# OCR AAQ Human Biology

***OCR Level 3 Alternative Academic Qualification Cambridge Advanced Nationals in Human Biology***

# Transition Induction Pack

Table of Contents

# Course Structure

The OCR Level 3 Alternative Academic Qualification Cambridge Advanced Nationals in Human Biology is equivalent to one A-Level. The course is made up of Six units:

*OCR AAQ Human Biology Specification*

## Unit 1 – Fundamentals of Human Biology

This unit explores the biological principles behind medical advances, from diagnosis to treatment. Students learn about cell, tissue, and organ system structure and function, with emphasis on the endocrine, nervous, and reproductive systems. It covers the causes and treatment of system dysfunctions and introduces microbiology, including beneficial microbes, pathogens, and the immune response. This foundation supports progression to healthcare, sports science, and related degrees.

## Unit 2 – Health and Disease

This unit explores the causes, effects, and treatment of physiological disorders and communicable diseases. Students learn about diagnostic and monitoring techniques, the evolving role of immunology, and how disease progression is measured. It also covers the importance of medical research and patient confidentiality, while developing skills in reviewing, measuring, and reporting on health-related data.

## Unit 3 – Genetics

This unit focuses on the principles of genetics and inheritance, especially in relation to genetic disorders. Students build on prior knowledge of DNA and cell division, applying mathematical techniques to predict inheritance patterns. The unit explores genetic testing, the role of genetic counsellors, and recent advances in gene therapy and genetic engineering, highlighting their potential to prevent or treat inherited conditions and their broader societal impact.

## Unit 4 – Biomedical Techniques

This unit teaches students how biomedical techniques are used to diagnose diseases. Learners plan and conduct investigations using both quantitative and qualitative methods, including chromatography, urinalysis, microscopy, and titration. These techniques help analyse biomolecules and biochemicals in patient samples. The unit also covers additional diagnostic tools used in biomedical laboratories and their role in supporting healthcare decisions.

## Unit 5 – Nutrition and Metabolism

This unit focuses on the importance of nutrition for maintaining health. Students learn about digestion, absorption, and assimilation of nutrients, dietary needs for different groups, and the effects of poor nutrition. It covers metabolic pathways, hormonal regulation of nutrients and hunger, and techniques for diagnosing and treating nutritional disorders. The unit also teaches how to interpret food labels and identify essential biomolecules for a healthy body.

## Unit 6 – Human Reproduction

This unit explores human reproduction, from conception to birth. Students learn about the reproductive system, development of the zygote, embryo, and foetus, and the stages of pregnancy and antenatal care. The unit also covers contraception, causes of infertility, and how modern medicine supports individuals with fertility challenges through diagnosis and treatment.

# Assessment in the course

A summary of the course assessment is found below:

| Unit | Assessment Format | Extra Information |
|---|---|---|
| **Unit 1 – Fundamentals of Human Biology** | External Exam | 1hr 15mins<br>60 Marks |
| **Unit 2 – Health and Disease** | External Exam | 1hr 15mins<br>60 Marks |
| **Unit 3 – Genetics** | Internal assessment | Three assignments |
| **Unit 4 – Biomedical Techniques** | Internal assessment | One investigative task |
| **Unit 5 – Nutrition and Metabolism** | Internal assessment | Two assignments |
| **Unit 6 – Human Reproduction** | Internal assessment | Three assignments |

# Post-18 Progression

## University

| Grade | UCAS Points |
|---|---|
| D* | 56 |
| D | 48 |
| M | 32 |
| P | 16 |

The qualification carries UCAS points and is recognised by higher education providers as contributing to admission requirements of many relevant applied human biology/health science courses. When combined with other strong level 3 qualifications students can expect a good opportunity to step forward into higher education. All OCR AAQs provide transferable knowledge and skills that prepare learners for progression to university. The transferable skills that universities value include:

- the ability to learn independently.
- the ability to research actively and methodically.
- the ability to give presentations and be active group members.

OCR learners can also benefit from opportunities for deep learning where they are able to make connections among units and select areas of interest for detailed study. OCR AAQs provide a vocational context in which learners can develop the knowledge and skills required for degree courses, including:

- reading technical texts
- analytical skills
- preparation for assessment methods used in degrees.

## Degree Apprenticeships & Employability

In the OCR AAQs units, there are opportunities during the teaching and learning phase to give learners practice in developing employability skills. Where employability skills are referred to in this specification, we are generally referring to skills in the following three main categories:

- Cognitive and problem-solving skills: using critical thinking, approaching non-routine problems applying expert and creative solutions, using systems and technology.
- Interpersonal skills: communicating, working collaboratively, negotiating, and influencing, self-presentation.
- Intrapersonal skills: self-management, adaptability and resilience, self-monitoring, and development.

