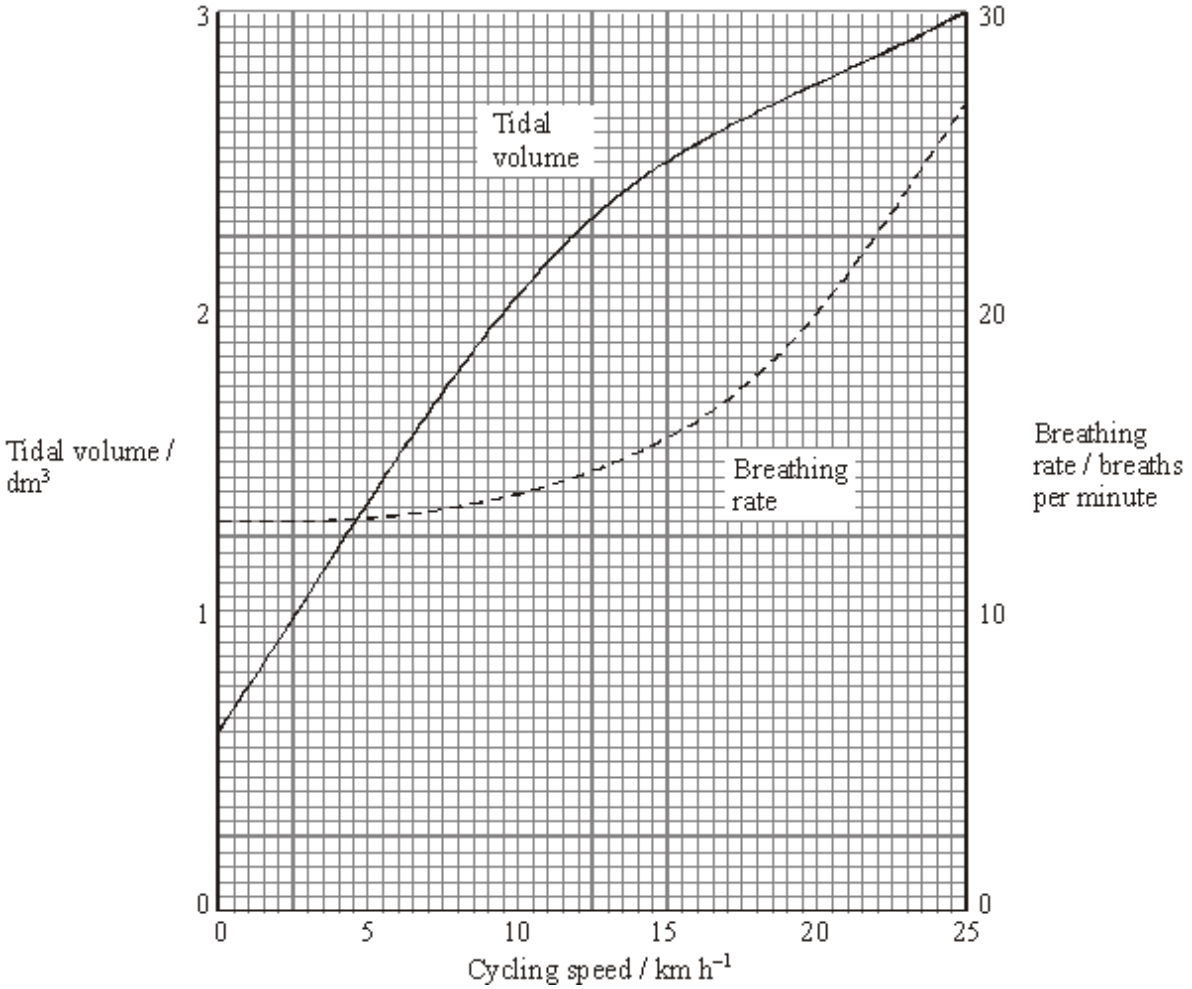
	Type of replacement heart valve	
	Mechanical	**Biological**
Number of patients given the valve	2852	1754
Number of patients who died from heart-related problems after valve replacement	180	178
Percentage of patients alive after 5 years	91	89
Percentage of patients needing a second valve replacement within 6 years	2.2	5.2
Percentage of patients who had a blood clot on the brain after surgery	5.8	0.1

1. Give **one** conclusion about the death of patients from heart-related problems after a valve replacement.
   Include calculations to support your answer.

