SPM · KSSM FORM 4 + FORM 5 · ENGLISH (DLP)

Biology Infographic Notes

One picture page per chapter

- 📄 **28** chapter pages
- ✍️ **84** quick-check questions
- ✅ Worked answers
- 🔤 English–BM glossary
- 📐 Formula / key terms box
- ⚠️ Common mistake box



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Worked answers to every Quick Check	**31**
English–BM key terms glossary	**35**

1. Look at the picture first
The middle diagram shows the whole chapter. Cover the side cards and explain it out loud.

2. Learn the two boxes
The yellow box has the formulas and key words. The red box shows the mistake most students make.

3. Do the Quick Check
Answer the 3 questions on paper, then check the worked answers at the back.

BIOLOGY · FORM 4 · CHAPTER 2

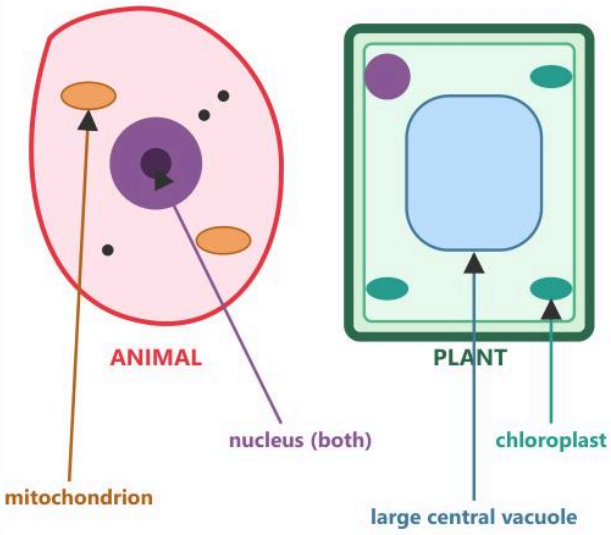
Cell Biology and Cell Organisation

Nucleus
Holds DNA; controls all cell activities.

Mitochondrion
Site of aerobic respiration; releases energy (ATP).

Ribosome + RER
Ribosomes make protein; RER carries it. Golgi apparatus packs and sends it out.

Animal cell vs Plant cell



Plant cell ONLY: cellulose cell wall, chloroplasts, large central vacuole, fixed regular shape
Animal cell ONLY: centrioles, irregular shape, small temporary vacuoles, stores glycogen

Chloroplast
Has chlorophyll; site of photosynthesis (plant cells).

Levels
Cell → tissue → organ → system → organism.

Unicellular
Amoeba, Paramecium: one cell does everything (move, feed, reproduce).

FORMULA / KEY TERMS

- **Organelle**: a structure with a special job inside a cell
- **Tissue**: group of similar cells doing one job
- **Organ**: different tissues working together
- **Lysosome**: digestive enzymes; breaks down old organelles

COMMON MISTAKE

❌ "Plant cells have no mitochondria because they photosynthesise."

✅ Plant cells HAVE mitochondria. They respire all the time, day and night.

QUICK CHECK (worked answers at the back, page 31)

1. Name TWO structures found in a plant cell but not in an animal cell, and give one function of each.
2. Pancreas cells make a lot of enzymes. Which organelles would they have many of? Explain.
3. Arrange in order: organ, cell, system, tissue, organism.

Movement of Substances across a Plasma Membrane

Osmosis

Water moves from a dilute solution (high water potential) to a concentrated one through a partially permeable membrane.

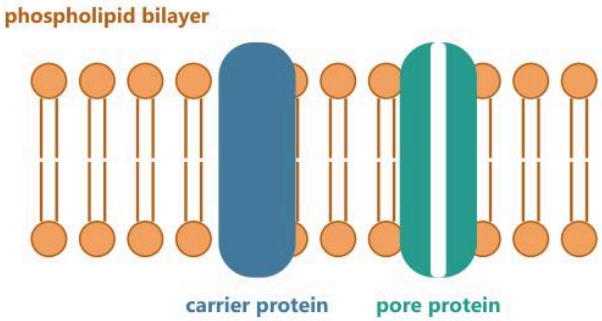
Isotonic

Same concentration as cell sap: no net water movement.