Students of OCR AAQ Human Biology regularly progress to apprenticeships and careers in:

- Health and social care
- Sport science
- Nursing
- Midwifery
- Occupational Health

# Command words

**External assessment**

The table below shows the command words that will be used in exam questions. This shows what we mean by the command word and how students should approach the question and understand its demand. Remember that the rest of the wording in the question is also important.

| Command Word | Meaning |
|---|---|
| **Analyse** | • Separate or break down information into parts and identify their characteristics or elements<br>• Explain the different elements of a topic or argument and make reasoned comments<br>• Explain the impacts of actions using a logical chain of reasoning |
| **Annotate** | • Add information, for example, to a table, diagram or graph |
| **Calculate** | • Work out the numerical value. Show your working unless otherwise stated |
| **Choose** | • Select an answer from options given |
| **Compare** | • Give an account of the similarities and differences between two or more items or situations |
| **Complete** | • Add information, for example, to a table, diagram or graph to finish it |
| **Describe** | • Give an account that includes the relevant characteristics, qualities or events |
| **Discuss** (how/whether/etc) | • Present, analyse and evaluate relevant points (for example, for/against an argument) to make a reasoned judgement |
| **Draw** | • Produce a picture or diagram |
| **Explain** | • Give reasons for and/or causes of something<br>• Make something clear by describing and/or giving information |
| **Give examples** | • Give relevant examples in the context of the question |
| **Identify** | • Name or provide factors or features from stimulus |
| **Label** | • Add information, for example, to a table, diagram or graph until it is final |
| **Outline** | • Give a short account or summary |
| **State** | • Give factors or features<br>• Give short, factual answers |

**Internal Assessments**

| Command Word | Meaning |
|---|---|
| **Adapt** | • Change to make suitable for a new use or purpose |
| **Analyse** | • Separate or break down information into parts and identify their characteristics or elements<br>• Explain the different elements of a topic or argument and make reasoned comments<br>• Explain the impacts of actions using a logical chain of reasoning |
| **Assess** | • Offer a reasoned judgement of the standard or quality of situations or skills. The reasoned judgement is informed by relevant facts |
| **Calculate** | • Work out the numerical value. Show your working unless otherwise stated |
| **Classify** | • Arrange in categories according to shared qualities or characteristics |
| **Compare** | • Give an account of the similarities and differences between two or more items, situations or actions |
| **Conclude** | • Judge or decide something |
| **Describe** | • Give an account that includes the relevant characteristics, qualities or events |
| **Discuss** (how/whether/etc) | • Present, analyse and evaluate relevant points (for example, for/against an argument) to make a reasoned judgement |
| **Evaluate** | • Make a reasoned qualitative judgement considering different factors and using available knowledge/experience |
| **Examine** | • To look at, inspect, or scrutinise carefully, or in detail |
| **Explain** | • Give reasons for and/or causes of something<br>• Make something clear by describing and/or giving information |
| **Interpret** | • Translate information into recognisable form<br>• Convey one's understanding to others, e.g. in a performance |
| **Investigate** | • Inquire into (a situation or problem) |
| **Justify** | • Give valid reasons for offering an opinion or reaching a conclusion |
| **Research** | • Do detailed study in order to discover (new) information or reach a (new) understanding |
| **Summarise** | • Express the most important facts or ideas about something in a short and clear form |

We might also use other command words but these will be:

- commonly used words whose meaning will be made clear from the context in which they are used (e.g. create, improve, plan)
- subject specific words drawn from the unit content.

# Summer Activities

## Biological Molecules

**Learn**

SaveMyExams.co.uk | Revisionscience.com | Seneca Learning | Free Science Lessons (Videos)

**Questions**

1) **Structure of Carbohydrates**
   a. Describe the structure of a monomer.
   b. Describe the structure of a polymer.
   c. State the elements that make up a carbohydrate.
   d. Sugars are water-soluble. Describe what this means.
   e. Describe the term and give an example of a monosaccharide.
   f. Describe the term and give an example of a disaccharide.
   g. Describe the term and give an example of a polysaccharide.

h. Describe the role of condensation reactions in the context of carbohydrates.

i. Explain the role of monosaccharides in biology.

j. Explain the role of polysaccharides in biology.

**2) Structure of Proteins**

a. State the monomer of a protein.

b. Describe the general structure of an amino acid.

c. What bond is found between two amino acids to form a dipeptide.

d. Describe and structure and function of the protein's primary structure.

e. Describe and structure and function of the protein's secondary structure.

f. Describe and structure and function of the protein's tertiary structure.

