



Learn with Tayo: Human Anatomy Answer Booklet for parents

Module 1: Cells: The Building Blocks of Life

Worksheet, Ages 8–11 (23 items)

1. Diagram: 1. Cell membrane; 2. Nucleus; 3. Mitochondrion; 4. Cytoplasm; 5. Endoplasmic reticulum; 6. Vacuole

2. Order: 1. 1665 Robert Hooke names 'cells' in cork; 2. 1674 Van Leeuwenhoek sees living single cells; 3. 1839 Schwann and Schleiden: all living things are made of cells; 4. 1953 The double-helix shape of DNA is discovered

3. True or false: 1. True; 2. False; 3. True; 4. False

4. Match up: Cell = B; Nucleus = D; Mitochondria = A; Membrane = C

5. Short answers

1. What is the control centre of the cell called?

The nucleus.

2. Name one cell part found in plant cells but not animal cells.

Cell wall, chloroplast or one large permanent vacuole.

3. What instrument do we need to see cells?

A microscope.

4. Explain in your own words: In your own words, explain what a cell is and why it is called the basic unit of life.

Open answer: the idea explained simply in the learner's own words, with one correct fact.

5. Stretch: Choose two parts of a cell and explain what each one does.

Open answer: a clear explanation using one or two facts from the module.

Worksheet, Ages 12–15 (29 items)

1. Diagram: 1. Cell membrane; 2. Nucleus; 3. Mitochondrion; 4. Cytoplasm; 5. Endoplasmic reticulum; 6. Vacuole

2. Order: 1. 1590s Early compound microscopes made in the Netherlands; 2. 1665 Robert Hooke names 'cells' in cork; 3. 1665 Hooke publishes Micrographia; 4. 1674 Van Leeuwenhoek sees living single cells; 5. 1839 Schwann and Schleiden: all living things are

made of cells; 6. 1855 Virchow: every cell comes from another cell; 7. 1953 The double-helix shape of DNA is discovered

3. Source analysis

1. What did Hooke compare the cork to?

A honeycomb, made of many little boxes.

2. Why do you think he chose the word 'cells'?

The boxes reminded him of small rooms (cells) like those monks lived in.

3. Hooke was looking at cork, which is dead. What could he not see?

The living contents: nucleus, cytoplasm and so on; only the empty walls.

4. Significance: Robert Hooke = English scientist who first used the word 'cell' in 1665 after looking at cork.; Antonie van Leeuwenhoek = Dutch lens-maker who first saw living single cells, which he called 'animalcules'.; Theodor Schwann = German scientist who said all animals are made of cells (1839).; Rosalind Franklin = British scientist whose X-ray photos helped reveal the shape of DNA.; Cell = The smallest unit of a living thing.

5. Cause and consequence

1. Explain why the invention of better microscopes led to cell theory.

Better lenses let scientists see cells in many plants and animals, so they could conclude all living things are made of cells.

2. Explain one consequence of a cell's mitochondria not working properly.

Less energy released, so the cell (e.g. muscles) cannot do its job well; tiredness.

6. Longer answers and 7. Essay

1. Explain how a red blood cell is adapted to its job.

No nucleus leaves more room for haemoglobin; the dented disc shape gives a large surface for oxygen and lets it bend through capillaries.

2. Why was the invention of the microscope so important for biology?

Cells are too small to see by eye; microscopes revealed cells and microbes and led to cell theory and germ theory.

3. Describe the levels of organisation from cell to organism, with an example of each.

Cell (muscle cell) → tissue (muscle tissue) → organ (heart) → organ system (circulatory system) → organism (human).

4. What does 'every cell comes from another cell' mean, and how does it explain growth and healing?
New cells are only made when existing cells divide; growing and repairing cuts happen by cell division.
5. Explain in your own words: Explain how cells, tissues, organs and organ systems are linked.
Open answer: an accurate explanation in the learner's own words, with supporting detail.
6. Essay: 'The cell is the most important discovery in biology.' How far do you agree? Plan an essay with points for and against and a conclusion.
Open answer: an introduction, paragraphs for and against with evidence from the module, and a reasoned conclusion.

Quiz

1. About how many cells are in an adult human body?
D. 37 trillion
2. Which part of the cell holds the DNA?
B. Nucleus
3. What do mitochondria do?
A. Release energy
4. Who first used the word 'cell'?
A. Robert Hooke
5. Which cell has no nucleus?
C. Red blood cell
6. A group of similar cells doing the same job is a...
B. Tissue
7. Why are nerve cells long and thin?
Model answer: They carry electrical messages from one part of the body to another, sometimes over a long distance, so a long thin shape lets one cell reach far.
8. Explain the difference between a tissue and an organ.
Model answer: A tissue is a group of similar cells doing one job; an organ is made of several different tissues working together, like the heart.

Checkpoints

Open answers. Look for the learner explaining the idea in their own words, with at least one accurate fact from the lesson.

Module 2: The Skeleton: Your Body's Frame

Worksheet, Ages 8–11 (24 items)

1. Diagram: 1. Skull; 2. Ribcage; 3. Spine; 4. Pelvis; 5. Humerus; 6. Femur; 7. Tibia

2. Order: 1. c.180 AD Galen writes about bones and muscles in Rome; 2. 1543 Vesalius publishes his great anatomy book; 3. 1895 Röntgen discovers X-rays; 4. 1962 Charnley's modern hip replacement

3. True or false: 1. True; 2. False; 3. True; 4. False

4. Match up: Skeleton = B; Vertebrae = D; Bone marrow = A; Joint = C

5. Short answers

1. Name the bones that protect your heart and lungs.

The ribs, or ribcage.