2. Evaluate the use of mechanical replacement heart valves and biological replacement heart valves.
   Use information from **Table 4**.

Activity 9 Analysing complex graphs

The volume of air breathed in and out of the lungs during each breath is called the tidal volume.
The breathing rate and tidal volume were measured for a cyclist pedaling at different speeds. The graph shows the results



1. State the tidal volume when the cycling speed was 17 km h^{-1}.

2. State the breathing rate when the cycling speed was 8 km h^{-1}.

3. Calculate the change in breathing rate when the cyclist speed changed from 10 to 20 km h^{1}.
   Express this as a percentage.

4. State the speed at which the breathing rate starts to increase.

5. The tidal volume increased linearly with the cycling speed up to about 10 km h^{-1}. Calculate the increase in volume for each increase in speed of 1 km h^{-1}.

Extended writing

The ability to write coherently in a logical, well-structured way is an essential skill to develop. At GCSE the 6-mark extended response questions are used so students can demonstrate this skill. At A-level you need to develop this skill further, and you will be expected to write longer extended response questions, including an essay worth 25 marks.

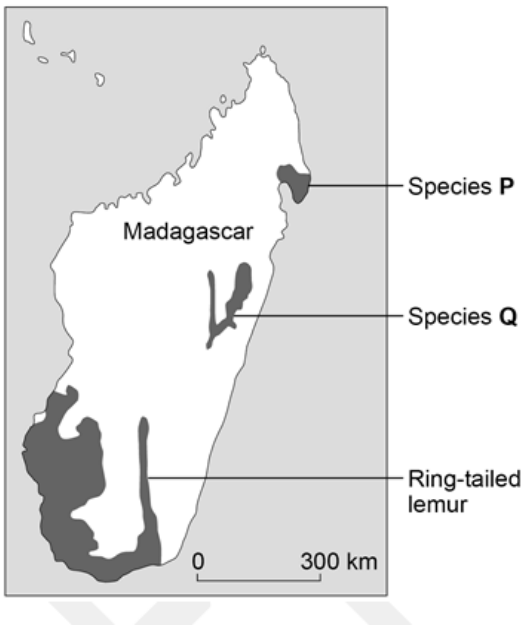
Activity 10 Extended writing

This is an 'open book' activity, meaning you can use notes/ resources to help you.

Before attempting the question below, you might want to remind yourself of the work you did on the following topics at GCSE (using notes/ textbooks/ revision guides etc):

- the theory of evolution
- the role of mutation and natural selection

Lemurs are only found on the island of Madagascar. Madagascar is off the coast of Africa. Scientists think that ancestors of modern lemurs evolved in Africa and reached Madagascar about 50-60 million years ago.
Today there are many species of lemur living on Madagascar
Figure 1 shows the distribution of three species of lemur on Madagascar.



Describe how the ancestors of modern lemurs may have evolved into the three different species shown on the map (species P, species Q and ring tail lemurs)

Complete on separate paper.

Progression of content

What you learnt at GCSE forms the foundation to your further study at A-level. Ideas will be developed and refined, new concepts and skills will be introduced. The follow are some **optional** questions which you might like to have a go at. They are designed to help refresh your memory of some of the important concepts you will use during your study of AS and A -level Biology.

Use the questions in each section to help to identify where your knowledge and understanding is secure and which areas you may need to revisit.

Activity 11 Cell structure and magnification

Figure 1 shows an animal cell viewed using a microscope

The cell contains a nucleus.

