

List 20 high-probability exam questions by chapter

1. Describe the structure and function of the nucleus, mitochondria, and ribosomes in a cell.

Model Answer:

- The nucleus contains genetic material (DNA) and controls cell activities.
- Mitochondria are organelles where aerobic respiration occurs and energy (ATP) is produced.
- Ribosomes are sites of protein synthesis and may be free or attached to the endoplasmic reticulum.

Marking Rubric:

- 1 mark for nucleus function
- 1 mark for nucleus structure (contains DNA)
- 1 mark for mitochondria function
- 1 mark for mitochondria description as site of respiration/energy production
- 1 mark for ribosome function
- 1 mark for ribosome location (free/attached)
- Max 6 marks

2. Compare the structure and functions of plant and animal cells.

Model Answer:

- Both have a cell membrane, cytoplasm, nucleus, mitochondria, and ribosomes.
- Plant cells have a cell wall (made of cellulose), chloroplasts (for photosynthesis), and a large permanent vacuole.
- Animal cells do not have a cell wall or chloroplasts and usually have small vacuoles.

Marking Rubric:

- 2 marks for common features of both (cell membrane, nucleus, etc.)
- 1 mark for plant cell wall description
- 1 mark for chloroplasts function

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- 1 mark for vacuole size difference
- 1 mark for absence of wall/chloroplasts in animal cells
- Max 6 marks

3. Explain how specialized cells are adapted to their functions (e.g., root hair cell, red blood cell).

Model Answer:

- Root hair cells have long extensions to increase surface area for water absorption.
- Red blood cells have a biconcave shape to increase surface area and no nucleus to carry more oxygen.
- They contain hemoglobin to bind oxygen efficiently.

Marking Rubric:

- 1 mark for root hair cell shape
- 1 mark for root hair cell function
- 1 mark for red blood cell shape
- 1 mark for absence of nucleus in RBC
- 1 mark for hemoglobin function
- Max 5 marks

4. Explain how enzymes work using the lock-and-key model.

Model Answer:

- Enzymes have an active site with a specific shape.
- The substrate fits exactly into the active site like a key in a lock.
- The enzyme-substrate complex forms, allowing the reaction to occur.
- The product is released, and the enzyme remains unchanged.

Marking Rubric:

- 1 mark for active site shape specificity

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- 1 mark for substrate fitting
- 1 mark for enzyme-substrate complex formation
- 1 mark for product release
- 1 mark for enzyme unchanged
- Max 5 marks

5. Describe the role of enzymes in the human digestive system.

Model Answer:

- Enzymes break down large food molecules into smaller soluble molecules.
- Amylase breaks down starch into maltose.
- Protease breaks down proteins into amino acids.
- Lipase breaks down lipids into glycerol and fatty acids.

Marking Rubric:

- 1 mark for general enzyme role
- 1 mark each for naming and role of amylase, protease, lipase
- Max 4 marks

6. Discuss factors that affect enzyme activity.

Model Answer:

- Temperature: Enzyme activity increases up to an optimum temperature; beyond that, enzymes denature and activity decreases.
- pH: Each enzyme has an optimum pH; deviations cause reduced activity or denaturation.
- Substrate concentration: Increasing substrate increases activity until enzymes are saturated.
- Enzyme concentration: More enzyme molecules increase activity if substrate is sufficient.

Marking Rubric:

- 1 mark for temperature effect explanation
- 1 mark for denaturation concept at high temperature

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- 1 mark for pH optimum concept
 - 1 mark for substrate concentration effect
 - 1 mark for enzyme concentration effect
 - Max 5 marks
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7. Describe the structure and function of xylem vessels.

Model Answer:

- Xylem vessels are long, hollow tubes made of dead cells.
- They have thick, lignified walls for support and to prevent collapse.
- They transport water and minerals from roots to leaves.

Marking Rubric:

- 1 mark for tube structure of xylem
 - 1 mark for dead cells description
 - 1 mark for lignified walls and support
 - 1 mark for movement of water and minerals
 - Max 4 marks
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8. Explain how water moves from the roots to the leaves.