2. What is the smallest bone and where is it?

The stirrup (stapes), in the ear.

3. What mineral makes bones strong?

Calcium.

4. Explain in your own words: In your own words, explain three jobs the skeleton does.

Open answer: the idea explained simply in the learner's own words, with one correct fact.

5. Stretch: Explain why bones are described as living tissue.

Open answer: a clear explanation using one or two facts from the module.

Worksheet, Ages 12–15 (30 items)

1. Diagram: 1. Skull; 2. Ribcage; 3. Spine; 4. Pelvis; 5. Humerus; 6. Femur; 7. Tibia

2. Order: 1. c.180 AD Galen writes about bones and muscles in Rome; 2. c.1000 Ibn Sina's Canon of Medicine describes bones; 3. 1543 Vesalius publishes his great anatomy book; 4. 1895 Röntgen discovers X-rays; 5. 1896 X-rays first used to find broken bones; 6. 1962 Charnley's modern hip replacement; 7. 1970s CT scanners show bones in 3D

3. Source analysis

1. What three jobs of bones does Vesalius describe?

Protection, support and movement (levers).

2. Why are comparisons to walls, pillars and levers helpful?

They use familiar buildings and machines to explain jobs clearly.

3. Why might Vesalius be more reliable than Galen on human bones?

He dissected human bodies himself; Galen relied on animals.

4. Significance: Andreas Vesalius = Flemish doctor whose 1543 book 'On the Fabric of the Human Body' showed the skeleton accurately.; Wilhelm Röntgen = German scientist who discovered X-rays in 1895, letting doctors see bones inside living people.; Galen = Greek doctor in Rome (about 130–210 AD) whose ideas about the body were followed for 1,300 years.; John Charnley = British surgeon who developed modern hip replacements in the 1960s.; Skeleton = The frame of bones that supports the body.

5. Cause and consequence

1. Explain why a child's broken bone usually heals faster than an adult's.

Children's bones are growing, with more active cells and good blood supply.

2. Explain one consequence of X-rays for treating injuries.

Doctors could see fractures exactly and set bones correctly, so fewer people were left disabled.

6. Longer answers and 7. Essay

1. Describe the structure of a long bone from the outside in.

Compact bone outside, spongy bone inside, marrow in the centre; with blood vessels and nerves.

2. Explain why bones need to be both hard and slightly bendy.

Calcium minerals make them hard and strong to support weight; collagen lets them bend a little so they do not snap easily.

3. Explain how the skeleton and muscles work together to make movement.

Muscles are attached to bones by tendons; when a muscle contracts it pulls a bone around a joint.

4. Why was Vesalius's book so important?

He dissected human bodies himself and showed Galen was wrong in places; accurate drawings began modern anatomy.

5. Explain in your own words: Compare a hinge joint and a ball-and-socket joint, with an example of each.

Open answer: an accurate explanation in the learner's own words, with supporting detail.

6. Essay: 'Vesalius was the most important person in the history of anatomy.' How far do you agree? Plan an essay.

Open answer: an introduction, paragraphs for and against with evidence from the module, and a reasoned conclusion.

Quiz

1. How many bones does an adult have?

B. 206

2. Which is the longest bone in the body?

C. Femur

3. What protects the brain?

C. Skull

4. Where are blood cells made?

A. In bone marrow

5. What kind of joint is the knee?

B. Hinge

6. Who discovered X-rays?

B. Röntgen

7. Why does a baby have more bones than an adult?

Model answer: A baby has around 300 bones, and some of them fuse together as the child grows, which leaves 206 in an adult.

8. How did X-rays change medicine?

Model answer: For the first time doctors could see bones inside a living person without surgery, so they could find fractures and set them properly.

Checkpoints

Open answers. Look for the learner explaining the idea in their own words, with at least one accurate fact from the lesson.

Module 3: Muscles: How We Move

Worksheet, Ages 8–11 (23 items)

1. Diagram: 1. Deltoid; 2. Pectorals; 3. Biceps; 4. Abdominals; 5. Quadriceps; 6. Calf

2. Order: 1. c.180 AD Galen shows nerves control muscles; 2. 1791 Galvani: electricity makes muscles twitch; 3. 1922 Hill wins a Nobel Prize for muscle research; 4. 1954 Sliding filament theory explains contraction

3. True or false: 1. False; 2. True; 3. True; 4. False

4. Match up: Contract = B; Tendon = D; Voluntary = A; Involuntary = C

5. Short answers

1. Name the three types of muscle.

Skeletal, smooth and cardiac.

2. Which muscle never stops working?

The heart (cardiac muscle).

3. What food helps muscles grow and repair?

Protein, such as beans, eggs, fish or meat.

4. Explain in your own words: In your own words, explain why muscles must work in pairs.

Open answer: the idea explained simply in the learner's own words, with one correct fact.

5. Stretch: Explain the difference between voluntary and involuntary muscles, with an example of each.

Open answer: a clear explanation using one or two facts from the module.

Worksheet, Ages 12–15 (29 items)

1. Diagram: 1. Deltoid; 2. Pectorals; 3. Biceps; 4. Abdominals; 5. Quadriceps; 6. Calf

2. Order: 1. c.180 AD Galen shows nerves control muscles; 2. 1543 Vesalius draws the muscles in detail; 3. 1663 Swammerdam studies how muscles change when they contract; 4. 1791 Galvani: electricity makes muscles twitch; 5. 1850 Helmholtz measures the speed of nerve signals; 6. 1922 Hill wins a Nobel Prize for muscle research; 7. 1954 Sliding filament theory explains contraction

3. Source analysis

1. What made the frog's muscles contract?

Electricity reaching the nerve.

