AQA

GCSE

Foundation: Combined Science Trilogy and Entry Level Certificate

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Message from AQA

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We approve textbooks because we know how important it is for teachers and students to have the right resources to support their teaching and learning. However, the publisher is ultimately responsible for the editorial control and quality of this book.

Please note that when teaching the AQA Entry Level Certificate or AQA GCSE Combined Science: Trilogy course, you must refer to AQA's specification as your definitive source of information. While this book has been written to match the specification, it cannot provide complete coverage of every aspect of the course.

A wide range of other useful resources can be found on the relevant subject pages of our website: www.aqa.org.uk.

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How to use this book

Learning objectives

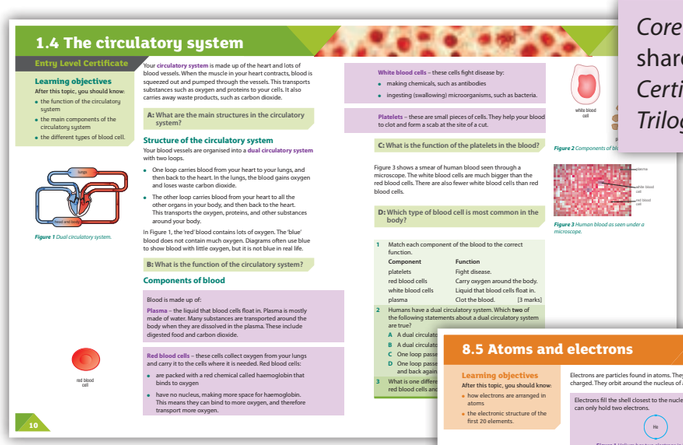
After this topic, you should know:

- Learning objectives at the start of each spread tell you what you will be learning about.

This book has been written by subject experts to match the specifications for *AQA Entry Level Certificate Science and AQA GCSE Combined Science: Trilogy*. It is has lots of features to help you prepare for your course and achieve the very best you can.

Key words are highlighted in the text. You can look them up in the glossary at the back of the book if you are not sure what they mean.

Diagrams are as important as the text for your understanding, so make sure you revise them carefully.


1.4 The circulatory system

Entry Level Certificate

Learning objectives

After this topic, you should know:
- the function of the circulatory system
- the main components of the circulatory system
- the different types of blood cell.

Your circulatory system is made up of the heart and lots of blood vessels. When the muscle in your heart contracts, blood is squeezed out and pumped through the vessels. This transports substances such as oxygen and proteins to your cells. It also carries away waste products, such as carbon dioxide.

A: What are the main structures in the circulatory system?

Structure of the circulatory system

Your blood vessels are organised into a dual circulatory system with two loops.
- One loop carries blood from your heart to your lungs, and then back to the heart. In the lungs, the blood gains oxygen and loses waste carbon dioxide.
- The other loop carries blood from your heart to all the other organs in your body, and then back to the heart. This transports the oxygen, proteins, and other substances around your body.

In Figure 1, the 'red' blood contains lots of oxygen. The 'blue' blood does not contain much oxygen. Diagrams often use blue to show blood with little oxygen, but it is not blue in real life.

B: What is the function of the circulatory system?

Components of blood

Blood is made up of:

Plasma – the liquid that blood cells float in. Plasma is mostly made of water. Many substances are transported around the body when they are dissolved in the plasma. These include digested food and carbon dioxide.

Red blood cells – these cells collect oxygen from your lungs and carry it to the cells where it is needed. Red blood cells:
- are packed with a red chemical called haemoglobin that binds to oxygen
- have no nucleus, making more space for haemoglobin. This means they can bind to more oxygen, and therefore transport more oxygen.

White blood cells – these cells fight disease by:
- making chemicals, such as antibodies
- ingesting (swallowing) microorganisms, such as bacteria.

Platelets – these are small pieces of cells. They help your blood to clot and form a scab at the site of a cut.

C: What is the function of the platelets in the blood?

Figure 3 shows a smear of human blood seen through a microscope. The white blood cells are much bigger than the red blood cells. There are also fewer white blood cells than red blood cells.

D: Which type of blood cell is most common in the body?