Model Answer:

- Water is absorbed by root hair cells by osmosis.
- It moves through the cortex to the xylem vessels.
- Water moves upwards in xylem due to transpiration pull.
- Cohesion and adhesion between water molecules help to pull water upwards.

Marking Rubric:

- 1 mark for osmosis at root hair cells
- 1 mark for movement through cortex
- 1 mark for transpiration pull
- 1 mark for cohesion and adhesion explanation

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- Max 4 marks
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9. Describe the process of translocation in phloem.

Model Answer:

- Translocation moves sugars (mainly sucrose) from source (leaves) to sink (roots, fruits).
- Sugars are actively transported into phloem sieve tubes at source.
- Water enters by osmosis, creating high pressure.
- The pressure difference pushes the sugar solution to sinks where sugars are removed.

Marking Rubric:

- 1 mark for source to sink movement
 - 1 mark for active transport of sugars
 - 1 mark for osmosis of water into phloem
 - 1 mark for pressure flow and unloading at sink
 - Max 4 marks
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10. Describe the structure and function of the heart.

Model Answer:

- The heart has four chambers: two atria and two ventricles.
- Right side pumps deoxygenated blood to lungs.
- Left side pumps oxygenated blood to the body.
- Valves prevent backflow of blood.

Marking Rubric:

- 1 mark for four chambers
- 1 mark for right side pumping deoxygenated blood
- 1 mark for left side pumping oxygenated blood
- 1 mark for valve function

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- Max 4 marks

11. Explain how oxygen is transported in the blood.

Model Answer:

- Oxygen binds to hemoglobin in red blood cells forming oxyhemoglobin.
- Oxygen is transported mainly in this form.
- When reaching tissues, oxygen dissociates for use in cellular respiration.

Marking Rubric:

- 1 mark for oxygen binding to hemoglobin
- 1 mark for formation of oxyhemoglobin
- 1 mark for transport in red blood cells
- 1 mark for release/dissociation at tissues
- Max 4 marks

12. Outline the process of gas exchange in the lungs.

Model Answer:

- Air enters alveoli where gas exchange occurs.
- Oxygen diffuses from alveoli into blood capillaries.
- Carbon dioxide diffuses from blood into alveoli to be exhaled.
- Thin alveolar walls and large surface area aid diffusion.

Marking Rubric:

- 1 mark for oxygen diffusion to blood
- 1 mark for carbon dioxide diffusion to alveoli
- 1 mark for thin walls aiding diffusion
- 1 mark for large surface area
- Max 4 marks

13. Describe the structure and function of neurons.

Model Answer:

- Neurons have dendrites (receive signals), a cell body (contains nucleus), and an axon (transmits impulses).
- Axon may be covered with myelin sheath for faster transmission.
- Synapses allow transmission to next neuron or effector.

Marking Rubric:

- 1 mark for dendrites function
- 1 mark for cell body contents
- 1 mark for axon function
- 1 mark for myelin sheath role
- 1 mark for synapse function
- Max 5 marks

14. Explain how nerve impulses are transmitted.

Model Answer:

- Nerve impulse is a electrical signal moving along the neuron.
- It involves movement of ions across the membrane creating action potentials.
- Impulse jumps across synapses using neurotransmitters.

Marking Rubric:

- 1 mark for electrical signal description
- 1 mark for ion movement across membrane
- 1 mark for action potential concept
- 1 mark for neurotransmitter role at synapse
- Max 4 marks

15. Discuss the role of insulin in blood glucose regulation.

Model Answer:

- Insulin is a hormone produced by the pancreas.
- It lowers blood glucose by enabling uptake into cells.
- Excess glucose is stored as glycogen in liver and muscle.

Marking Rubric:

- 1 mark for insulin production location
- 1 mark for lowering blood glucose
- 1 mark for glucose uptake by cells
- 1 mark for glycogen storage
- Max 4 marks

16. Explain the flow of energy through a food chain.

Model Answer:

- Energy enters the food chain via producers (plants) using photosynthesis.
- It flows to primary consumers (herbivores) and then to secondary/tertiary consumers (carnivores).
- Energy is lost as heat at each trophic level.