2. What did this suggest about how muscles are controlled?

Electrical signals in nerves control muscles.

3. Why should we check other scientists' experiments, like Volta did with Galvani's?

To test whether the explanation is right; Volta argued about where the electricity came from.

4. Significance: Luigi Galvani = Italian scientist who showed in 1791 that electricity makes muscles twitch.; Andrew Huxley and Hugh Huxley = Two British scientists (not related) who in 1954 explained how muscle fibres slide to contract.; Galen = Greek doctor who showed muscles are controlled by nerves.; Archibald Hill = British scientist who won a Nobel Prize in 1922 for studying muscle energy and heat.; Contract = When a muscle gets shorter and pulls.

5. Cause and consequence

1. Explain why muscles need to work in antagonistic pairs.

Muscles only pull, so a second muscle is needed to move the bone back.

2. Explain one consequence of not exercising for a long time.

Muscles become weaker and thinner; bones weaker; fitness falls.

6. Longer answers and 7. Essay

1. Explain what an antagonistic pair is, using the quadriceps and hamstrings.

Two muscles pull opposite ways: quadriceps contracts to straighten the knee while hamstrings relax, and the reverse to bend it.

2. Why do we get hot during exercise and shiver when cold?

Contracting muscles release heat; shivering is rapid small contractions to warm the body.

3. Compare skeletal and cardiac muscle in two ways.

Skeletal is voluntary and tires; cardiac is involuntary, only in the heart, and does not tire in the same way.

4. How did Galvani's experiment change ideas about the body?

It showed electrical signals control muscles, leading to the study of nerves as electrical messengers.

5. Explain in your own words: Explain two ways you can keep your muscles healthy.
Open answer: an accurate explanation in the learner's own words, with supporting detail.
6. Essay: 'Cardiac muscle is the most important muscle in the body.' How far do you agree?
Plan an essay.
Open answer: an introduction, paragraphs for and against with evidence from the module, and a reasoned conclusion.

Quiz

1. Roughly how many muscles do you have?
B. Over 600
2. What joins a muscle to a bone?
B. Tendon
3. Which muscle bends your arm at the elbow?
B. Biceps
4. Where is cardiac muscle found?
B. Heart
5. Muscles can only...
B. Pull
6. Which is the largest muscle?
B. Gluteus maximus
7. Explain how the biceps and triceps move the arm.
Model answer: To bend the arm the biceps contracts and the triceps relaxes; to straighten it the triceps contracts and the biceps relaxes, because muscles can only pull.
8. Why is it useful that smooth muscle is involuntary?
Model answer: Digestion and blood flow must happen all the time, even when we sleep, so they work without us having to think about them.

Checkpoints

Open answers. Look for the learner explaining the idea in their own words, with at least one accurate fact from the lesson.

Module 4: The Heart and Blood

Worksheet, Ages 8–11 (24 items)

1. Diagram: 1. Right atrium; 2. Right ventricle; 3. Left atrium; 4. Left ventricle; 5. Aorta; 6. Vena cava; 7. Pulmonary artery

2. Order: 1. 1628 Harvey shows blood circulates; 2. 1661 Malpighi sees capillaries; 3. 1901 Landsteiner discovers blood groups; 4. 1967 First human heart transplant

3. True or false: 1. True; 2. False; 3. True; 4. False

4. Match up: Atrium = B; Ventricle = D; Artery = A; Vein = C

5. Short answers

1. About how big is your heart?

About the size of your fist.

2. What colour substance in red blood cells carries oxygen?

Haemoglobin (it is red).

3. Where can you feel your pulse?

At the wrist (or the neck).

4. Explain in your own words: In your own words, explain why the heart is called a double pump.

Open answer: the idea explained simply in the learner's own words, with one correct fact.

5. Stretch: Describe the journey of blood from the body, through the heart and lungs, and back out.

Open answer: a clear explanation using one or two facts from the module.

Worksheet, Ages 12–15 (30 items)

1. Diagram: 1. Right atrium; 2. Right ventricle; 3. Left atrium; 4. Left ventricle; 5. Aorta; 6. Vena cava; 7. Pulmonary artery

2. Order: 1. c.170 AD Galen says blood is made in the liver and used up; 2. c.1242 Ibn al-Nafis describes blood flowing through the lungs; 3. 1628 Harvey shows blood circulates; 4.

1661 Malpighi sees capillaries; 5. 1818 First human-to-human blood transfusion; 6. 1901 Landsteiner discovers blood groups; 7. 1967 First human heart transplant

3. Source analysis

1. What does Harvey claim about the blood?

It moves in a circle: out through arteries, back through veins.

2. Why was this idea controversial in 1628?

It contradicted Galen, who had been trusted for 1,400 years.

3. What kind of evidence would help Harvey convince others?

Measurements of blood pumped, experiments with valves and tied arms.

4. Significance: William Harvey = English doctor who proved in 1628 that the heart pumps blood round the body in a circuit.; Ibn al-Nafis = Arab doctor in Cairo who described blood travelling through the lungs around 1242.; Karl Landsteiner = Austrian scientist who discovered blood groups A, B and O in 1901.; Christiaan Barnard = South African surgeon who did the first human heart transplant in 1967.; Atrium = A top chamber of the heart that collects blood.

5. Cause and consequence

1. Explain why a blockage in a coronary artery is dangerous.

Heart muscle loses its oxygen supply and can be damaged (heart attack).

2. Explain how discovering blood groups changed medicine.

Transfusions became safe, allowing surgery and saving accident victims.

6. Longer answers and 7. Essay

1. Explain how the structure of arteries and veins suits their jobs.

Arteries have thick elastic walls for high pressure; veins have thinner walls and valves to stop backflow at low pressure.