**3) Structure of Lipids**

a. State the three elements that make up lipids.

b. Describe the structure of a triglyceride.

c. What type of bond occurs between the atoms in a triglyceride.

d. Describe and compare a saturated and unsaturated triglyceride.

e. Another type of lipid is a phospholipid, describe the structure and function of these in cell plasma membrane.

## Cellular Ultrastructure

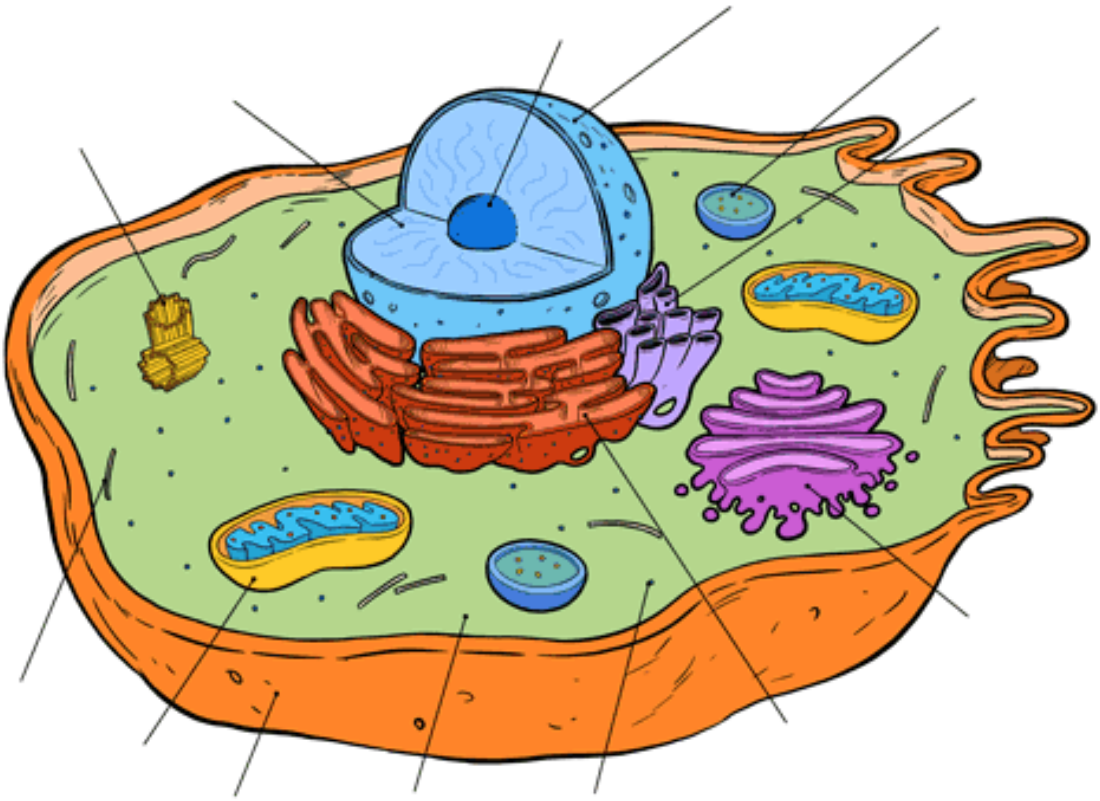
### Learn

PMT | Revisionscience.com | Seneca Learning | Free Science Lessons (Videos)

### Task

1) Label the diagram of an animal cell below.

| | | | |
|---|---|---|---|
| ***Lysosome*** | ***Ribosomes*** | ***Nucleus*** | ***Golgi apparatus*** |
| ***Cytoplasm*** | ***Nucleolus*** | ***Mitochondria*** | ***Chromatin*** |
| ***Cytoskeleton*** | ***Centrioles*** | ***Plasma membrane*** | |
| ***Smooth endoplasmic reticulum*** | ***Rough endoplasmic reticulum*** | | |



2) List the structures labelled above in the table and state their function within the cell

| Structure | Function |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
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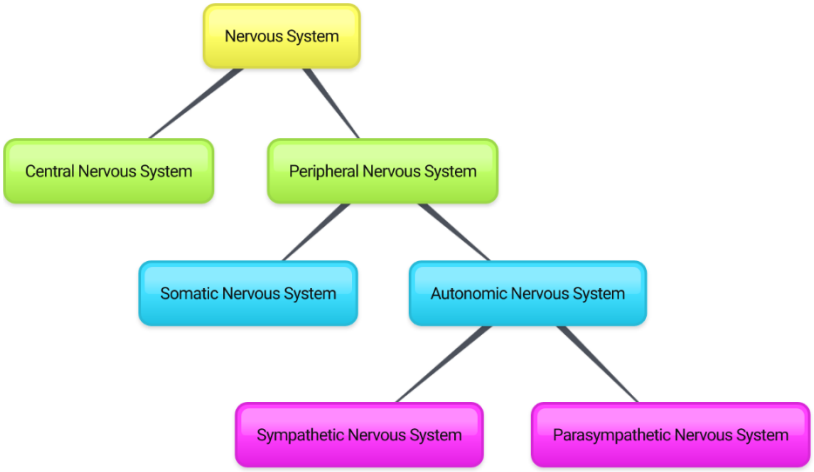
| | |
| | |