Marking Rubric:

- 1 mark for energy input by producers
- 1 mark for transfer through consumers
- 1 mark for energy loss as heat
- Max 3 marks

17. Describe adaptations of organisms to their environment.

Model Answer:

- Adaptations can be structural (e.g., thick fur in cold climates).

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- Behavioral (e.g., migration to warmer areas).
- Physiological (e.g., hibernation to conserve energy).

Marking Rubric:

- 1 mark for each type of adaptation explained (max 3)
- Max 3 marks

18. Discuss the impact of human activity on ecosystems.

Model Answer:

- Pollution can damage habitats and reduce biodiversity.
- Deforestation destroys habitats and affects carbon cycle.
- Overfishing can disrupt aquatic food chains.

Marking Rubric:

- 1 mark for pollution impact
- 1 mark for deforestation impact
- 1 mark for overfishing or other human impact
- Max 3 marks

19. Explain the process of photosynthesis including light and dark reactions.

Model Answer:

- Photosynthesis occurs in chloroplasts.
- Light reactions use sunlight to produce ATP and NADPH.
- Dark reactions (Calvin cycle) use ATP and NADPH to convert CO₂ into glucose.

Marking Rubric:

- 1 mark for chloroplast location
- 1 mark for light reaction role
- 1 mark for dark reaction role
- 1 mark for glucose production

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- Max 4 marks
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20. Compare aerobic and anaerobic respiration in terms of energy production.

Model Answer:

- Aerobic respiration uses oxygen to produce large amounts of ATP.
- Anaerobic respiration occurs without oxygen producing less ATP and lactic acid in animals.
- Aerobic respiration: glucose + oxygen → carbon dioxide + water + energy.
- Anaerobic respiration: glucose → lactic acid + energy.

Marking Rubric:

- 1 mark for oxygen use in aerobic
- 1 mark for ATP difference
- 1 mark for lactic acid production in anaerobic
- 1 mark for chemical equations or description
- Max 4 marks

List of 20 high-probability exam questions for Cambridge IGCSE Biology 610 Paper 6 extended

1. Describe how to prepare and observe a stained specimen (e.g., onion epidermis) under a microscope.

Model Answer:

- Peel a thin layer of onion epidermis.
- Place it on a microscope slide.
- Add a few drops of stain (e.g., iodine) to highlight cell structures.
- Gently lower a coverslip to avoid air bubbles.
- Observe under low then high power objectives.

Marking Rubric:

- 1 mark for peeling thin layer
- 1 mark for placing on slide
- 1 mark for applying correct stain
- 1 mark for proper coverslip placement
- 1 mark for observing at increasing magnifications
- Max 5 marks

2. Explain how to calculate magnification using a scale bar or diagram.

Model Answer:

- Measure the length of the scale bar on the diagram using a ruler.
- Know the actual length that the scale bar represents.
- Calculate magnification by dividing the measured length by the actual length.

Marking Rubric:

- 1 mark for measuring scale bar length
- 1 mark for knowing actual scale length

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- 1 mark for correct magnification formula (measured length ÷ actual length)
- Max 3 marks

3. Describe how to measure cell size using a microscope and graticule.

Model Answer:

- Calibrate the eyepiece graticule using a stage micrometer.
- Count how many graticule units fit across the cell.
- Convert graticule units to actual distance using calibration.
- Record cell length or width.

Marking Rubric:

- 1 mark for calibration using stage micrometer
- 1 mark for counting units across cell
- 1 mark for converting units to actual size
- Max 3 marks

4. Design an experiment to investigate the effect of temperature or pH on enzyme activity.

Model Answer:

- Use a measurable reaction involving the enzyme (e.g., amylase breaking down starch).
- Prepare test tubes with starch and enzyme solutions.
- Vary the temperature/pH in each tube (use water baths/pH buffers).
- Measure the time taken for starch to break down using iodine test.
- Record the results and repeat for accuracy.