2. Name the four parts of blood and give the job of each.

Plasma carries substances; red cells carry oxygen; white cells fight germs; platelets clot.

3. Why are capillaries only one cell thick?

So oxygen, food and waste can pass quickly between blood and body cells.

4. Why did it take until 1628 for people to accept circulation?

Galen's ideas were trusted for centuries; Harvey used measurements and experiments to show blood must go round.

5. Explain in your own words: Explain the difference between arteries, veins and capillaries.

Open answer: an accurate explanation in the learner's own words, with supporting detail.

6. Essay: 'Harvey's discovery was more important than the first heart transplant.' How far do you agree? Plan an essay.

Open answer: an introduction, paragraphs for and against with evidence from the module, and a reasoned conclusion.

Quiz

1. How many chambers does the heart have?

C. Four

2. Which blood vessel carries blood away from the heart to the body?

B. Aorta

3. Where does blood pick up oxygen?

B. Lungs

4. What do platelets do?

C. Help blood clot

5. Who proved that blood circulates?

A. William Harvey

6. What makes the 'lub-dub' sound?

B. Valves closing

7. Why does the left ventricle have a thicker wall than the right?

Model answer: It has to pump blood all the way round the body, which needs more force than pumping to the nearby lungs.

8. Why does your heart beat faster when you exercise?

Model answer: Your muscles need more oxygen and glucose and must remove more carbon dioxide, so the heart pumps faster to deliver blood more quickly.

Checkpoints

Open answers. Look for the learner explaining the idea in their own words, with at least one accurate fact from the lesson.

Module 5: Lungs and Breathing

Worksheet, Ages 8–11 (24 items)

1. Diagram: 1. Nose; 2. Mouth; 3. Trachea; 4. Bronchus; 5. Lung; 6. Diaphragm; 7. Alveoli

2. Order: 1. 1661 Malpighi describes alveoli and capillaries; 2. 1774 Priestley discovers oxygen; 3. 1816 Laennec invents the stethoscope; 4. 1950 Doctors link smoking to lung disease

3. True or false: 1. True; 2. False; 3. True; 4. False

4. Match up: Trachea = B; Bronchus = D; Alveoli = A; Diaphragm = C

5. Short answers

1. What waste gas do we breathe out?

Carbon dioxide.

2. What do hairs and mucus in the nose do?

Trap dust and germs.

3. Name the muscle under the lungs.

The diaphragm.

4. Explain in your own words: In your own words, explain why we need to breathe.

Open answer: the idea explained simply in the learner's own words, with one correct fact.

5. Stretch: Describe the path air takes from your nose to the alveoli.

Open answer: a clear explanation using one or two facts from the module.

Worksheet, Ages 12–15 (30 items)

1. Diagram: 1. Nose; 2. Mouth; 3. Trachea; 4. Bronchus; 5. Lung; 6. Diaphragm; 7. Alveoli

2. Order: 1. 1543 Vesalius describes the lungs; 2. 1661 Malpighi describes alveoli and capillaries; 3. 1774 Priestley discovers oxygen; 4. 1777 Lavoisier names oxygen and explains breathing; 5. 1816 Laennec invents the stethoscope; 6. 1865 Lister uses carbolic spray in surgery; 7. 1950 Doctors link smoking to lung disease

3. Source analysis

1. What did Laennec's tube let him hear more clearly?

The heartbeat (and breath sounds).

2. Why might doctors before 1816 have found it hard to listen to the chest?

Placing the ear directly was awkward and sounds were faint.

3. How is a modern stethoscope similar to and different from his tube?

Same idea of carrying sound; now flexible tubes, earpieces and a diaphragm.

4. Significance: Joseph Priestley = English scientist who discovered oxygen gas in 1774.; Antoine Lavoisier = French chemist who named oxygen and showed breathing is like slow burning.; René Laennec = French doctor who invented the stethoscope in 1816 to listen to the chest.; Marcello Malpighi = Italian scientist who described the alveoli and capillaries in the lungs in 1661.; Trachea = The windpipe, carrying air to the lungs.

5. Cause and consequence

1. Explain why smoking reduces how well someone can exercise.

Damaged alveoli and airways reduce gas exchange, so less oxygen reaches muscles.

2. Explain one consequence of Priestley's discovery of oxygen.

Lavoisier explained breathing and burning; the start of modern chemistry and physiology.

6. Longer answers and 7. Essay

1. Explain how the alveoli are adapted for gas exchange (three features).

Huge surface area, walls one cell thick, a rich blood supply; moist lining.

2. Explain the link between breathing and respiration.

Breathing moves air in and out; respiration is the chemical reaction in cells that uses oxygen and releases energy and carbon dioxide.

3. Describe what happens to volume and air when you breathe out.

Diaphragm relaxes, ribs go down and in, chest volume falls, pressure rises, air is pushed out.

4. How did the stethoscope help doctors?

They could listen to breathing and heart sounds clearly to diagnose illness without surgery.

5. Explain in your own words: Explain what the diaphragm and ribs do when you breathe in and out.

Open answer: an accurate explanation in the learner's own words, with supporting detail.

6. Essay: 'Breathing is the most important body process.' How far do you agree? Plan an essay.

Open answer: an introduction, paragraphs for and against with evidence from the module, and a reasoned conclusion.

Quiz

1. Which gas do we need to take in?

B. Oxygen

2. What is the windpipe's scientific name?

B. Trachea

3. Where does gas exchange happen?

B. Alveoli

4. What happens to the diaphragm when you breathe in?

A. It contracts and flattens

5. Who invented the stethoscope?

A. Laennec

6. What stops food going into the trachea?

B. Epiglottis

7. Why are alveoli so good at gas exchange?

Model answer: There are millions, giving a huge surface area; their walls are very thin and covered in capillaries, so gases pass across quickly.