## Nervous system

### Learn

The Science Hive | Study Mind | Libre Texts | MME

### Structure of the nervous system




1. Describe the structure and function of the following terms.
    a. Central nervous system

    b. Peripheral nervous system

    c. Somatic nervous system

    d. Autonomic nervous system

e. Sympathetic nervous system

f. Parasympathetic nervous system

2. Using an annotated diagram, explain the role of synapses in the nervous system.

3. Use this opportunity to practice your research and note taking skills. Watch this video on a neuronal process called action potentials. Write notes of key aspects of action potentials. Include questions which you still may have, we can address in September.

Action Potential Video

**Circulatory system**

**Learn**

[Revision Science]

[Study Mind]

[Science Hive]

[Libre Texts]

**Blood Vessels**

The blood vessels are the structures in our blood in which blood is transported. There are three types of blood vessels. In the next task you will explain the structure and function of the different blood vessels (to support you, an initial example has been provided).

**Arteries**

Overall function: *e.g. transport blood away from the heart*

| **Adaption of artery:** | **Explanation of adaptation** |
|---|---|
| *e.g. layers of elastic tissue in wall of artery* | *e.g. the elastic tissue enables the blood to remain at high pressure once it has left the heart* |
| | |
| | |

**Veins**

Overall function:

| **Adaption of artery:** | **Explanation of adaptation** |
|---|---|
| | |
| | |
| | |

**Capillaries**

Overall function:

| Adaption of artery: | Explanation of adaptation |
|---|---|
| | |
| | |
| | |

**Blood Composition**

The definition of a tissue is: a collection of cells working together to carry out a specific function. So by definition, blood is a tissue. It is composed of four key components. Research these components and complete the table below.

| Blood component | Function | Composition within blood (%) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

**Disease related to the circulatory system.**

Research the following diseases and explain what the conditions are, what the symptoms are, their risk factors and how they are treated.

**Coronary heart disease (CHD)**

**Stroke**

**Chronic obstructive pulmonary disease (COPD)**

**Hypertension**

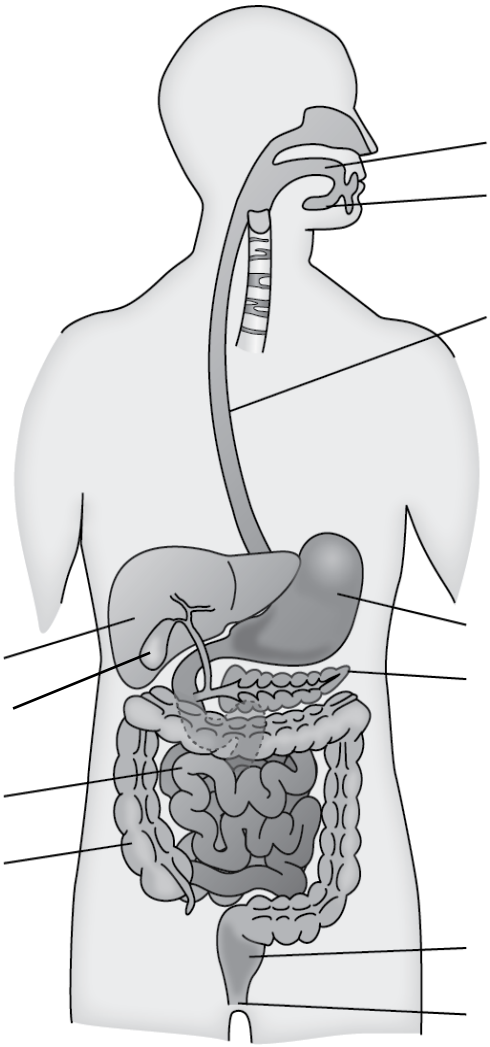
**Hypotension**

## Digestive system

The digestive system consists of organs that break down food, absorb its nutrients, and expel any remaining waste. Most of these organs make up the gastrointestinal (GI) tract. Food passes through these organs. The rest of the organs of the digestive system are called accessory organs. These organs secrete enzymes and other substances into the GI tract, but food does not actually pass through them.

**Structures of the digestive system**

Complete the diagram below identifying the structures of the digestive system.