1 Match each component of the blood to the correct function.

Component	Function
platelets	Fight disease.
red blood cells	Carry oxygen around the body.
white blood cells	Liquid that blood cells float in.
plasma	Clot the blood. [3 marks]

2 Humans have a dual circulatory system. Which **two** of the following statements about a dual circulatory system are true?
- A A dual circulato
- B A dual circulato
- C One loop passe
- D One loop passe and back again

3 What is one differe red blood cells and

Figure 1 Dual circulatory system.

Figure 2 Components of bl

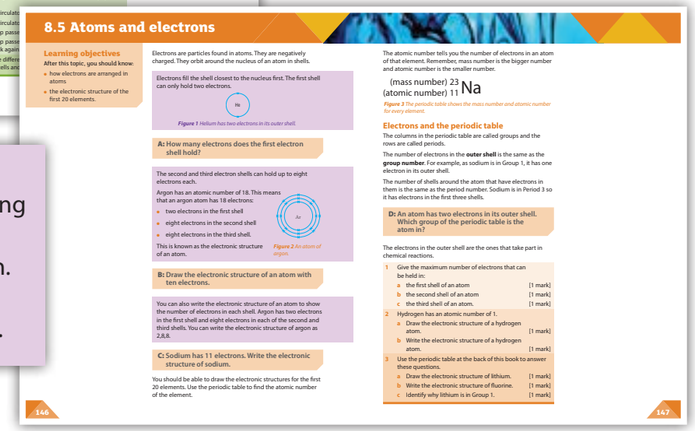
Figure 3 Human blood as seen under a microscope.

red blood cell

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Core Entry Level Certificate topics cover shared topics from the *AQA Entry Level Certificate and AQA Combined: Science Trilogy* specifications.

Combined Science: Trilogy topics build on what you have already learnt, adding new information from the *AQA GCSE Combined Science: Trilogy* specification. These spreads will introduce some of the maths skills you will need to learn.


8.5 Atoms and electrons

Learning objectives

After this topic, you should know:
- how electrons are arranged in atoms
- the electronic structure of the first 20 elements.

Electrons are particles found in atoms. They are negatively charged. They orbit around the nucleus of an atom in shells.

Electrons fill the shell closest to the nucleus first. The first shell can only hold two electrons.

Figure 1 Helium has two electrons in its outer shell.

A: How many electrons does the first electron shell hold?

The second and third electron shells can hold up to eight electrons each.

Argon has an atomic number of 18. This means that an argon atom has 18 electrons:
- two electrons in the first shell
- eight electrons in the second shell
- eight electrons in the third shell.

This is known as the electronic structure of an atom.

Figure 2 An atom of argon.

B: Draw the electronic structure of an atom with ten electrons.

You can also write the electronic structure of an atom to show the number of electrons in each shell. Argon has two electrons in the first shell and eight electrons in each of the second and third shells. You can write the electronic structure of argon as 2,8,8.

C: Sodium has 11 electrons. Write the electronic structure of sodium.

You should be able to draw the electronic structures for the first 20 elements. Use the periodic table to find the atomic number of the element.

The atomic number tells you the number of electrons in an atom of that element. Remember, mass number is the bigger number and atomic number is the smaller number.

(mass number) 23
(atomic number) 11 Na

Figure 3 The periodic table shows the mass number and atomic number for every element.

Electrons and the periodic table

The columns in the periodic table are called groups and the rows are called periods.

The number of electrons in the **outer shell** is the same as the **group number**. For example, as sodium is in Group 1, it has one electron in its outer shell.

The number of shells around the atom that have electrons in them is the same as the period number. Sodium is in Period 3 so it has electrons in the first three shells.

D: An atom has two electrons in its outer shell. Which group of the periodic table is the atom in?

The electrons in the outer shell are the ones that take part in chemical reactions.

1 Give the maximum number of electrons that can be held in:
- a the first shell of an atom [1 mark]
- b the second shell of an atom [1 mark]
- c the third shell of an atom. [1 mark]

2 Hydrogen has an atomic number of 1.
- a Draw the electronic structure of a hydrogen atom. [1 mark]
- b Write the electronic structure of a hydrogen atom. [1 mark]

3 Use the periodic table at the back of this book to answer these questions.
- a Draw the electronic structure of lithium. [1 mark]
- b Write the electronic structure of fluorine. [1 mark]
- c Identify why lithium is in Group 1. [1 mark]

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Summary questions

There are summary questions at the end of each topic.