8. Why do we breathe faster when we exercise?

Model answer: Muscles need more oxygen for respiration and make more carbon dioxide, so we breathe faster and deeper.

Checkpoints

Open answers. Look for the learner explaining the idea in their own words, with at least one accurate fact from the lesson.

Module 6: Digestion: The Food Journey

Worksheet, Ages 8–11 (25 items)

1. Diagram: 1. Mouth; 2. Oesophagus; 3. Liver; 4. Stomach; 5. Pancreas; 6. Small intestine; 7. Large intestine; 8. Rectum

2. Order: 1. 1822 Beaumont begins studying a patient's stomach; 2. 1904 Pavlov wins the Nobel Prize for digestion research; 3. 1921 Insulin is discovered; 4. 1982 Bacteria found to cause stomach ulcers

3. True or false: 1. True; 2. True; 3. False; 4. False

4. Match up: Digestion = B; Enzyme = D; Oesophagus = A; Peristalsis = C

5. Short answers

1. Which organ churns food with acid?

The stomach.

2. How long can the whole food journey take?

About 1 to 3 days.

3. Name one food that contains fibre.

Any fruit, vegetable, beans or whole grain.

4. Explain in your own words: In your own words, explain why we need to digest food.

Open answer: the idea explained simply in the learner's own words, with one correct fact.

5. Stretch: Describe what happens to food in the mouth and the stomach.

Open answer: a clear explanation using one or two facts from the module.

Worksheet, Ages 12–15 (31 items)

1. Diagram: 1. Mouth; 2. Oesophagus; 3. Liver; 4. Stomach; 5. Pancreas; 6. Small intestine; 7. Large intestine; 8. Rectum

2. Order: 1. 1752 Réaumur studies digestion using a hawk; 2. 1822 Beaumont begins studying a patient's stomach; 3. 1833 Beaumont publishes on gastric juice; 4. 1904 Pavlov wins the Nobel Prize for digestion research; 5. 1921 Insulin is discovered; 6. 1953 Insulin structure worked out; 7. 1982 Bacteria found to cause stomach ulcers

3. Source analysis

1. What did Beaumont observe?

Meat was partly dissolved by the stomach after an hour or two.

2. What does this show about the stomach?

It breaks down food chemically with gastric juice, not just by churning.

3. Why are Beaumont's experiments seen as raising questions about ethics today?

His patient depended on him and may not have freely consented.

4. Significance: William Beaumont = American army doctor who studied digestion in the 1820s through a patient's healed stomach wound.; Ivan Pavlov = Russian scientist who won a Nobel Prize in 1904 for studying digestion.; Frederick Banting = Canadian doctor who discovered insulin, made by the pancreas, in 1921.; Barry Marshall = Australian doctor who showed in 1982 that bacteria cause most stomach ulcers.; Digestion = Breaking food down into small molecules the body can absorb.

5. Cause and consequence

1. Explain why fibre is important for digestion.

It keeps food moving through the intestines and prevents constipation.

2. Explain one consequence of the discovery of insulin.

People with type 1 diabetes could be treated and live long lives.

6. Longer answers and 7. Essay

1. Explain the role of enzymes in digestion with one example.

They speed up breaking big molecules into small ones; e.g. salivary amylase breaks starch into sugar.

2. Describe how food is absorbed and where it goes next.

Small molecules pass through villi into capillaries and are carried in the blood to the liver and body cells.

3. Why does the pancreas belong to two body systems?

It makes digestive enzymes (digestive system) and insulin (hormone system controlling blood sugar).

4. What did Barry Marshall's discovery change?

Ulcers were blamed on stress; showing bacteria cause them meant they could be cured with antibiotics.

5. Explain in your own words: Explain the jobs of the small intestine and the large intestine.

Open answer: an accurate explanation in the learner's own words, with supporting detail.

6. Essay: 'The small intestine is the most important digestive organ.' How far do you agree? Plan an essay.

Open answer: an introduction, paragraphs for and against with evidence from the module, and a reasoned conclusion.

Quiz

1. What does saliva start to break down?

B. Starch

2. What is the food pipe called?

B. Oesophagus

3. Where are villi found?

B. Small intestine

4. What does the large intestine mainly absorb?

A. Water

5. Which organ makes bile?

B. Liver

6. What is peristalsis?

B. Waves of muscle pushing food

7. Why is the small intestine so long and covered in villi?

Model answer: To give a huge surface area so lots of digested food can be absorbed into the blood.

8. Why does the stomach contain acid?

Model answer: The acid helps enzymes break down protein and kills many germs that are swallowed with food.

Checkpoints

Open answers. Look for the learner explaining the idea in their own words, with at least one accurate fact from the lesson.

Module 7: The Brain and Nerves

Worksheet, Ages 8–11 (24 items)

1. Diagram: 1. Frontal lobe; 2. Parietal lobe; 3. Occipital lobe; 4. Temporal lobe; 5. Cerebellum; 6. Brain stem; 7. Spinal cord

2. Order: 1. c.170 AD Galen shows the brain, not the heart, controls the body; 2. 1861 Broca finds a language area of the brain; 3. 1888 Cajal shows the brain is made of separate neurons; 4. 1897 Sherrington names the synapse

3. True or false: 1. True; 2. False; 3. True; 4. False

4. Match up: Neuron = B; Cerebrum = D; Cerebellum = A; Brain stem = C

5. Short answers

1. What protects the brain?

The skull (and fluid around it).

2. Which way do the brain halves control the body?

Left half controls the right side, right half the left side.