Marking Rubric:

- 1 mark for defining independent variable (temperature/pH)
- 1 mark for controlling other variables (concentration, time)
- 1 mark for method to measure activity (iodine test)

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- 1 mark for repeating for reliability
- Max 4 marks

5. Explain how to measure reaction rate from a graph or experimental data.

Model Answer:

- Identify the quantity that changes over time (e.g., gas volume, concentration).
- Calculate the gradient of the curve by drawing a tangent (change in y ÷ change in x).
- Use initial rates if the curve levels off later.

Marking Rubric:

- 1 mark for identifying quantity changed over time
- 1 mark for drawing tangent to curve
- 1 mark for calculating gradient correctly
- 1 mark for using initial rate where applicable
- Max 4 marks

6. Discuss variables to control in enzyme experiments to ensure reliable results.

Model Answer:

- Control enzyme concentration so it's constant in all tests.
- Use the same substrate concentration.
- Maintain constant temperature or pH except for the variable being tested.
- Use the same incubation time for each test.
- Use replicates to reduce anomalies.

Marking Rubric:

- 1 mark for enzyme concentration control
- 1 mark for substrate concentration control
- 1 mark for temperature or pH control
- 1 mark for consistent incubation time
- 1 mark for use of replicates

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- Max 5 marks
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7. Describe a practical method to measure the rate of transpiration using a potometer.

Model Answer:

- Assemble the potometer ensuring airtight seals.
- Cut a leafy shoot underwater and insert into the potometer.
- Record the starting position of an air bubble in the capillary tube.
- Measure the distance moved by the bubble over a set time.
- Calculate transpiration rate as distance moved/time.

Marking Rubric:

- 1 mark for airtight setup
 - 1 mark for underwater cutting and insertion
 - 1 mark for recording start position of bubble
 - 1 mark for measuring bubble movement over time
 - 1 mark for calculating rate
 - Max 5 marks
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8. Explain how to investigate the effect of environmental factors (light, humidity, wind) on transpiration rate.

Model Answer:

- Change one factor while keeping others constant.
- For light, vary light intensity using lamps or shading.
- For humidity, use a plastic bag or spray water to increase humidity.
- For wind, use a fan to blow air across the leaves.
- Measure transpiration rate with potometer for each condition.

Marking Rubric:

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- 1 mark for changing one factor at a time
- 1 mark for describing variation in light intensity
- 1 mark for describing variation in humidity
- 1 mark for describing variation in wind
- 1 mark for measuring transpiration rate accurately
- Max 5 marks

9. Suggest improvements for increasing the reliability of transpiration experiments.

Model Answer:

- Use multiple replicates and calculate the average.
- Ensure airtight seals to prevent leaks.
- Maintain constant temperature and other environmental variables.
- Calibrate the potometer before use.
- Use fresh leafy shoots of similar size.

Marking Rubric:

- 1 mark each for replicates, airtight seals, constant variables, calibration, uniform samples
- Max 5 marks

10. Design an experiment to investigate osmosis using potato cylinders or visking tubing.

Model Answer:

- Prepare equal-sized potato cylinders or fill visking tubing with sugar solution.
- Place samples in solutions of different concentrations.
- After a set time, measure mass or length change.
- Calculate percentage change to determine water movement.
- Keep temperature and time constant.

Marking Rubric:

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- 1 mark for preparation of samples
- 1 mark for using different concentration solutions
- 1 mark for measuring change (mass/length)
- 1 mark for using percentage change calculation
- 1 mark for controlling temperature and time
- Max 5 marks

11. Explain how to calculate percentage change in mass for osmosis experiments.

Model Answer:

- Percentage change = $[(\text{final mass} - \text{initial mass}) \div \text{initial mass}] \times 100$.
- Positive value indicates water uptake; negative value indicates water loss.

Marking Rubric:

- 1 mark for correct formula
- 1 mark for explaining meaning of positive/negative values
- Max 2 marks

12. Describe factors affecting rate of diffusion or osmosis.

Model Answer:

- Concentration gradient: greater gradient increases rate.
- Temperature: higher temperature increases kinetic energy and rate.
- Surface area: larger surface area increases rate.
- Distance: shorter distance increases rate.

