Zig Zag Education

**Biology**

AS & A Level | WJEC | 2400


# Topic Tests

## for WJEC AS Biology

**zigzageducation.co.uk**

**POD 7083**

# Contents

# Teacher's Introduction

These topic tests have been designed to help you and your students assess their knowledge of a topic after you have taught each section of the **WJEC AS Biology specification**. Each topic test is closely tied to the WJEC specification, ensuring all aspects of the course will be covered. The units covered in these tests are Unit 1 and Unit 2. The table on the right shows the number of marks given for each topic within the two units.

**Remember!**
Always check the exam board website for new information, including changes to the specification and sample assessment material.

Each topic test provides a variety of question styles, including:

- **Quick-testing questions** – these test basic understanding and knowledge of terminology, and allow immediate identification of weaker topics
- **Long-answer questions** – these are exam-style questions that require use of comprehensive knowledge and aid practice of writing skills and exam technique
- **Missing information questions** – these allow key knowledge to be tested without it being time-consuming and provide context for further questions
- **Diagram and graph-dependent questions** – these require identification of features, interpretation of data and application of knowledge, as well as testing mathematical skills
- **Practical questions** – cover aspects of practicals from planning and risk awareness to data analysis and evaluation, as well as testing all mathematical skills.
- **Context-dependent questions** – these push students to apply their knowledge to unfamiliar situations, spot key points within provided information and draw on multiple aspects of the course.

| AS Unit 1: Basic Biochemistry and Cell Organisation | |
|---|---|
| **Topic number** | **Number of marks** |
| 1 | 36 + 44 |
| 2 | 49 |
| 3 | 45 |
| 4 | 40 |
| 5 | 48 + 45 |
| 6 | 40 |

| AS Unit 2: Biodiversity and Physiology of Body Systems | |
|---|---|
| **Topic number** | **Number of marks** |
| 1 | 50 |
| 2 | 50 |
| 3 | 50 + 49 |
| 4 | 47 |

Tests have been aimed to take approximately 45 minutes and contain on average between 40 and 50 marks, though please note that this has not been possible where topics are brief and introductory or require more detailed knowledge and assessment. Larger topics have been split into two tests. All information for a question is provided within the test; however, some questions will require use of a calculator and ruler.

Students are able to see the number of marks allocated for each question, allowing them to judge the detail required in their answers as in exam conditions. Full answers are at the end of the resource and are accompanied by marker instructions, providing quick guidelines on what answers would and would not be accepted in exam conditions.

All diagrams and graphs have been designed with black-and-white photocopying in mind, so key features will not be lost.

We hope you find these tests useful during your teaching.



# 1. All organisms are related through their evo

1. a) What is a species?
   b) What is a binomial name? Why is it useful for every species to ha

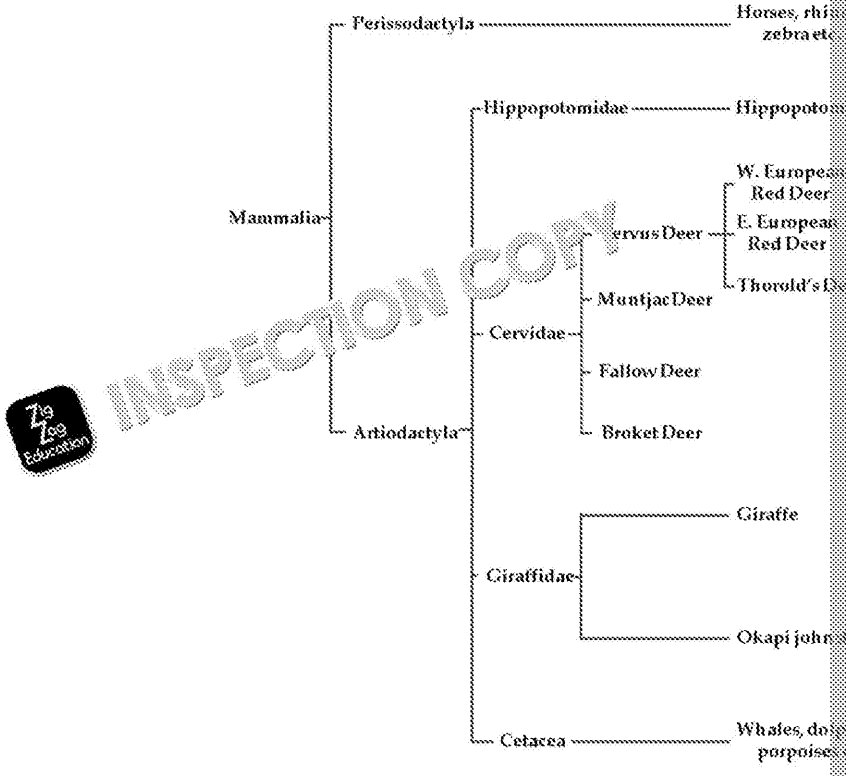
2. Copy and fill in the following taxonomic hierarchy:

Highest – Domain ⟶ _____ _____ _____ _____ ____

3. Copy and fill in the missing inform[illegible] the table describing feature

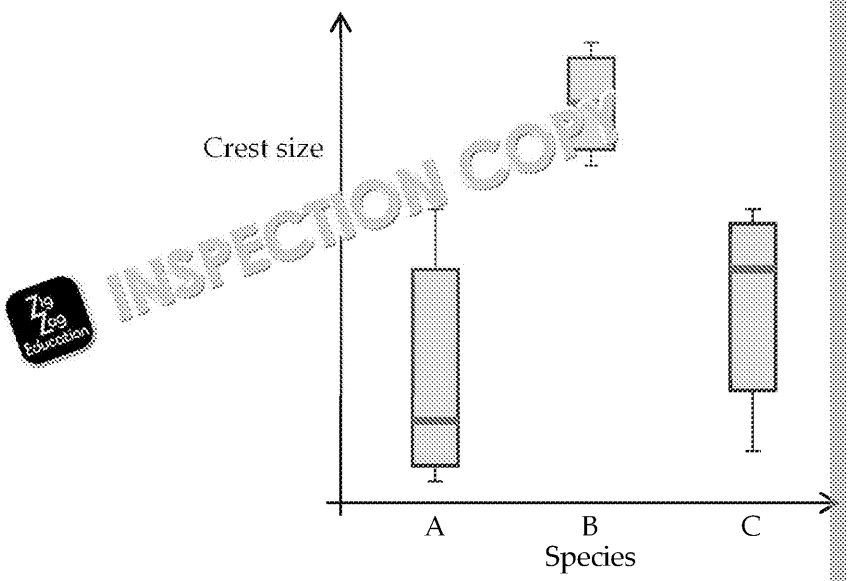
| Domain | [illegible] | Archaea | |
|---|---|---|---|
| King | | | Animals, |
| Features | Single-celled prokaryotes | | Single |
| | Small 70S ribosomes | Small 70S ribosomes | |
| | | | Cellu |

4. Phylogenetic relationships show evolutionary relationships, and are f
of different organisms.
Name a method used to assess DNA at the molecular level
Use the phylogenetic classification diagram below to answer the follo
   a) What is the closest related order to artiodactyla?
   b) Whales, dolphins and porpoises all belong to one family. Identify
   c) What genus do red deer belong to?
   d) What is the closest related species to the giraffes?



5. Which three molecules can be used to assess genetic diversity?

6. The graph below shows the mean crest size (solid bar) in three differe
of the box shows 90% standard deviation and the extending lines enc
   a) Explain the difference between 'mean' and 'standard deviation'.
   b) Explain why two species could still be considered the same specie
   considered a separate species, based on their crest size.




7. Define 'biodiversity'.

8. Simpson's Diversity Index allows calculation of a habitat's diversity.
   a) State the formula for Simpson's Diversity Index.
   b) Calculate the diversity of the two habitats using the species data b
   c) Explain which habitat is agricultural land and which is ancient fo
   d) What species is the farmer growing?
   e) What species has become locally extinct on the farm?

| Habitat A | | |
|---|---|---|
| **Species** | **n** | **n(n-1)** |
| B | 63 | |
| C | 49 | |
| D | 86 | |
| E | 45 | |
| F | 21 | |

| |
|---|
| **Species** |
| A |
| B |
| C |
| E |
| F |

9. Conse n is not only concerned about the number of individuals i
but als genetic variation. How is genetic diversity of alleles calc

10. What is meant by genetic diversity?

11. a) Identify the four processes of evolution.
    b) Use the four principles of evolution to answer the following scena

    A mutation in pine trees caused their needles to have a light-gree
    reduce water loss so the adaptation spread.

    Explain why, as the leaf-stripe became more common, the caterpi
    started to show striped patterns.