Hypotonic

More dilute outside: water goes IN. Red blood cell bursts (haemolysis); plant cell becomes turgid.

Fluid mosaic model



HIGH concentration → LOW

Simple diffusion: O_2, CO_2, lipids
Facilitated diffusion: glucose, amino acids (carrier / pore protein, no ATP)
Osmosis: WATER through a partially permeable membrane

LOW → HIGH (needs ATP)

Active transport: carrier protein + ATP
e.g. Na^+/K^+ pump, mineral ions into root hairs

Hypertonic

More concentrated outside: water goes OUT. Red cell shrinks (crenation); plant cell plasmolyses.

Daily life

Salted fish keeps longer: bacteria lose water by osmosis. Wilted veg gets crisp in plain water.

Active transport

Against the gradient; needs carrier protein + ATP.

📐 FORMULA / KEY TERMS

- **Passive**: high → low, no ATP (diffusion, facilitated diffusion, osmosis)
- **Active**: low → high, uses ATP
- **Plasmolysis**: plasma membrane pulls away from the cell wall
- **Deplasmolysis**: plasmolysed cell put in water recovers

⚠️ COMMON MISTAKE

❌ "Water moves from low concentration to high concentration."

✅ Say which concentration: water moves from a region of HIGH WATER potential (dilute) to LOW water potential (concentrated).

✍️ QUICK CHECK (worked answers at the back, page 31)

1. A red blood cell is put in distilled water. Describe and explain what happens.
2. Why does a root hair cell take in mineral ions by active transport?
3. A potato strip loses mass in 0.8 M sucrose. Name the type of solution and explain.

BIOLOGY · FORM 4 · CHAPTER 5

Metabolism and Enzymes

Metabolism

All chemical reactions in a cell: anabolism (build up) + catabolism (break down).

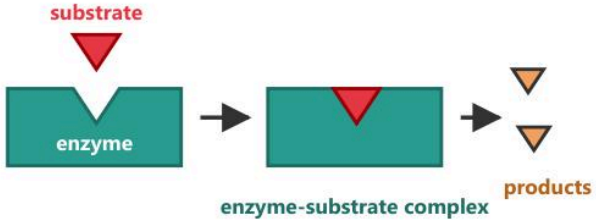
Enzymes

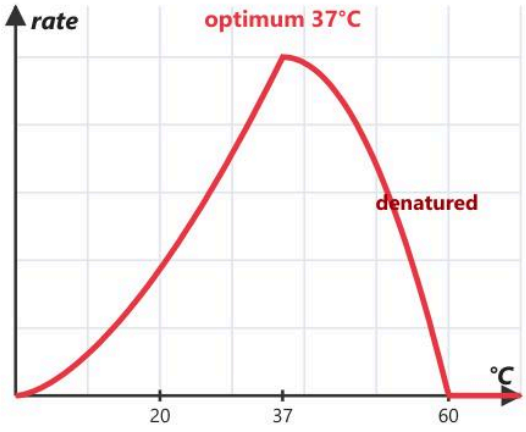
Protein catalysts; speed up reactions; not used up; specific to one substrate.

Temperature

Rate rises to the optimum (≈37°C in humans); above it the active site changes shape: denatured.

Lock-and-key hypothesis





pH

Pepsin works best at pH 2; salivary amylase ≈ pH 7; trypsin ≈ pH 8.

Concentration

More substrate or enzyme → faster, until something else limits.

Uses

Biological washing powder (protease, lipase), meat tenderiser (papain), cheese (rennin).

FORMULA / KEY TERMS

- **Active site**: the part of the enzyme the substrate fits into
- **Intracellular** enzyme works inside the cell
- **Extracellular** enzyme is secreted out (digestive enzymes)
- Naming: substrate + "-ase" (lipase, protease)

COMMON MISTAKE

❌ "At low temperature the enzyme is denatured."