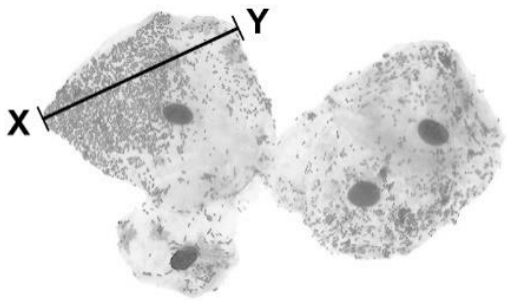
1. State the function of the nucleus.

2. Name **one** type of cell that does **not** contain a nucleus.

3. On the diagram label three parts of the cell.

4. Name **one** structure found in a plant cell but **not** found in an animal cell.

The figure below shows some different cells.



The real length from point **X** to point **Y**i s 0.06 mm.

5. Calculate the magnification.

The cells shown above were viewed using a light microscope.

6. Give **two** advantages of using an electron microscope instead of a light microscope.

Table 3

	Statement is true for		
Statement	**Mitosis only**	**Meiosis only**	**Both mitosis and meiosis**
All cells produced are genetically identical			
In humans, at the end of cell division each cell contains 23 chromosomes			
Involves DNA replication			

Activity 12: Transport across cell membranes

One of the required practicals at GCSE is on osmosis, make sure that you can interpret the graph used to show the results.

A student carried out an investigation using chicken eggs. This is the method used.

1. Place 5 eggs in acid for 24 hours to dissolve the egg shell.
2. Measure and record the mass of each egg.
3. Place each egg into a separate beaker containing 200 cm^3 of distilled water.
4. After 20 minutes, remove the eggs from the beakers and dry them gently with a paper towel.
5. Measure and record the mass of each egg. **Table 4** shows the results.

Table 4

Egg	Mass of egg without shell in grams	Mass of egg after 20 minutes in grams
1	73.5	77.0
2	70.3	73.9
3	72.4	75.7
4	71.6	73.1
5	70.5	73.8

Another student suggested that the result for egg **4** was anomalous.

1. Do you agree with the student? Give a reason for your answer.

2. Calculate the percentage change in mass of egg **3.**

3. Explain why the masses of the eggs increased.

4. Explain how the student could modify the investigation to determine the concentration of the solution inside each egg.

Chicken egg shells contain calcium. Calcium ions are moved from the shell into the cytoplasm of the egg.

Table 5 shows information about the concentration of calcium ions.

Table 5

Location	Concentration of calcium ions in arbitrary units
Egg shell	0.6
Egg cytoplasm	2.1

5. Explain how calcium ions are moved from the shell into the cytoplasm of the egg.

Activity 13 Digestion and food tests

It is important to understand the role of enzymes in digestion and how enzymes work. Recalling the food tests is important, particularly how to test for protein and sugars.

1. Describe how a student could test cow's milk to show whether it contains protein and different types of carbohydrate.

A scientist investigated the effect of bile on the breakdown of fat in a sample of milk.

The scientist used an indicator that is colourless in solutions with a pH lower than 10, and pink in solutions with a pH above 10

This is the method used.

- Add 1 drop of bile to a test tube and one drop of water to a second test tube.
- Add the following to each test tube:
  - 5 cm^3 of milk
  - 7 cm^3 of sodium carbonate solution (to make the solution above pH 10)
  - 5 drops of the indicator
  - 1 cm^3 of lipase.
- Time how long it takes for the indicator in the solutions to become colourless.

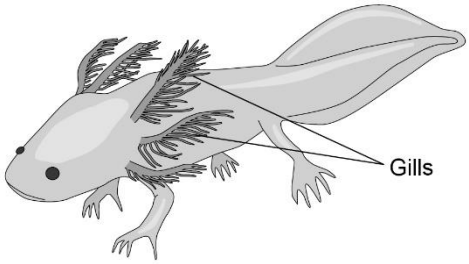
	Time taken for the indicator to become colourless in seconds
Solution with bile	65
Solution without bile	143

1. Explain why the indicator in both tubes became colourless.

2. Explain the difference in the results for the two test tubes in the table above

Activity 16 Circulatory system and gas exchange

A small animal called an axolotl lives in water.