12. Identify the three types of adaptation that allow animals to become ad

# 2. Adaptations for gas exchang

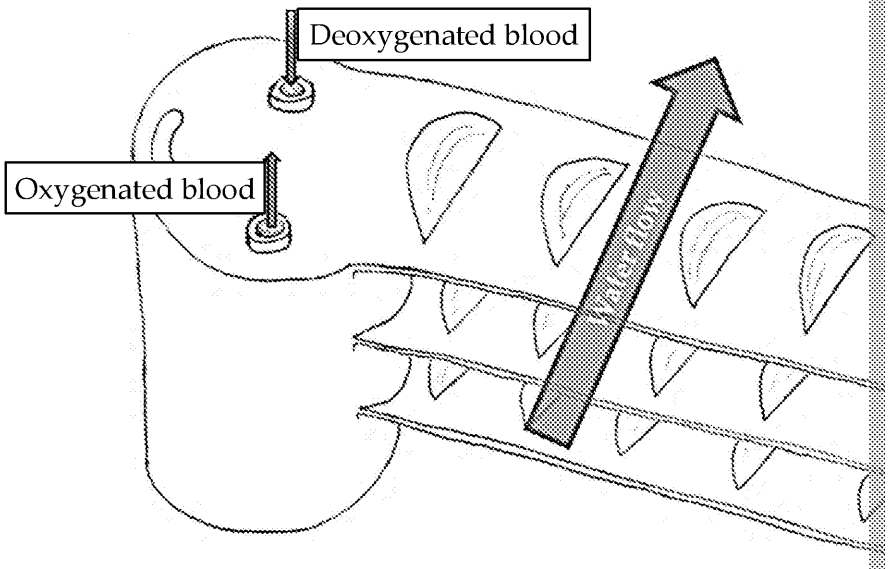
1. What method of gas exchange is used by single-celled and small orga

2. Why do large, active animals need ventilating mechanisms to obtain

3. Compare the gas exchange mechanisms of a flatworm and an earthwo

4. Insects and plants both have to compromise gas exchange so they do
   a) Describe the structures insects have to allow exchange.
   b) How do gases move through these structures?
   c) Give two adaptations insects have to reduce water loss.

5. Fish provide a large surface area for gas exchange with their gills.
   a) L e missing parts of the gill below and draw on the flow of
   b) W the name of the process of gas exchange in the gills?
   c) Explain why the above process allows more oxygen to enter the b
   flow of water and blood.



6. Match each human lung structure to its features and its function.

| | |
|---|---|
| Bronchi | Minute air sacs lined with elastic fibres |
| Alveoli | Smaller, branching airways lined with smooth muscle fibres |
| Trachea | Large flexible airway supported by cartilage |
| Bronchioles | Two branches supported by cartilage |

7. Explain how movement of air and blood in the lungs gas exchange.

8. Copy the text and fill in the missing words in the process below:

During inspiration, the _____ intercostal muscles contract and the _____ and pull them down. This increases the volume, thereby decreasing the pressure, allowing air to enter the lungs. At rest, expiration and inspiration are _____ processes. During expiration during exercise, only the _____ intercostal muscles and the

9. Describe how gas exchange for photosynthesis and respiration takes place.

10. An experiment was designed to calculate the number of stomata present on the abaxial and adaxial (top) surfaces of the leaf of a geranium. A replica of the epidermis was made by applying two layers of clear nail varnish to the leaf and gently peeling it off. A microscope was used to count how many stomata were present in 10 fields of view.

| Field of view | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **Abaxial surface** | 5 | 5 | 6 | 7 | 8 | 6 | 7 |
| **Adaxial surface** | 4 | 3 | 5 | 4 | 3 | 3 | 6 |

(a) Calculate the mean number of stomata present in the field of view on the abaxial surface. Give your answer to the nearest whole number.

(b) The eyepiece graticule is calibrated so that 1 eyepiece division = 0.1 mm at this magnification. The diameter of the field of view measures 90 eyepiece divisions. Use this information to calculate the area of the field of view in mm$^2$ to 1 decimal place.

(c) Use the equation below to calculate the mean number of stomata per mm$^2$ of the leaf.

$$\text{Mean number of stomata per mm}^2 = \frac{\text{Mean number of stomata}}{\text{area of field of view}}$$