1. Explain the two functions of the stomach.

2. Describe the role of the pancreas in digestion.

3. Explain the role of the small intestine in digestion, include the villi and microvilli in your answer.

4. Describe the role of the large intestine.

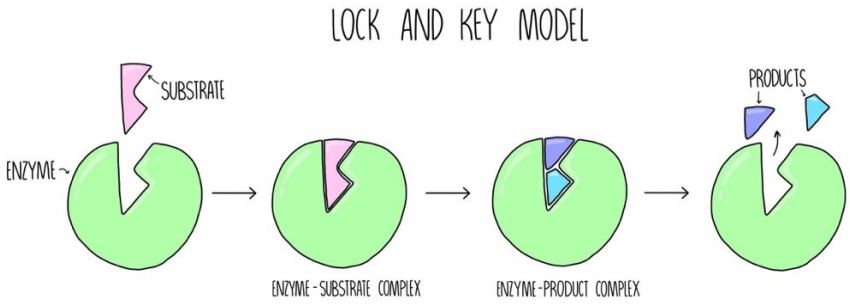
5. Describe the function of bile, including where it is produced, stored, and secreted.

**Enzymes**

Enzymes are biological catalysts - they speed up the rate of chemical reactions happening inside our body. They work by reducing the activation energy of a reaction. Activation energy is defined as the minimum amount of energy needed for a reaction to happen. If less energy is needed, then reactions can take place as lower temperatures than would be needed without an enzyme. Without the enzymes in our bodies, the reactions that happen inside of us would not be possible at normal body temperature. Remember that enzymes are unchanged at the end of a reaction which means they can be reused.

**The lock and key model**

At GCSE you learn about the lock and key model. Using the diagram below to explain this model.




**The induced fit model**

The lock and key model is a great way to explain how enzymes work at GCSE. However, there are limitations to this model, and it is not entirely accurate. The more accurate but complex model we use is the induced fit model.

Use the QR code to watch a video on the induced fit model and write notes below. Include questions which you still may have, we can address in September.

## Mathematical skills in AAQ Human Biology

### Converting Units

In biology we often come across numbers that are obscenely large or small. To make these numbers easier to work with, we use multiplication factors, these factors have specific prefix and symbols. For example, the standard unit for length is the meter (m). If an object is much smaller than a meter instead of stating its length as 0.001m, we would say it is 1mm. 1mm = 0.001m.

Examples of typical multiplication factors and their prefixes are found below:

| Multiplication factors | Prefix | Symbol |
|---|---|---|
| $10^{9}$ | giga | G |
| $10^{6}$ | mega | M |
| $10^{3}$ | kilo | k |
| $10^{-2}$ | centi | c |
| $10^{-3}$ | milli | m |
| $10^{-6}$ | micro | µ |
| $10^{-9}$ | nano | n |

**Practice questions**

1. The average diameter of a human eyeball is 0.023m. State this value in centimetres

_____ Unit:_____

2. A red blood cell has an average length of 0.000008m. State this value in micrometres

_____ Unit:_____

3. The Saitic nerves are the longest nerves in the human body, running from the lower back down each leg. The average thickness of a Saitic nerve is 18000µm. State this value in the most appropriate unit.

_____ Unit:_____

4. If laid out, the length of the small intestine is 6m and the large intestine is 1.5m. State the total length of the intestines in kilometres.

_____ Unit:_____

**Decimal numbers**

A decimal number has a decimal point. Each figure before the point is a whole number, and the figures after the point represent fractions.

The number of decimal places is the number of figures after the decimal point. For example, the number 47.38 has 2 decimal places, and 47.380 is the same number to 3 decimal places.

In science, you must write your answer to a sensible number of decimal places (typically two decimal places, but the context of the number might change this)

**Practice questions**

1. New antibiotics are being tested. A student calculates the area of clear zones in Petri dishes in which the antibiotics have been used. List these in order from smallest to largest.

   $0.0214\ cm^2$ $0.03\ cm^2$ $0.0218\ cm^2$ $0.034\ cm^2$

   _____ _____ _____ _____

2. A student measures the heights of a number of different plants. List these in order from smallest to largest.

   22.003 cm 22.25 cm 12.901 cm 12.03 cm 22 cm

   _____ _____ _____ _____ _____

**Standard Form**

Sometimes biologists need to work with numbers that are very small, such as dimensions of organelles, or very large, such as populations of bacteria. In such cases, the use of scientific notation or standard form is very useful, because it allows the numbers to be written easily.

Standard form is expressing numbers in powers of ten, for example, $1.5\times10^7$ microorganisms.