These questions give you a chance to test whether you have learnt and understood everything in the topic.

The questions start off easier and get harder, so that you can stretch yourself.

1.5 The digestive system

Entry Level Certificate

Learning objectives

After this topic, you should know:

- the function of the digestive system
- the main organs of the digestive system
- the role of enzymes in digestion.

The food you eat is made up of large molecules that cannot dissolve in your blood. These molecules are **insoluble**. Your body cannot use these molecules. They need to be broken down (digested) to form smaller molecules that can dissolve in your blood.

These smaller molecules are **soluble** and therefore can be absorbed and used by your cells. The process of **digestion** takes place in your **digestive system**.

A: What happens during digestion?

Your digestive system starts with your mouth and finishes at your anus. In between, there are several different organs that help you to digest food.

B: Write down three of the organs in the digestive system.

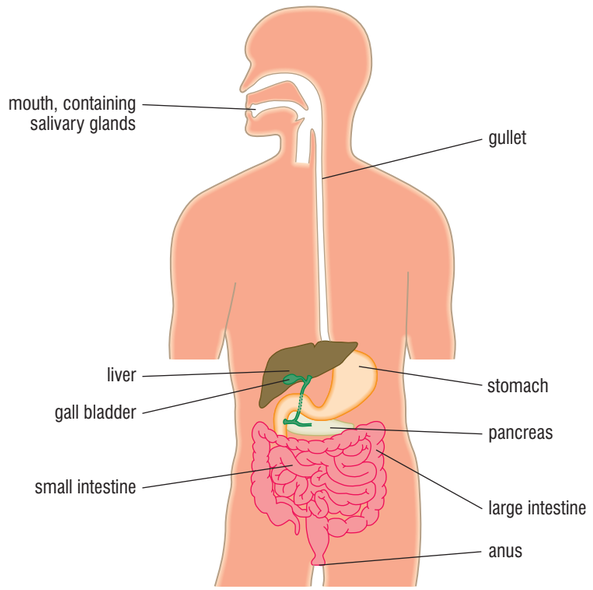


Figure 1 *The main organs in the digestive system.*

Movement of food through the digestive system

Mouth – where food enters the body. Food is chewed to break it into smaller chunks.

↓

Stomach – pieces of food are mixed with digestive juices and acids. The food breaks down more.

↓

Small intestine – the useful small molecules (nutrients) pass through the intestine wall into the bloodstream. This is called absorption.

↓

Large intestine – only food that cannot be digested gets this far. Water is absorbed back into the body. This leaves a solid waste of undigested food. This leaves the body through the anus.

C: What happens to food in your stomach?

Digestive juices

Your digestive system contains glands called the **salivary glands** and **pancreas**. These glands make and release **enzymes**. Enzymes break down large insoluble food molecules into smaller soluble molecules. Your stomach and small intestine makes enzymes too

Your **liver** produces bile. Bile is then stored in the **gall bladder**. Bile makes the food in your small intestine less acidic and also helps to digest fats.

D: Where is bile stored in the digestive system?

1 Match each organ to its correct function.

Organ	Function
liver	Absorbs small soluble food molecules into the bloodstream.
stomach	Absorbs water from undigested food.
small intestine	Produces bile.
large intestine	Breaks down large insoluble molecules.

[3 marks]

2 Complete the sequence of organs below to correctly describe the passage of food through the digestive system:

mouth ➔ _____ ➔ _____ intestine ➔ _____ intestine ➔ anus

[3 marks]