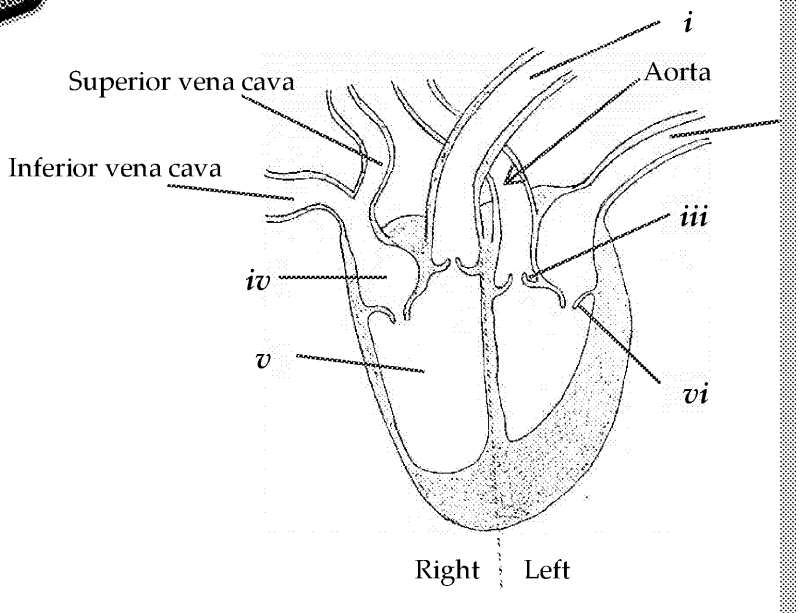
# 3. Adaptations for transport (

1. Define each of the following types of system and give an example of a
   a) Single circulatory system
   b) Double circulatory system

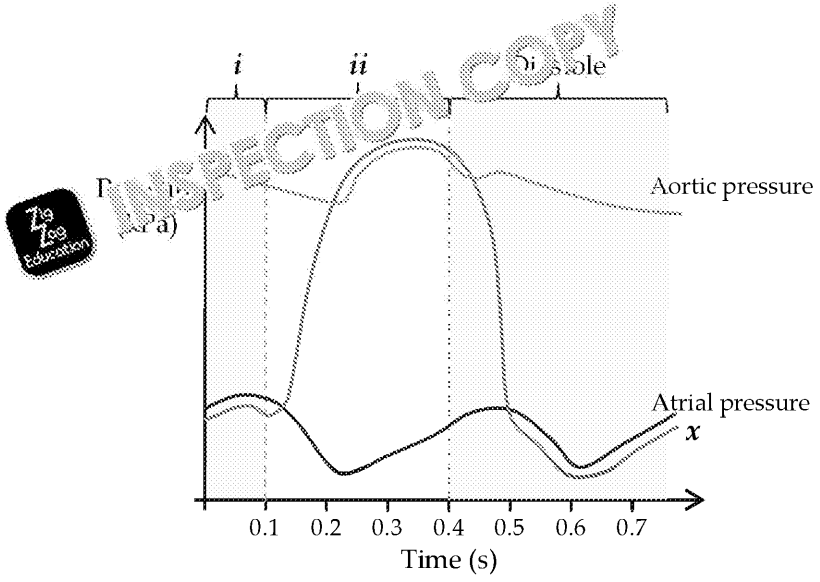
2. What are the main differences between closed and open circulatory sy

3. Excluding substances for gaseous exchange, name one other substanc in blood.

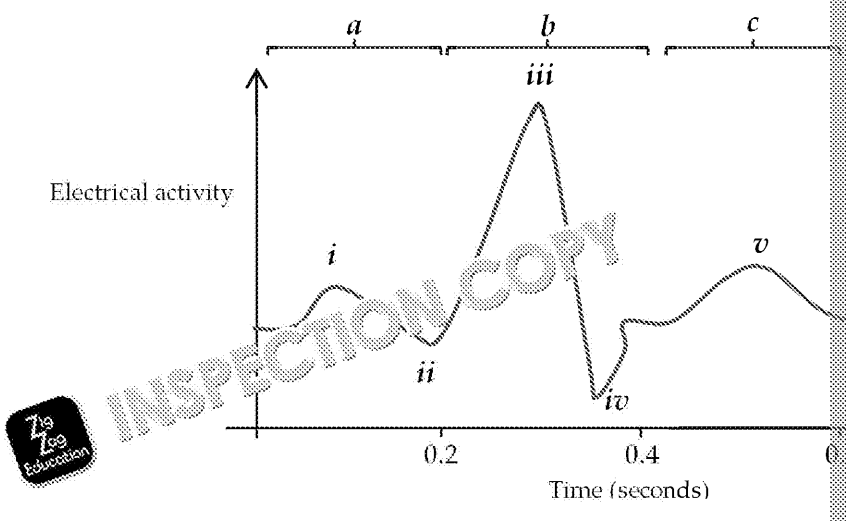
4. The diagram below shows the human heart.
   a) Fill in the missing labels for the h[illegible] valves and blood vessels.
   b) Draw and label two ar[illegible] showing the movement of oxygenate
   c) How do the v[illegible] and why are they necessary?
   d) W[illegible] th[illegible]ac muscle of the ventricle thicker on the left side?