✅ Low temperature only makes it INACTIVE (slow).

Denaturation happens at high temperature or extreme pH and is permanent.

QUICK CHECK (worked answers at the back, page 31)

1. Explain why the rate of an enzyme reaction falls above the optimum temperature.
2. Why does pepsin stop working when it enters the duodenum?
3. Give one industrial use of enzymes.

Cellular Respiration

Why respire?

To release energy from food (glucose) as ATP for every life process.

Aerobic

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 2898$ kJ

Oxygen debt

Hard exercise: muscles make lactic acid. Later you breathe fast to oxidise it.

	Aerobic	Anaerobic (muscle)	Fermentation (yeast)
Oxygen	needed	not needed	not needed
Glucose broken down	completely	partly	partly
Products	$CO_2 + H_2O$	lactic acid	ethanol + CO_2
Energy	2898 kJ (a lot)	150 kJ	210 kJ
Where	cytoplasm + mitochondria	cytoplasm	cytoplasm

Yeast

Glucose → ethanol + CO_2 + 210 kJ. Used for bread and tapai.

Lactic bacteria

Make yoghurt and cheese from milk.

Energy

Aerobic gives far more energy per glucose than anaerobic.

FORMULA / KEY TERMS

- Aerobic: glucose + oxygen → carbon dioxide + water + energy
- Muscle (anaerobic): glucose → lactic acid + energy
- Yeast: glucose → ethanol + carbon dioxide + energy
- **ATP** = energy carrier of the cell

COMMON MISTAKE

❌ "Plants only respire at night."

✅ Plants respire ALL the time. In daylight, photosynthesis is just faster than respiration.

QUICK CHECK (worked answers at the back, page 31)

1. Write the word equation for anaerobic respiration in human muscle.
2. Why does a runner keep breathing fast after a race?
3. Why does bread dough rise?

Transport in Humans and Animals

Arteries

Carry blood AWAY from the heart; thick, elastic, muscular walls; high pressure.

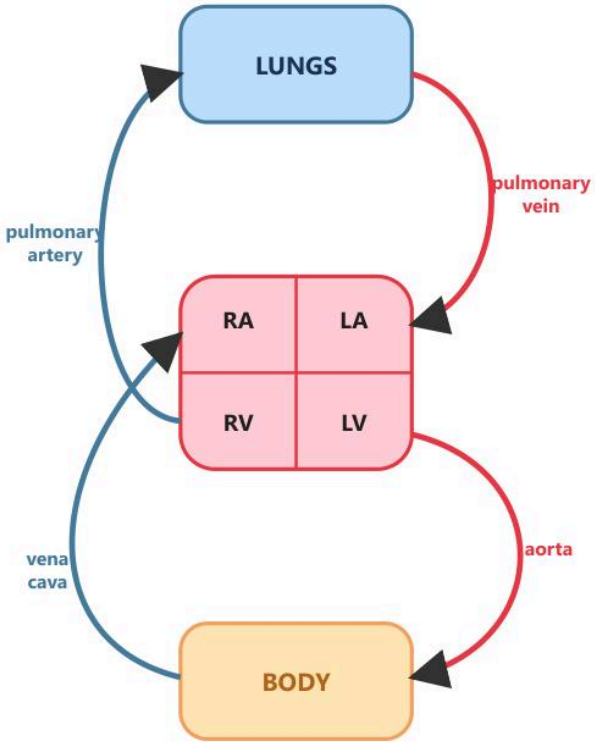
Veins

Carry blood TO the heart; thin walls, valves, low pressure.

Capillaries

One cell thick: exchange of substances with cells.

Double circulation (human)



red = oxygenated · blue = deoxygenated

Blood

Plasma, red cells (O_2), white cells (defence), platelets (clotting).

Clotting

Platelets + thromboplastin → prothrombin → thrombin → fibrinogen → fibrin threads.

Lymph

Tissue fluid not returned to blood drains into lymph vessels → back to veins.