3. How many hours of sleep do children your age need?

About 9 to 12 hours.

4. Explain in your own words: In your own words, explain what the brain does.

Open answer: the idea explained simply in the learner's own words, with one correct fact.

5. Stretch: Choose two parts of the brain and explain what each controls.

Open answer: a clear explanation using one or two facts from the module.

Worksheet, Ages 12–15 (30 items)

1. Diagram: 1. Frontal lobe; 2. Parietal lobe; 3. Occipital lobe; 4. Temporal lobe; 5. Cerebellum; 6. Brain stem; 7. Spinal cord

2. Order: 1. c.170 AD Galen shows the brain, not the heart, controls the body; 2. 1543 Vesalius describes the brain; 3. 1861 Broca finds a language area of the brain; 4. 1873 Golgi's stain makes neurons visible; 5. 1888 Cajal shows the brain is made of separate neurons; 6. 1897 Sherrington names the synapse; 7. 1924 Berger records brain waves (EEG)

3. Source analysis

1. What does Cajal compare neurons to?

Trees with branches in a forest.

2. What is his main claim?

Neurons are separate cells that touch but are not joined.

3. How did later science support him?

Microscopes showed the synapse gap between neurons.

4. Significance: Santiago Ramón y Cajal = Spanish scientist who showed the brain is made of separate neurons, and drew them beautifully.; Paul Broca = French doctor who found a language area in the frontal lobe in 1861.; Camillo Golgi = Italian scientist who invented a stain that made neurons visible.; Charles Sherrington = British scientist who studied reflexes and named the synapse in 1897.; Neuron = A nerve cell that carries electrical messages.

5. Cause and consequence

1. Explain why damage to the brain stem is very dangerous.

It controls breathing and heartbeat, which are vital.

2. Explain why wearing a cycle helmet matters.

It protects the brain from injury in a fall; brain cells repair poorly.

6. Longer answers and 7. Essay

1. Compare sensory and motor neurons.

Sensory neurons carry signals from sense organs to the CNS; motor neurons carry signals from the CNS to muscles.

2. Describe the path of a reflex when you touch something hot.

Receptor in skin → sensory neuron → spinal cord → motor neuron → arm muscle contracts; brain told afterwards.

3. Explain what happens at a synapse.

The electrical signal reaches the end of a neuron; chemicals cross the gap and start a signal in the next neuron.

4. How did Broca's discovery show that different brain areas have different jobs?

A patient with damage to one small frontal area lost speech, showing language is located in a specific region.

5. Explain in your own words: Explain what a reflex is and why it is useful.

Open answer: an accurate explanation in the learner's own words, with supporting

detail.

6. Essay: 'The brain is the most important organ in the body.' How far do you agree? Plan an essay.

Open answer: an introduction, paragraphs for and against with evidence from the module, and a reasoned conclusion.

Quiz

1. About how many neurons are in the brain?

C. 86 billion

2. Which part of the brain controls balance?

A. Cerebellum

3. Which lobe handles seeing?

C. Occipital

4. What does the brain stem control?

B. Breathing and heartbeat

5. The gap between two neurons is a...

A. Synapse

6. Which of these is a reflex?

B. Blinking when something flies at you

7. Why do reflexes not go through the thinking part of the brain first?

Model answer: Going straight through the spinal cord is faster, which protects the body from harm such as burns before we even think.

8. Why is sleep important for the brain?

Model answer: During sleep the brain sorts and stores memories, recovers and clears waste, so we can learn, concentrate and stay healthy.

Checkpoints

Open answers. Look for the learner explaining the idea in their own words, with at least one accurate fact from the lesson.

Module 8: The Senses: Eyes and Ears

Worksheet, Ages 8–11 (24 items)

1. Diagram: 1. Cornea; 2. Iris; 3. Pupil; 4. Lens; 5. Vitreous humour; 6. Retina; 7. Optic nerve

2. Order: 1. c.1021 Ibn al-Haytham explains that light enters the eye; 2. c.1286 Spectacles invented in Italy; 3. 1604 Kepler explains the image on the retina; 4. 1824 Braille invents raised-dot reading

3. True or false: 1. True; 2. True; 3. False; 4. True

4. Match up: Retina = B; Pupil = D; Lens = A; Optic nerve = C

5. Short answers

1. What does the lens do?

Focuses light onto the retina.

2. Name the three tiny bones in the ear.

Hammer, anvil and stirrup.

3. Give one way to protect your hearing.

Keep headphones at a safe volume / don't put things in your ears.

4. Explain in your own words: In your own words, explain how a sense organ sends information to the brain.

Open answer: the idea explained simply in the learner's own words, with one correct fact.

5. Stretch: Describe how light travels through the eye to make an image.

Open answer: a clear explanation using one or two facts from the module.

Worksheet, Ages 12–15 (30 items)

1. Diagram: 1. Cornea; 2. Iris; 3. Pupil; 4. Lens; 5. Vitreous humour; 6. Retina; 7. Optic nerve

2. Order: 1. c.1021 Ibn al-Haytham explains that light enters the eye; 2. c.1286 Spectacles invented in Italy; 3. 1604 Kepler explains the image on the retina; 4. 1824 Braille invents raised-dot reading; 5. 1851 Corti describes hearing cells in the cochlea; 6. 1876 Bell's telephone helps research on hearing; 7. 1949 Ridley implants an artificial lens

3. Source analysis

1. What older idea is he rejecting?

That the eye sends out rays to see.

2. What does he say instead?

Light from objects enters the eye.

3. Why is experiment important in his work?

He tested ideas with light and dark rooms rather than just trusting old authorities.