5. The graph below shows pressure changes within the heart and aorta.
   a) Name the two missing stages of contraction © and *ii*.
   b) What does line *x* represent?
   c) Circle and label where the semilunar valves and atrioventricular v



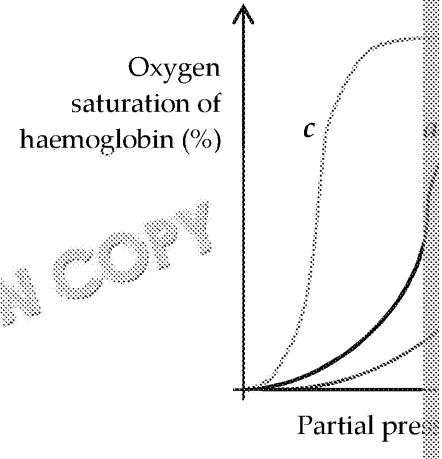
6. a) Label parts *i* to *v* on the electrocardiogram shown below.
   b) What does wave ***a*** represent?
   c) What does wave ***b*** represent?
   d) What does wave ***c*** represent?




7. Haemoglobin carries oxygen around the body.
   Copy and fill in the gaps in the process of oxygen dissociation below:

> If carbon dioxide concentration increases in the blood, some diffuses
> _____ combines carbon dioxide with water to form _____. T
> and hydrogen ions. The former diffuses out of the cell, while _____
> balance the hydrogen ions – a process known as _____. The hyd
> haemoglobin, causing dissociation of oxygen and producing _____

8. The graph below shows three oxygen dissociation curves. Curve *a* is a
   Curve *b* shows the dissociation curve in high $CO_2$. Curve *c* shows the
   an animal adapted to high-altitude environments.
   a) Name the effect shown in curve *b*.
   b) Why is this effect necessary in muscles during exercise?
   c) What are the advantages of curve *c* in a high-altitude environment?

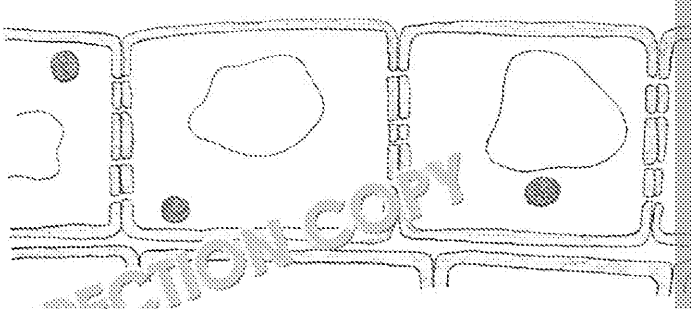



9. Cells are bathed in tissue fluid, which acts as an exchange medium be
   and capillaries.
   a) Give an example of substances found in tissue fluid.
   b) Describe how tissue fluid is formed and two ways it re-enters the

# 3. Adaptations for transport (i

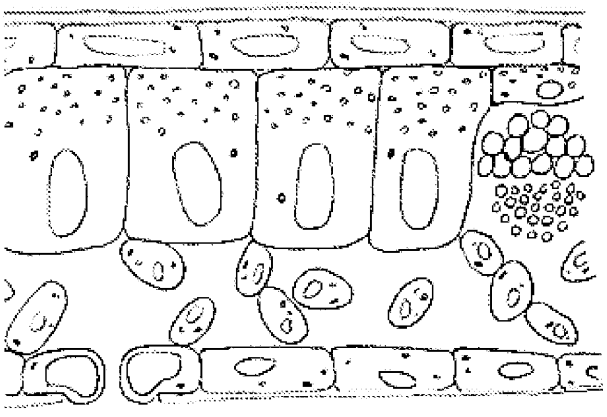
1. Describe the pathway of water from absorption by the roots to enterin

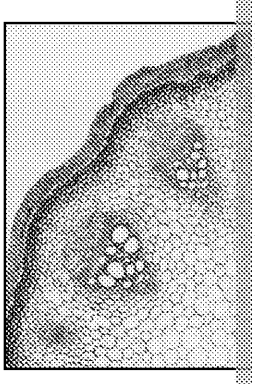
2. Draw and label the three pathways of water movement through plant



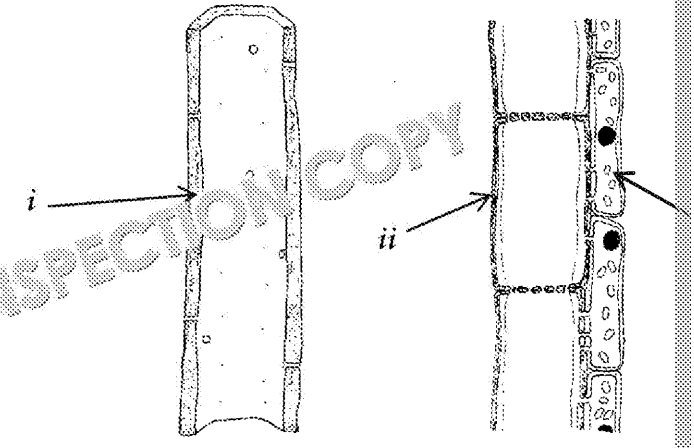
3. Label xylem and phloem in the cross-section of the leaf in diagram A and photograph B.