3 What is the role of enzymes in digestion? [1 mark]

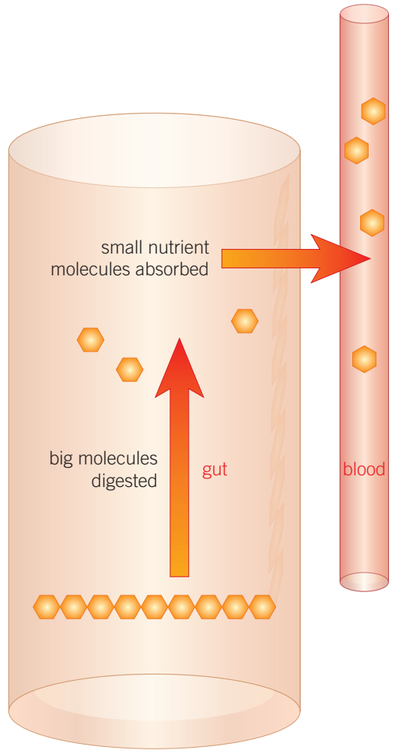


Figure 2 *During digestion large insoluble molecules are broken down into small soluble molecules. These then pass into the bloodstream.*

1 Checkpoint

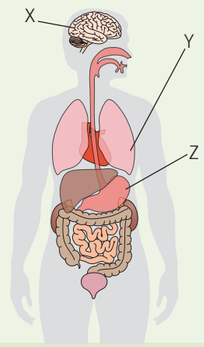
1 Choose the correct words from the box to complete the following sentences.

cells **membrane** **microscope** **nucleus** **reactions**

All living organisms are made up of _____. They are so small that they can only be seen using a _____.
Animal cells have three important parts:

- a _____ that controls the cell and contains the genetic material
- cytoplasm, where chemical _____ take place
- a cell _____ that controls what comes in and out of the cell. [4 marks]

2 The diagram shows some of the main organs in the human body.



a What is the name of organ X?
brain lung stomach [1 mark]

b What is the name of organ Y?
brain lung stomach [1 mark]

c What is the name of organ Z?
brain lung stomach [1 mark]

3 Put these structures in increasing size order from smallest to biggest.
reproductive system sperm kidney glandular tissue [3 marks]

4 **a** What is the function of a nerve cell? [1 mark]

b Which of the following is an adaptation of a nerve cell that helps it carry out its function?

A can change shape
B chemicals in head section
C lots of projections [1 mark]

5 **a** What is the function of the circulatory system? [1 mark]

b Which of the following is an organ that is found in the circulatory system?
liver lung ovary [1 mark]

6 Complete this sentence.
In the digestive system, _____ convert food into small soluble molecules. [1 mark]

7 **a** Which part of the blood carries oxygen? [1 mark]

b A student accidentally cuts her finger. What would happen if she did not have any platelets? [1 mark]

1 Vocabulary builder

1 **a** Match each key term to its definition.

Key term	Definition
soluble	A substance that **cannot** dissolve.
insoluble	A substance that **can** dissolve.

[1 mark]

b Choose the correct term to complete this definition of digestion.

Digestion is the breakdown of large **insoluble / soluble** molecules into small **insoluble / soluble** molecules. [2 marks]

2 Choose the correct answer from the box to complete each sentence.

cell membrane **cytoplasm** **nucleus**

a The _____ is where the chemical reactions happen in a cell. [1 mark]

b The _____ is a barrier that controls what comes in and out of the cell. [1 mark]

c The _____ contains the cell's genetic material. [1 mark]

3 **a** Draw one line to match the blood cell to its definition.

Blood cell	Definition
platelets	Carries oxygen around the body.
white blood cell	Fights disease.
red blood cell	Involved in blood clotting.

[2 marks]

b What is the name of the part of the blood that the cells float in? [1 mark]

4 Use the correct words from the box to complete the following diagram that shows the levels of organisation in an organism.

cell **organ** **organism** **organ system** **tissue**

_____ – smallest unit in an organism
↓
_____ – group of cells working together
↓
_____ – collection of tissues working together
↓
_____ – group of organs working together
↓
_____ – group of organ systems working together

[5 marks]

1.6 Plant and animal cells

Learning objectives

After this topic, you should know:

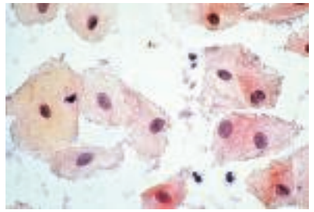
- the main parts of plant and animal cells
- the similarities and differences between plant and animal cells
- examples of specialised plant cells.

Your body is made up of animal cells. These contain a nucleus, cell membrane, and cytoplasm.