4. Significance: Ibn al-Haytham = Arab scientist in Cairo who showed around 1021 that we see because light enters the eye.; Johannes Kepler = German astronomer who showed in 1604 that the lens focuses an upside-down image on the retina.; Alfonso Corti = Italian scientist who described the hearing cells in the cochlea in 1851.; Louis Braille = French teacher, blind from childhood, who invented raised-dot reading in 1824.; Retina = The light-sensitive layer at the back of the eye.

5. Cause and consequence

1. Explain why loud music can cause permanent hearing loss.

Loud sound damages hair cells in the cochlea, which do not grow back.

2. Explain one consequence of the invention of spectacles.

People with poor sight could read and work longer; more learning.

6. Longer answers and 7. Essay

1. Compare rods and cones.

Rods: many, work in dim light, black and white. Cones: fewer, need brighter light, detect colour.

2. Explain why we have a blind spot.

Where the optic nerve leaves the retina there are no rods or cones, so light there is not detected.

3. Explain the job of the middle ear bones.

They pass vibrations from the eardrum to the cochlea and amplify them.

4. Why was Ibn al-Haytham's idea a big change?

Many Greeks thought eyes sent out rays; he showed light comes into the eye, using experiments, a foundation of optics.

5. Explain in your own words: Explain how sound gets from the air to the brain.

Open answer: an accurate explanation in the learner's own words, with supporting detail.

6. Essay: 'Sight is our most important sense.' How far do you agree? Plan an essay.
Open answer: an introduction, paragraphs for and against with evidence from the module, and a reasoned conclusion.

Quiz

1. Which part of the eye changes size in bright light?

B. Pupil

2. Which cells in the retina detect colour?

B. Cones

3. What is the snail-shaped part of the ear?

B. Cochlea

4. Which nerve carries signals from the eye to the brain?

B. Optic nerve

5. Which part of the ear helps you balance?

A. Semicircular canals

6. Who invented raised-dot reading for blind people?

B. Louis Braille

7. Why does the pupil change size?

Model answer: To control how much light enters: smaller in bright light to protect the retina, bigger in dim light to let in enough light to see.

8. Why is flavour affected when you have a blocked nose?

Model answer: Much of flavour comes from smell; if smell receptors cannot detect the food, it tastes bland.

Checkpoints

Open answers. Look for the learner explaining the idea in their own words, with at least one accurate fact from the lesson.

Module 9: Skin and the Immune System

Worksheet, Ages 8–11 (25 items)

1. Diagram: 1. Epidermis; 2. Dermis; 3. Fat layer; 4. Hair; 5. Oil gland; 6. Sweat gland; 7. Blood vessel; 8. Nerve

2. Order: 1. 1796 Jenner makes the first vaccine; 2. 1847 Semmelweis shows handwashing saves lives; 3. 1928 Fleming discovers penicillin; 4. 1980 Smallpox declared wiped out

3. True or false: 1. True; 2. False; 3. True; 4. False

4. Match up: Epidermis = B; Dermis = D; Melanin = A; Pathogen = C

5. Short answers

1. Name the outer layer of the skin.

The epidermis.

2. What are goose bumps for?

Hairs stand up to trap warm air when cold.

3. How long should you wash your hands?

About 20 seconds, with soap.

4. Explain in your own words: In your own words, explain four jobs your skin does.

Open answer: the idea explained simply in the learner's own words, with one correct fact.

5. Stretch: Describe how your body's barriers and white blood cells protect you from germs.

Open answer: a clear explanation using one or two facts from the module.

Worksheet, Ages 12–15 (31 items)

1. Diagram: 1. Epidermis; 2. Dermis; 3. Fat layer; 4. Hair; 5. Oil gland; 6. Sweat gland; 7. Blood vessel; 8. Nerve

2. Order: 1. 1796 Jenner makes the first vaccine; 2. 1847 Semmelweis shows handwashing saves lives; 3. 1861 Pasteur's experiments support germ theory; 4. 1882 Koch identifies the germ that causes tuberculosis; 5. 1928 Fleming discovers penicillin; 6. 1955 Polio vaccine introduced; 7. 1980 Smallpox declared wiped out

3. Source analysis

1. What did Fleming notice?

Mould had killed nearby bacteria, leaving a clear ring.

2. Why was this partly luck?

The mould contaminated a dish he left out by accident.

3. Why did it take many more years to use penicillin as a medicine?

It had to be purified and mass-produced (Florey and Chain in the 1940s).

4. Significance: Edward Jenner = English doctor who made the first vaccine, against smallpox, in 1796.; Louis Pasteur = French scientist who showed that germs cause disease and made more vaccines.; Alexander Fleming = Scottish scientist who discovered penicillin, the first antibiotic, in 1928.; Mary Seacole = Jamaican-born nurse who cared for soldiers in the Crimean War and treated illness with care and cleanliness.; Epidermis = The thin outer layer of the skin.

5. Cause and consequence

1. Explain why vaccinating many people protects those who cannot be vaccinated.

If most are immune, the germ cannot spread (herd immunity).

2. Explain one consequence of overusing antibiotics.

Bacteria become resistant, so infections are harder to treat.

6. Longer answers and 7. Essay

1. Explain how the skin helps control body temperature, hot and cold.

Hot: sweating, vessels widen. Cold: vessels narrow, hairs rise, shivering.

2. Describe two ways white blood cells destroy pathogens.

Engulfing (swallowing) germs; making antibodies that target specific germs (also antitoxins).

3. How did Jenner's vaccine work?

Cowpox infection gave immunity to related smallpox; the body learned to recognise it.

4. Why is hand washing such an important discovery?

Semmelweis showed it cut deaths in hospitals; removes pathogens before they spread.