Look at this **worked example**. The number of cells in the human body is approximately 37 200 000 000 000. To write this in standard form, follow these steps:

Step 1: Write down the smallest number between 1 and 10 that can be derived from the number to be converted. In this case it would be 3.72

Step 2: Write the number of times the decimal place will have to shift to expand this to the original number as powers of ten. On paper this can be done by hopping the decimal over each number like this:


until the end of the number is reached.

In this example that requires 13 shifts, so the standard form should be written as $3.72\times10^{13}$.

For very small numbers the same rules apply, except that the decimal point must hop backwards. For example, 0.000 000 45 would be written as $4.5\times10^{-7}$.

**Practice questions**

1. Change the following values to standard form.
   a. 3060kJ
   b. 140,000kg
   c. 0.01
   d. 21,000,000

2. Give the following numbers in standard form.
   a. 100
   b. 10,000
   c. 0.00018m
   d. 0.000004

3. Give the following as decimals.
   a. $10^6$
   b. $4.7 \times 10^9$
   c. $1.2 \times 10^{12}$
   d. $7.96 \times 10^{-4}$

**Working with formulae**

It is often necessary to use a mathematical formula to calculate quantities. You may be tested on your ability to substitute numbers into formulae or to rearrange formulae to find specific values.

**Substituting into formulae**

Think about the data you are given in the question. Write down the equation and then think about how to get the data to substitute into the equation. Look at this worked example:

A cheek cell has a 0.06 mm diameter. Under a microscope it has a diameter 12 mm. What is the magnification?

$$magnification = image\ size\ (mm) \div object\ size\ (mm) \text{ or } M = \frac{I}{O}$$

Substitute the values and calculate the answer:

M = 12 mm/0.06 mm = 12/0.06 = 200

Answer: magnification = ×200 (magnification has no units)

Sometimes an equation is more complicated, and the steps need to be carried out in a certain order to succeed. A general principle applies here, usually known by the mnemonic BIDMAS. This stands for **B**rackets, **I**ndices (functions such as squaring or powers), **D**ivision, **M**ultiplication, **A**ddition, **S**ubtraction.

**Practice questions**

1. Calculate the magnification of a hair that has a width of 6.6 mm on a photograph. The hair is 165 µm wide.

_____

2. Estimate the area of a leaf by treating it as a triangle with base 2 cm and height 9 cm.

_____ Unit:_____

3. Estimate the area of a cell by treating it as a circle with a diameter of 0.7 µm.

_____ Unit:_____

4. A fat cell is 0.1 mm in diameter. Calculate the size of the diameter seen through a microscope with a magnification of ×50.

_____ Unit:_____

5. A Petri dish shows a circular colony of bacteria with a cross-sectional area of 5.3 $cm^2$. Calculate the radius of this area.

_____ Unit:_____

6. In a photograph, a red blood cell is 14.5 mm in diameter. The magnification stated on the image is ×2000. Calculate the real diameter of the red blood cell.

_____ Unit:_____

7. The cardiac output of a patient was found to be 2.5 $dm^3$/min and their heart rate was 77 bpm. Calculate the stroke volume of the patient. Use the equation: cardiac output = stroke volume × heart rate.

_____ Unit:_____

## Practical skills in biology

You need to be confident about the definitions of terms that describe measurements and results in Human Biology. Match the question to the correct defining answer.

| | |
|---|---|
| When is a measurement valid? | when repeat measurements are consistent/agree closely with each other |
| When is a result accurate? | how precise repeated measurements are when they are taken by *different* people, using *different* equipment |
| What are precise results? | when it measures what it is supposed to be measuring |
| What is repeatability? | when it is close to the true value |
| What is reproducibility? | how precise repeated measurements are when they are taken by the *same* person, using the *same* equipment, under the *same* conditions |
| What is the uncertainty of a measurement? | the difference between a measured value and the true value |
| Define measurement error | the interval within which the true value is expected to lie |
| What type of error is caused by results varying around the true value in an unpredictable way? | a measuring instrument gives a false reading when the true value should be zero |
| What is a systematic error? | random error |
| What does zero error mean? | a consistent difference between the measured values and true values |
| Which variable is changed or selected by the investigator? | a variable that is measured every time the independent variable is changed |
| What is a dependent variable? | independent variable |
| Define a fair test | variables that should be kept constant to avoid them affecting the dependent variable |
| What are control variables? | a test in which only the independent variable is allowed to affect the dependent variable |

**Accuracy & precision**

**A** **B** **C** **D**

1. Using the target as a metaphor for a dataset from an experiment.
    1. State and explain which target represents an accurate result.