**Diagram A**





4. a) Label cells ***i*** to ***iii*** in the diagram below.
   b) Give two differences between xylem and phloem.



5. Copy and fill in the missing words in the process below:

| |
|---|
| The _____ theory of water movement in the xylem depends on _ evaporates out of the _____ into an area of more _____ wate molecules are held together by _____ bonds, a continual stream upwards. |

6. State two environmental factors that affect transpiration.

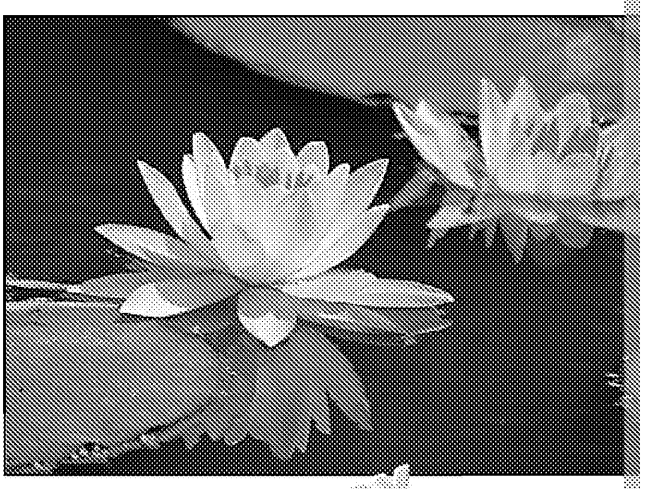
7. Two 28esynthesi experiments were set up to compare the amount of w conditions and in bright light. The rate of bubble movement in a 5 mm one minute and the results shown below

Calculate the ratio between the volume of water transpired in each co

| Condition | Rate of bubble movement (cm |
|---|---|
| Normal conditions | 0.13 |
| Bright light | 0.32 |

8. a) What are xerophytes?
   b) List three adaptations of xerophytes, and describe how they redu by transpiration.

9. Describe three adaptations of hydrophytes for survival in an aqua



10. What is translocation?

11. Describe the process of mass flow in the phloem.

12. There are two experiments that provide evidence for mass flow.
    a) How are radioactive tracers used to show mass flow?
    b) Describe how a ringing experiment is performed and what would

# 4. Adaptations for nutrition

1. Why do heterotrophic organisms rely on autotrophic organisms for th

2. Autotrophic organisms can be divided into _____ organisms, th energy source for _____, and _____ organisms, tho from _____ reactions.

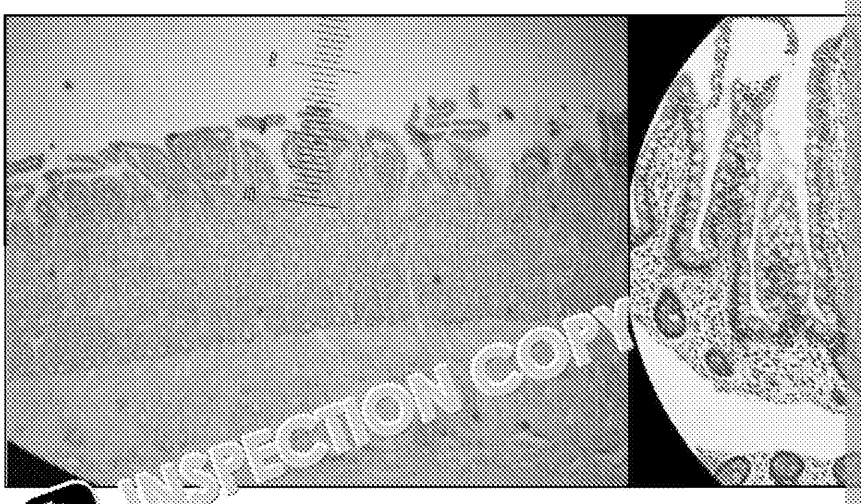
3. Compare saprotrophic and holozoic nutrition and state an example of

4. Describe how *Amoeba* obtain the nutrient[illegible]ed.

5. Copy and complete the table below.

| | Hydra | |
|---|---|---|
| **Ingestion/Egestion** | | Distinct anterior digestive system. |
| **Gut shape** | | |
| **Differentiation of gut** | None | |