The axolotl has a double circulatory system.

1. Explain what is meant by the term double circulatory system.

2. The diagram below shows the double circulatory system of the axolotl. The heart of the axolotl has only one ventricle. Label the ventricle on the diagram.

3. Explain why having only one ventricle makes the circulatory system less efficient than having two ventricles.

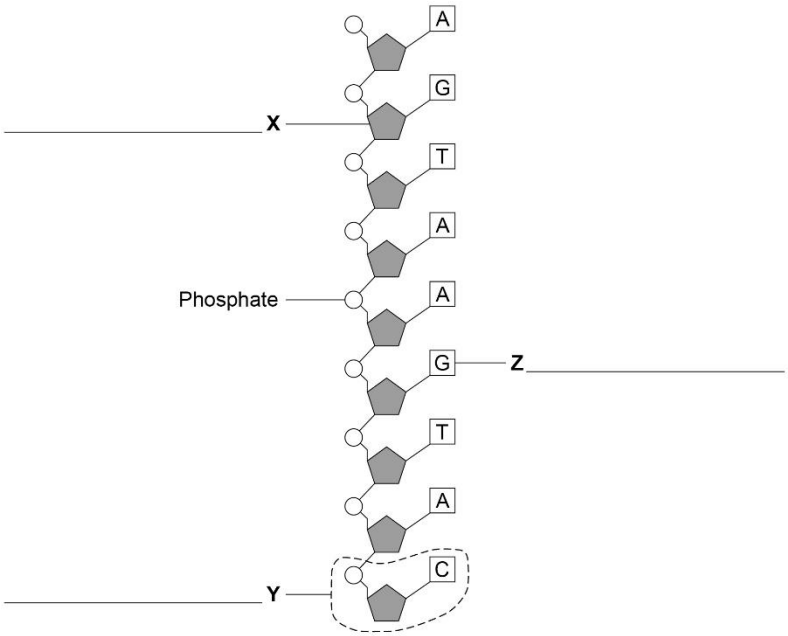
4. Explain why an axolotl may die in water with a low concentration of oxygen. Use the diagram above to help you, remember about surface area: volume ratio in gas exchange.

Activity 17 DNA and genetics

Genetic material is made of DNA.

1. Name the structures in the nucleus of a human cell which contain DNA.

The figure below shows part of one strand of a DNA molecule.



2. Label parts **X**, **Y** and **Z** with the correct word from the list below **:**

   base **fatty acid** **nucleotide** **sugar** **glycerol**

3. A complete DNA molecule is made of two strands twisted around each other.
   What scientific term describes this structure?

DNA codes for the production of proteins. A protein molecule is a long chain of amino acids.

4. How many amino acids could be coded for by the piece of DNA shown in the figure above?

Activity 18 Monoclonal antibodies

Monoclonal antibodies are identical copies of a specific type of antibody. Antibodies are extremely important as they are a type of protein that is produced by lymphocytes to fight pathogens (disease causing viruses, bacteria, fungi or protists). Pathogens have antigens on them which makes them unique. When a pathogen enters an organism and causes an infection, the lymphocyte recognises the unique antigen on the pathogen and start attacking them by producing antibodies. Monoclonal antibodies (copies) can be made in the lab.

A farmer thinks a potato crop is infected with potato virus Y (PVY). The farmer wants to buy a monoclonal antibody to get rid of the potato virus.
To make the monoclonal antibodies a scientist first isolates the PVY protein from the virus.

Describe how the scientist would use the PVY protein to produce the PVY monoclonal antibody for the farmer.