    2. State and explain which target represents a precise result.

2. Calculate the average and the uncertainty for each set of data:

| | Average | Uncertainty |
|---|---|---|
| SET A: 15.32, 15.37, 15.33, 15.38, 15.35 | | |
| SET B: 16.30, 16.19; 16.24 16.29, 16.23 | | |

The "true" value that we were attempting to measure was: 16.26.

a) Which data set is most precise.

b) Which data set is most accurate.

**Errors in Scientific Investigations**

1. In any scientific investigation there can be an array of different errors that occur. These errors can be classified in different ways. Research the following errors, describe what they mean and give an example of how they could appear during an investigation.
   a. Random Error:

   b. Systemic error:

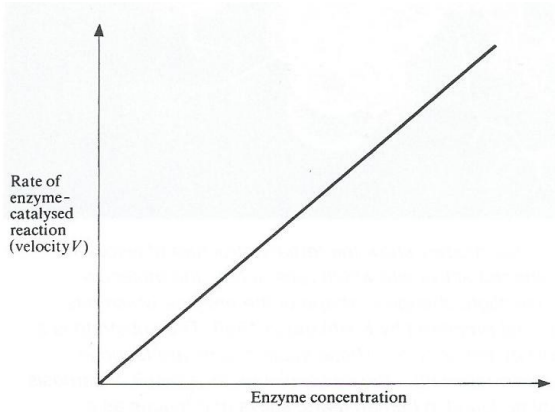
   c. Instrumental error

   d. Human transcriptional error

   e. Human estimation error

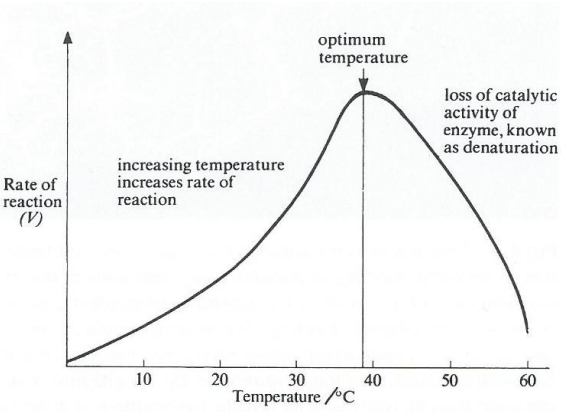
**Interpreting Graphs**

*Graph 1*




*Relationship between enzyme concentration and the rate of an enzyme-controlled reaction.*

*Graph 2*




*Effect of temperature on the rate of an enzyme-controlled reaction.*

1. Describe the trend in Graph 1

2. Describe the trend in Graph 2

3. Read the exam question below.

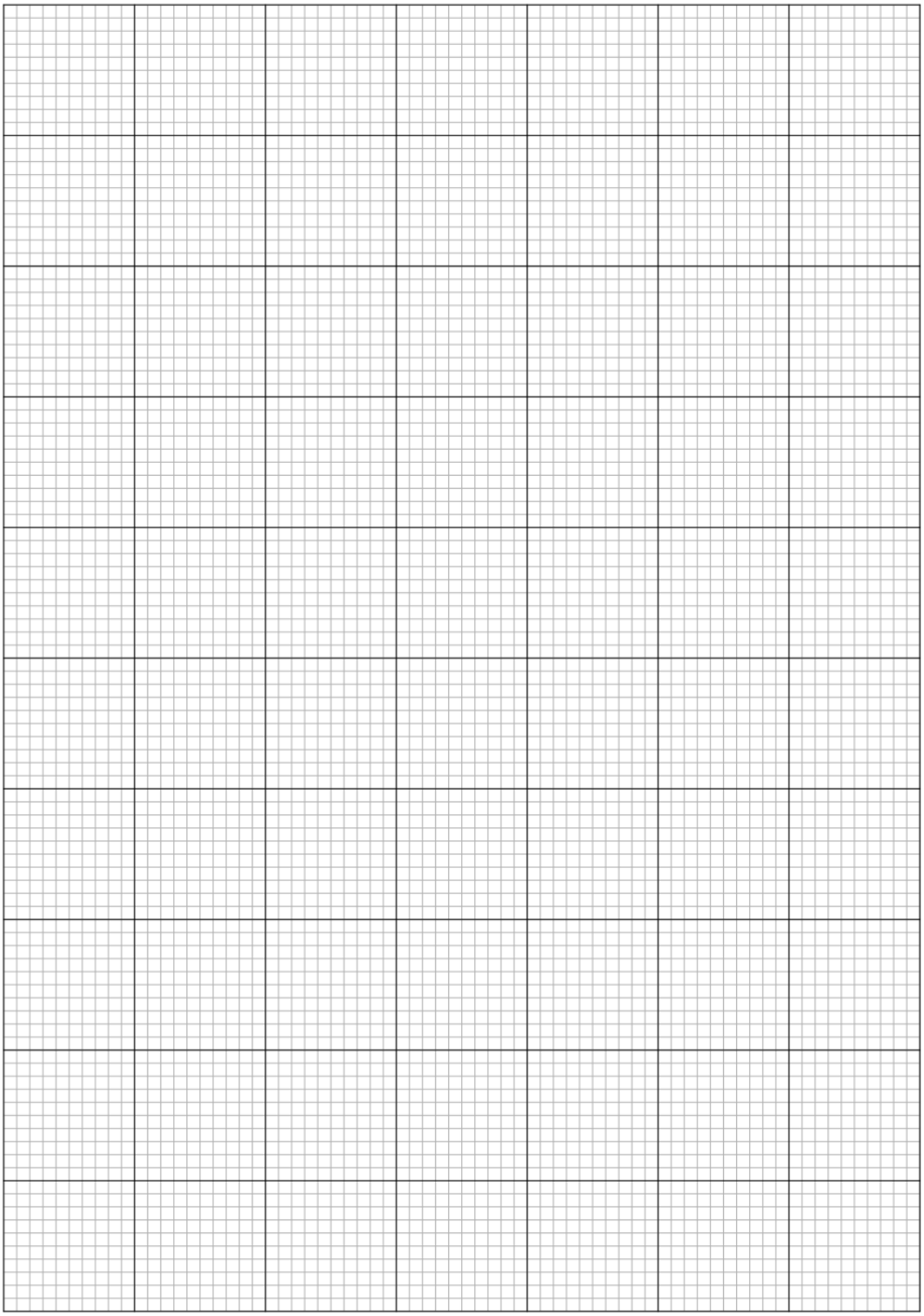
Biological process can be investigated using models.
The effects of cell size under vision can be investigated using cubes of agar jelly to represent cells of different sizes.
Student used cubes have I got jelly containing universal indicator, which changes colour different pH