Marking Rubric:

- 1 mark for each factor explained (max 4)
- Max 4 marks

13. Describe a practical method to measure the rate of photosynthesis (e.g., volume of oxygen produced by pondweed).

Model Answer:

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- Place pondweed in water under a light source.
- Collect oxygen bubbles produced in a capillary tube or syringe.
- Measure volume or count bubbles over time.
- Vary light intensity by changing distance to light.

Marking Rubric:

- 1 mark for setup with pondweed and light source
- 1 mark for collection method for oxygen
- 1 mark for measuring oxygen production
- 1 mark for varying light intensity
- Max 4 marks

14. Explain how to vary light intensity or carbon dioxide concentration in photosynthesis experiments.

Model Answer:

- Change light intensity by varying distance of light source or using filters.
- Change CO₂ by adding sodium bicarbonate to water or enclosing apparatus in different CO₂ atmospheres.

Marking Rubric:

- 1 mark for light intensity variation method
- 1 mark for CO₂ concentration variation method
- Max 2 marks

15. Discuss how to control or measure temperature in practical photosynthesis setups.

Model Answer:

- Use water baths to maintain constant temperature.
- Use thermometers to monitor temperature.
- Perform experiments in temperature-controlled rooms.

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

Marking Rubric:

- 1 mark for method to control temperature
 - 1 mark for method to measure temperature
 - Max 2 marks
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16. Describe how to use a colorimeter to measure concentration in a solution.

Model Answer:

- Calibrate colorimeter with a blank (distilled water).
- Place test solution in cuvette in colorimeter.
- Measure absorbance of light passed through solution.
- Use a calibration curve to relate absorbance to concentration.

Marking Rubric:

- 1 mark for calibration with blank
 - 1 mark for placing test solution correctly
 - 1 mark for measuring absorbance
 - 1 mark for using calibration curve
 - Max 4 marks
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17. Explain how to draw accurate and fully labeled scientific diagrams from microscopic observations.

Model Answer:

- Use pencil and draw clear outline, no shading.
- Draw to correct proportion or magnification.
- Label all key structures with straight lines ending near but not on the drawing.
- Include title and magnification.

Marking Rubric:

- 1 mark for pencil use and neatness

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- 1 mark for proportional drawing
 - 1 mark for correct labeling
 - 1 mark for including title and magnification
 - Max 4 marks
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18. Discuss the importance of replicates and control variables in practical biology investigations.

Model Answer:

- Replicates reduce effect of random errors and increase reliability.
- Controlling variables ensures only the independent variable affects results.
- Both improve validity and accuracy of conclusions.

Marking Rubric:

- 1 mark for replicates purpose
 - 1 mark for control variables purpose
 - 1 mark for overall impact on reliability and validity
 - Max 3 marks
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19. Outline how to safely handle and dispose of biological samples and reagents.

Model Answer:

- Wear gloves and goggles as necessary.
- Follow disposal instructions (e.g., bleach or biohazard waste for biological samples).
- Avoid contamination by using clean equipment.
- Handle acids/alkalis with care and use fume hood if required.

Marking Rubric:

- 1 mark for personal protective equipment
- 1 mark for correct disposal methods

LIST OF 20 HIGH-PROBABILITY EXAM QUESTIONS

- 1 mark for clean technique
 - 1 mark for handling hazardous reagents safely
 - Max 4 marks
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20. Explain how to present experimental data clearly using tables and graphs.

Model Answer:

- Tables should have clear headings with units.
- Use consistent decimal places.
- Graphs should have labeled axes with units and a title.
- Choose appropriate graph type (line, bar).
- Plot points accurately and join with best fit curve or straight lines.

Marking Rubric:

- 1 mark for clear, labeled tables
- 1 mark for axis label and units on graphs
- 1 mark for title on graphs
- 1 mark for accurate plotting and appropriate graph type
- Max 4 marks