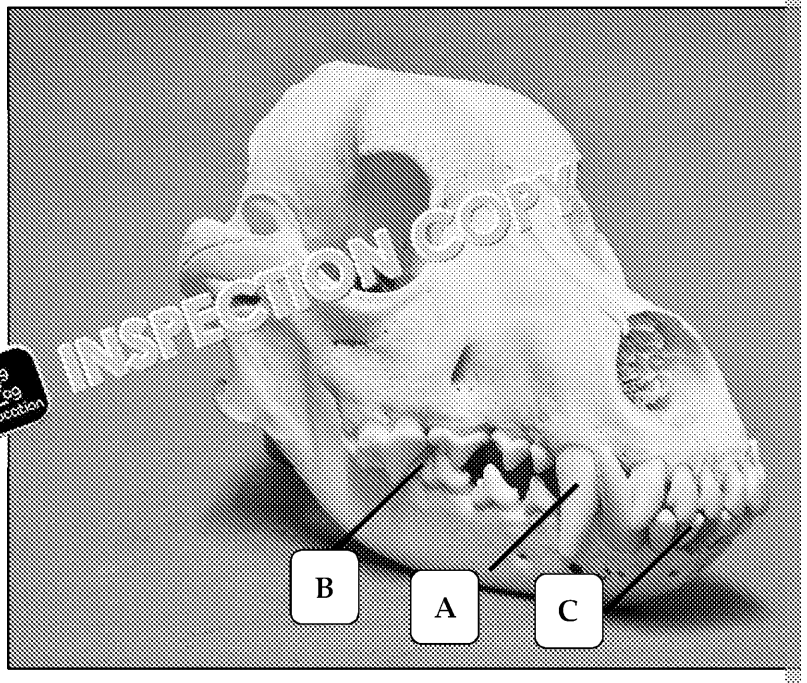
6. Below are microscope slides of cross sections of two distinct sections o
   (a) Label A and B.
   (b) Why might the intestine in slide B contain many mitochondria in
   (c) Would you expect the gut of a cow to be longer, shorter or about Explain your reasoning.



7. List three different enzymes involved in digestion and name their sub

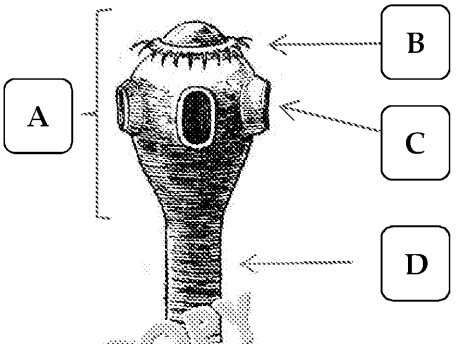
8. Ruminants make up a large proportion of all the animal protein eaten their diet consists mainly of plant material, yet they lack the enzyme t Explain how a ruminant obtains its nutrients.

9. Below is a diagram of the skull of an animal.
   (a) Does this skull belong to a carnivore, herbivore or omnivore?
   (b) What is tooth A used for?
   (c) Which label points to the carnassial tooth?
   (d) Describe two ways in which this dentition would differ to that of




10. A tapeworm is an example of a parasite, an organism that lives on or
own nourishment at the host's expense. Below is a diagram of a typic

   (a) Label parts *A*–*D*.




   (b) What is the binomial name for the pork tapeworm?
   (c) What are the parasite's primary and secondary hosts?
   (d) Describe two modifications of the tapeworm that enable it to be a

## Preview of Questions Ends Here

# Mark Scheme

## AS Unit 1: Basic Biochemistry and Cell Organisation

### 1. Chemical compounds are joined together to form biological com

1. 'Inorganic' means does not contain carbon (1)
'Ion' means they have gained or lost an electron (1)
Found in the cytoplasm (1)

2. Their positive or negative charge (1) [Accept charge]

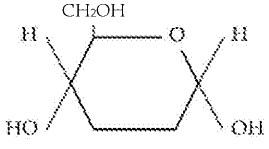
3.

| Inorganic ion | F |
|---|---|
| Iron ions | St[illegible] *haemoglobin* (1) |
| *Phosphate ions* (1) | S[illegible]acture of DNA and ATP |
| *Calci*[illegible] (1) | Structural component of bones and teeth |
| Magnesium ions | Formation of *Chlorophyll* (1) |

4. Hydrogen bonds form strong cohesion (1); allows transport of water through
Large latent heat of vaporisation (1) means effective cooling with little water loss f

5. Water is a *solvent* (1); therefore, substances can dissolve and move freely for r
It is also a *metabolite* (1) [Accept reactant] in hydrolysis and *condensation* (1) re
forming and breaking up *polymers* (1).

6. a) β-glucose [1 mark for β, 1 mark for glucose]
b) In the isomer, the OH and H molecules are swapped on the first carbon




[1 mark for drawing, ensure correct orientation of

7. A *condensation* (1) reaction causes two glucose monosaccharides to form a α-1
bond between them, creating a disaccharide called *maltose* (1). If more monos
*polysaccharide* (1) is formed.