- Five sizes of cubes were cut from a larger block using a scalpel.
- Cubes were placed in a beaker containing hydrochloric acid enough to cover the cubes and a stopwatch was started.
- After two minutes the cubes were removed, rinsed with distilled water and blotted dry.
- Acid absorbed at the outside, continued diffusing towards the centre of the blocks.
- The time taken for the blocks to turn entirely red was recorded.

| Cube | Length of one side of agar cube (mm) | Surface area to volume ratio | Time taken to turn red (min) | | | |
|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Mean |
| **A** | 5 | 1.20 | 6.4 | 2.9 | 5.4 | 4.9 |
| **B** | 10 | 0.60 | 14.8 | 15.5 | 14.6 | 15.0 |
| **C** | 20 | 0.30 | 30.6 | 28.3 | 27.4 | 28.8 |
| **D** | 30 | 0.20 | 44.1 | 42.2 | 43.0 | 43.1 |
| **E** | 40 | 0.15 | 58.7 | 60.1 | 57.4 | 58.7 |

Questions found on next page.

1. In the space below, plot a graph of meantime, taken to turn red against surface area to volume ratio.



2. Describe the trend shown in the graph.

3. An identical procedure was carried out on a cube of unknown signs. This cube turned red after 21.5 min.
   Use your graph to estimate the surface area to volume ratio of this cube.

1. The electrical activity of the heart can be monitored, using an electrocardiogram (ECG) trace. Figure 1 shows the ECG pattern for a single normal heartbeat.

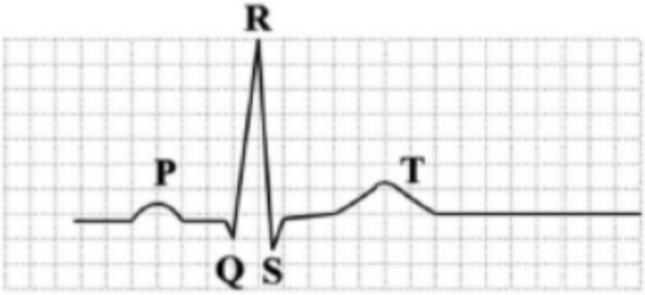



***Figure 1***

Figure 2 shows an ECG trace for a person with normal heart rhythm and figure 3 shows the trace for a person with tachycardia.


***Figure 2***


***Figure 3***

a) Calculate the percentage increase in heart rate for the person with tachycardia compared to the person with normal heart rhythm.
Use data between points, **A** and **B** on ***figure 2*** and points **C** and **D** on ***figure 3*** for your calculations.
Show your working. Give your answer to the nearest whole number.

_____%

b) The most obvious feature of tachycardia is an increased heart rate. Using the information in ***figure 1, figure 2*** and ***figure 3,*** what are the other key features of tachycardia.