Parts of animal cells

Animal cells also contain two other structures:

- **mitochondria** – where the chemical reaction **respiration** takes place, this transfers energy for the cell to use
- **ribosomes** – where proteins are made. Proteins are used for growth and repair.



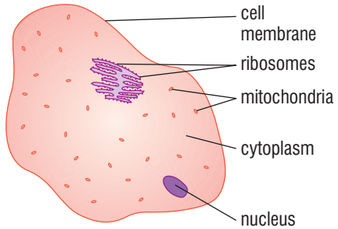


Figure 1 *This photo shows animal cheek cells. The structures in a cell are often easier to see in a cell diagram than in a real image.*

A: Give the function of a ribosome.

Parts of a plant cell

Plant cells have all the structures that an animal cell has. However, plants and animals are very different. Plants make their own food. They also cannot move their whole body from place to place. This means they need extra cell parts. Many plant cells also contain:

- **chloroplasts** – contain the chemical chlorophyll. Chlorophyll absorbs light, which is needed for the chemical reaction photosynthesis. This is how plants produce their food. All plant cells contain
- **permanent vacuole** – full of cell sap. Cell sap is made up of water, sugars, and salts. It keeps the cell rigid (stiff) which helps support the plant
- **cell wall** – surrounds the cell. The cell wall is made of cellulose, which makes the wall rigid. This helps support the cell.

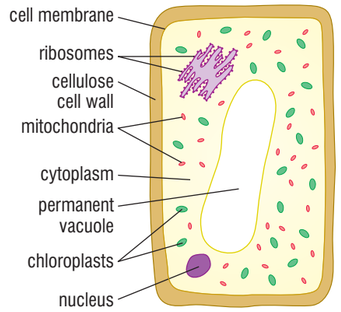


Figure 2 *Parts of a plant cell.*

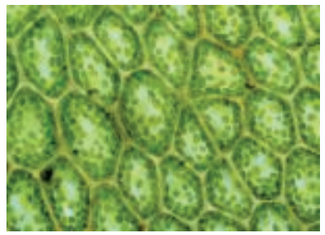


Figure 3 *These are moss cells viewed through a light microscope ×40.*

B: Name two cell structures that are only found in plant cells.

Specialised plant cells

Like animal cells, plant cells can also be specialised for specific functions.

What parts of a plant cell can you see with a microscope?

Use a microscope to look at a plant cell. What structures can you see?

Root hair cell

Root hair cells absorb water and nutrients from the soil. They have two main adaptations:

- root hair – creates a large surface area for absorbing water
- lots of mitochondria – transfer energy needed to move minerals into the cell

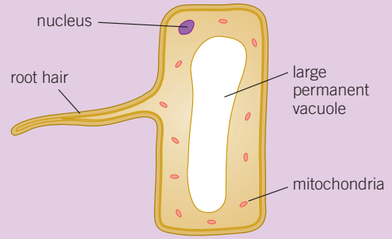


Figure 4 *A root hair cell.*

Xylem cell

Xylem is the transport tissue in plants. It carries water and minerals from the roots to the rest of the plant.

A special chemical called lignin builds up in spirals in the cell walls of xylem cells. The cells then die forming long hollow tubes. This means water can move through easily. The lignin also makes the tubes very strong, which helps support the plant stem.

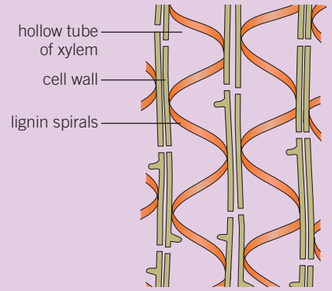


Figure 5 *Xylem cells.*

C: Name two examples of specialised plant cells.

1 From the following list, choose the cell components that are found in **both** plant and animal cells.

cell membrane **cell wall** **cytoplasm** **nucleus** **chloroplasts** [3 marks]

2 **a** Which cell component is **only** found in plant cells?

chloroplasts **mitochondria** **ribosomes** [1 mark]

b Describe the function of this cell component. [3 marks]

3 Explain why a root hair cell does not need chloroplasts. [3 marks]

1 Practice questions

01 Use the correct words from the box to complete each sentence.

a cell	**an organ**	**an organism**
an organ system	**a tissue**	

The basic building block of living organisms is called _____.