5. Explain in your own words: Explain how a vaccine helps your body become immune.

Open answer: an accurate explanation in the learner's own words, with supporting detail.

6. Essay: 'Vaccines are the greatest medical discovery ever.' How far do you agree? Plan an essay.

Open answer: an introduction, paragraphs for and against with evidence from the module, and a reasoned conclusion.

Quiz

1. What is the largest organ of the body?

C. Skin

2. What gives skin its colour?

A. Melanin

3. What do antibodies do?

B. Mark germs for destruction

4. Who made the first vaccine?

B. Edward Jenner

5. Antibiotics work against...

B. Bacteria

6. How does sweat cool you?

B. It evaporates from the skin

7. Why do you rarely catch chickenpox twice?

Model answer: After the first infection, memory white blood cells remember the germ and make antibodies quickly, so it is destroyed before you get ill.

8. Why should you not ask for antibiotics for a cold?

Model answer: Colds are caused by viruses and antibiotics only kill bacteria; using them unnecessarily helps bacteria become resistant.

Checkpoints

Open answers. Look for the learner explaining the idea in their own words, with at least one accurate fact from the lesson.

Module 10: Keeping Healthy

Worksheet, Ages 8–11 (24 items)

1. Diagram: 1. Balanced plate; 2. Water; 3. Brushing teeth; 4. Sleep; 5. Exercise; 6. Handwashing; 7. Sun protection

2. Order: 1. c.400 BC Hippocrates teaches that diet and exercise affect health; 2. 1747 Lind shows citrus fruit prevents scurvy; 3. 1854 Nightingale improves hospital cleanliness; 4. 1945 Fluoride first added to drinking water to protect teeth

3. True or false: 1. True; 2. False; 3. True; 4. False

4. Match up: Nutrient = B; Carbohydrate = D; Protein = A; Vitamin = C

5. Short answers

1. Name one food that contains protein.

Beans, lentils, eggs, fish, meat, nuts, dairy.

2. How many times a day should you brush your teeth?

Twice, for two minutes.

3. Give one way to stay safe in the sun.

Sunscreen, hat, sunglasses, shade.

4. Explain in your own words: In your own words, explain what a balanced diet is and why it matters.

Open answer: the idea explained simply in the learner's own words, with one correct fact.

5. Stretch: Explain why water, sleep and exercise are all important for your body.

Open answer: a clear explanation using one or two facts from the module.

Worksheet, Ages 12–15 (30 items)

1. Diagram: 1. Balanced plate; 2. Water; 3. Brushing teeth; 4. Sleep; 5. Exercise; 6. Handwashing; 7. Sun protection

2. Order: 1. c.400 BC Hippocrates teaches that diet and exercise affect health; 2. 1747 Lind shows citrus fruit prevents scurvy; 3. 1796 Jenner's vaccine; 4. 1854 Nightingale improves

hospital cleanliness; 5. 1912 The word 'vitamine' is first used; 6. 1945 Fluoride first added to drinking water to protect teeth; 7. 1948 Founding of the World Health Organization

3. Source analysis

1. What did Lind find?

Sailors given oranges and lemons recovered fast from scurvy.

2. Why is his experiment called a fair test?

He gave different treatments to similar sailors and compared results.

3. Why did it take years for the navy to act on it?

Fruit was hard to store; ideas were slow to change; the cause, vitamin C, was unknown.

4. Significance: Hippocrates = Greek doctor (about 460–370 BC), often called the father of medicine, who said diet and exercise matter for health.; James Lind = Scottish naval doctor who showed in 1747 that citrus fruit prevents scurvy.; Florence Nightingale = English nurse who showed that clean hospitals save lives, in the 1850s.; Frederick Gowland Hopkins = English scientist who helped discover vitamins and won a Nobel Prize in 1929.; Nutrient = A substance in food that the body needs.

5. Cause and consequence

1. Explain why a diet high in sugar can cause health problems.

Tooth decay, weight gain, energy spikes; risk of disease.

2. Explain one consequence of Nightingale's work.

Cleaner hospitals and trained nurses reduced deaths.

6. Longer answers and 7. Essay

1. Explain the difference between carbohydrates and proteins in the diet.

Carbohydrates are mainly for energy; proteins are for growth and repair of cells.

2. Explain how sleep supports both the body and the brain.

Growth hormone released and repair happens; the brain stores memories and clears waste.

3. Why is mental health part of keeping healthy?

Feelings affect sleep, eating, learning and the body; looking after both matters.

4. What did James Lind's experiment show, and why was it important?

He compared treatments fairly; citrus cured scurvy: an early controlled trial and the idea of vitamins.

5. Explain in your own words: Choose one healthy habit and explain which body systems it helps.

Open answer: an accurate explanation in the learner's own words, with supporting detail.

6. Essay: 'Prevention is better than cure.' How far do you agree? Plan an essay.

Open answer: an introduction, paragraphs for and against with evidence from the module, and a reasoned conclusion.

Quiz

1. Which nutrient mainly gives energy?

B. Carbohydrate

2. About how much of your body is water?

C. 60%

3. How long should children be active each day?

B. 60 minutes

4. What is the hardest substance in the body?

B. Tooth enamel

5. What did James Lind find prevents scurvy?

B. Citrus fruit

6. Who showed clean hospitals save lives?

A. Florence Nightingale

7. How does exercise help at least two body systems?

Model answer: It strengthens the heart and circulation, improves the lungs, builds muscles and bones, and helps the brain with mood and concentration.

8. Why can too many sugary drinks harm teeth?

Model answer: Bacteria on teeth feed on sugar and make acid, which dissolves enamel and causes holes.

Checkpoints

Open answers. Look for the learner explaining the idea in their own words, with at least one accurate fact from the lesson.