FORMULA / KEY TERMS

- **Double circulation**: pulmonary (heart–lungs) + systemic (heart–body)
- Left ventricle has the thickest wall (pumps to the whole body)
- Blood pressure ≈ 120/80 mmHg (systolic/diastolic)
- Blood groups A, B, AB, O; O = universal donor, AB = universal recipient

COMMON MISTAKE

❌ "Arteries always carry oxygenated blood."

✅ The PULMONARY ARTERY carries deoxygenated blood to the lungs; the pulmonary vein carries oxygenated blood.

QUICK CHECK (worked answers at the back, page 32)

1. Why is the wall of the left ventricle thicker than the right?
2. State the function of the valves in veins.
3. Describe how blood clots at a cut.

Worked Answers (1/4)

Form 4 Chapter 1: Introduction to Biology and Laboratory Rules

1. Manipulated: light intensity (distance of lamp). Responding: rate of photosynthesis (number of bubbles per minute).
2. "The higher the light intensity, the higher the rate of photosynthesis."
3. Any two: wear gloves; seal the Petri dish with tape; never open it to smell; autoclave before throwing away; wash hands.

Form 4 Chapter 2: Cell Biology and Cell Organisation

1. Cell wall: gives shape and support. Chloroplast: photosynthesis. (Or large central vacuole: keeps the cell turgid.)
2. Many ribosomes/rough ER (make protein enzymes) and Golgi apparatus (pack and secrete them); many mitochondria for energy.
3. Cell → tissue → organ → system → organism.

Form 4 Chapter 3: Movement of Substances across a Plasma Membrane

1. Distilled water is hypotonic. Water enters the cell by osmosis; there is no cell wall, so it swells and bursts (haemolysis).
2. The ions are more concentrated inside the root hair than in the soil, so they must move against the gradient; this needs carrier proteins and ATP.
3. Hypertonic. Water moves out of the potato cells by osmosis, so the cells become flaccid/plasmolysed and the strip gets lighter.

Form 4 Chapter 4: Chemical Composition in a Cell

1. Peptide bond; formed by condensation (a water molecule is removed).
2. Water molecules are polar, so many ions and polar molecules dissolve in it; reactions and transport happen in solution.
3. Maltose = glucose + glucose; sucrose = glucose + fructose; lactose = glucose + galactose.

Form 4 Chapter 5: Metabolism and Enzymes

1. Heat breaks the bonds holding the enzyme's shape; the active site changes, the substrate no longer fits, so the enzyme is denatured.
2. The duodenum is alkaline (about pH 8); pepsin's optimum is pH 2, so its active site changes and it stops working.
3. Any one: protease in washing powder; papain to tenderise meat; rennin for cheese; zymase/yeast for bread and fermentation.

Form 4 Chapter 6: Cell Division

1. Mitosis: 2 cells, diploid, identical, no crossing over. Meiosis: 4 cells, haploid, different, crossing over happens.
2. Metaphase.
3. So that when two gametes fuse at fertilisation the zygote gets the normal diploid number (23 + 23 = 46).

Form 4 Chapter 7: Cellular Respiration

1. Glucose → lactic acid + energy (150 kJ).
2. To repay the oxygen debt: extra oxygen is needed to break down the lactic acid built up in the muscles.
3. Yeast ferments the sugar and gives off carbon dioxide; the gas bubbles make the dough rise.

Form 4 Chapter 8: Respiratory Systems in Humans and Animals

1. Any three: wall one cell thick; moist surface; very large total surface area; dense network of capillaries.
2. External intercostal muscles contract, ribs move up and out, diaphragm contracts and flattens; thoracic volume increases, pressure falls below air pressure, so air rushes in.
3. It combines with haemoglobin (carboxyhaemoglobin) more strongly than oxygen, so the blood carries less oxygen.

Form 4 Chapter 9: Nutrition and the Human Digestive System

1. Pepsin; protein → polypeptides.
2. Any two: thin epithelium one cell thick; microvilli give a large surface area; dense capillary network; lacteal in the centre.
3. Deamination: the amine group is removed and turned into urea, which is excreted by the kidneys; the rest is used for energy.

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