A group of cells with similar structures and functions is called _____.

The brain is an example of _____.

[3 marks]

02 Figure 1 shows some organs of the male human body.

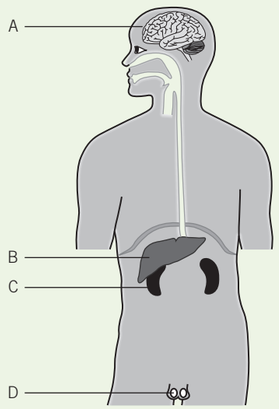


Figure 1

02.1 Name organs A, B, C, and D. Choose one answer for each organ.

A: **brain**	**eye**	**mouth**
B: **liver**	**lungs**	**stomach**
C: **kidney**	**small intestine**	**stomach**
D: **bladder**	**ovaries**	**testes**

[4 marks]

02.2 Which of organs A, B, C, or D is part of the reproductive system? [1 mark]

03 Look at Figure 2 of an animal cell.

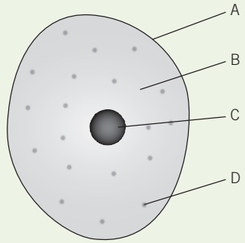


Figure 2

03.1 Choose the correct name for structure A.

cytoplasm **haemoglobin** **nucleus**

[1 mark]

03.2 Choose the correct function of the cell membrane.

A contains genetic material

B controls the activities of the cell

C controls which substances can pass into and out of a cell

D where chemical reactions take place [1 mark]

04 Complete the table showing a number of specialised cells and their function.

Name of cell	Function
sperm	
	change shape to cause movement
nerve	

[3 marks]

05 Figure 3 shows the components of the blood.

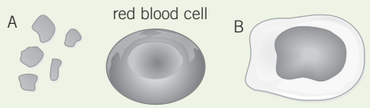


Figure 3

05.1 Name components A and B. [2 marks]

05.2 Describe **two** ways that red blood cells are adapted to transport oxygen from the lungs to cells of the body. [2 marks]

06 Which list of cell components can be found in **both** plant and animal cells?

A cell membrane, cytoplasm, nucleus, vacuole

B cell wall, chloroplasts nucleus, vacuole

C cytoplasm, mitochondria, nucleus, ribosomes

D chloroplasts, cytoplasm, mitochondria, nucleus [1 mark]

07.1 Complete the table using a tick (✓) to summarise the differences between diffusion and active transport.

	Diffusion	Active transport
substances move against the concentration gradient		
energy is needed		
oxygen moved into the blood from the air sacs due to this process		
mineral uptake into plant roots occurs due to this process		

[4 marks]

07.2 Give **two** ways you can speed up diffusion. [2 marks]

08.1 Choose the name of the blood vessel that carries blood away from the heart.

artery **capillary** **vein** [1 mark]

08.2 Give the function of a valve in a vein. [1 mark]

08.3 The coronary arteries carry blood to the heart muscle cells. In coronary heart disease, layers of fatty material build up inside the coronary arteries. Explain why this could be dangerous. [3 marks]

08.4 Name one way to treat a blocked coronary artery. [1 mark]

09.1 Figure 4 shows an enzyme and three possible substrate molecules, A, B, and C.

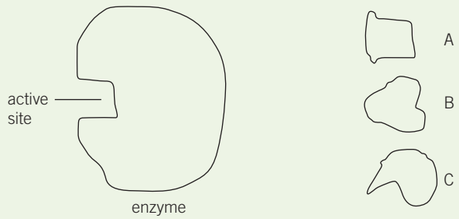


Figure 4

Select which **one** substrate would bind to the active site. [1 mark]

09.2 Amylase is an enzyme that breaks down large carbohydrate molecules. Explain why it is unable to break down lipids. [2 marks]

09.3 Name the type of enzyme that can break down lipids. [1 mark]

10 A student wanted to observe some cheek cells under a light microscope.

10.1 Name of the part of the microscope that the slide sits on. [1 mark]

10.2 The microscope has an objective lens with magnification ×40 and an eyepiece lens with a magnification of ×10. Calculate the total magnification of the microscope. [2 marks]