8.

| Monosaccharides | | D[illegible]charides |
|---|---|---|
| Glucose + Fructose | → | *Sucrose* |
| Glucos[illegible]*Gal*[illegible] | → | Lactose |

9. [Any two from:]
Glycogen is used for storage; cellulose is used structurally (1)
Glycogen is formed from α-glucose; cellulose is formed from β-glucose (1)
Glycogen has a heavily branched structure; cellulose forms a mesh / long fib

10. Iodine [or] potassium iodide (1)

11. a) Benedict's solution (1)
    b) Enzymes have broken down / hydrolysed starch into glucose (1); therefo
    detecting glucose monosaccharides (1)
    c) Reducing sugars (1)
    d) Using reagent strips (1) means can compare results to a colour-coded ch

## 1. Chemical compounds are joined together to form biological com

1. Triglyceride (1)

2. Condensation reaction (1) which produces an ester b[illegible] (1)

3. One of the R-groups / fatty acids of [illegible]yceride is replaced with / substitu

4. Phospholipid A is [illegible] phospholipid with no carbon-carbon double b
polyun[illegible]te [illegible]spholipid with multiple carbon-carbon double bonds (1

5. The head of the phospholipid is polar / negatively charged (1)
The head of the phospholipid is hydrophilic (1)
The tail of the phospholipid is non-polar / not charged (1)
The tail of the phospholipid is hydrophobic (1)
Therefore, they form a bilayer in water (1)

6. a) Emulsion test (1)
    b) Add ethanol and mix/shake (1) [½ for only ethanol]
    In a test tube, mix the above with water and shake gently (1)
    Test tube containing lipids turns cloudy (1)

7. The ratio of saturated and unsaturated fats in our diet has implications for lo
high in saturated fats, *low-density lipoproteins* (1) build up causing fatty mater
deposited in the *coronary arteries* (1). It impedes blood flow and restricts oxyg
disease known as *atherosclerosis* (1). If the diet contains more unsaturated fats
*high-density lipoproteins* (1), which carry harmful fats to the liver for processin

8. a) Amino group (1)
    b) R group (1)
    c) Acid group / Carboxyl group (1)

9. A *dipeptide* (1) is formed from two amino acids. A *peptide* (1) bond is created t
*condensation* (1) reaction.

10. a) Fibrous proteins are long [illegible]s[illegible]e (1) and have structural roles (1);
and soluble (1) and [illegible] metabolic roles (1)
    b) [Fibrous – [illegible] from:]
    - [illegible]ag[illegible]
    - [illegible]atin
    - Elastin

    [Globular – any two from:]
    - Haemoglobin
    - [Accept any named enzyme, e.g.] Amylase
    - [Accept any named hormone, e.g.] Insulin

11. a) Hydrogen (1)
    b) Disulphide bonds (1), Ionic bonds (1), Hydrogen bonds (1) [Remove 1 m
    c) Includes other polypeptide chains (1) and prosthetic groups (1)
    d) Any appropriate answer, e.g. Haemoglobin/collagen (1)

12. Biuret test (1)
    Biuret solution / copper (II) sulfate solution added one drop at a time (1)
    Turns mauve/lilac in presence of proteins (1)

## 2. Cell Structure and Organisation

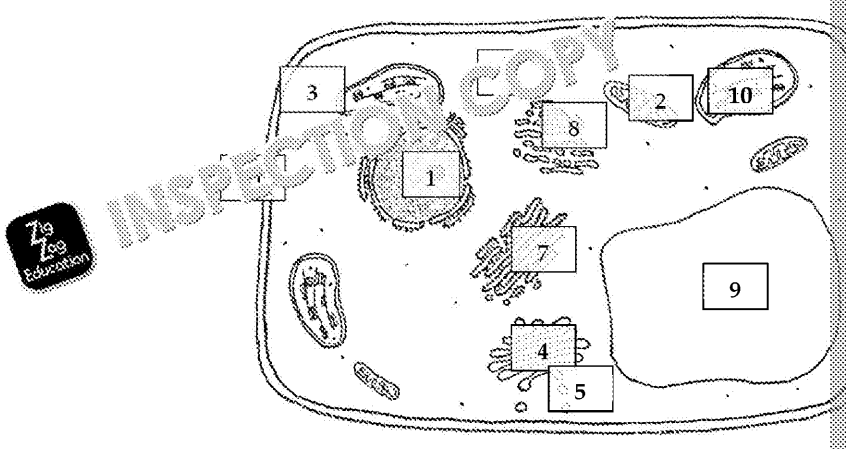
1. [Award half mark for each correct answer]

   *Organelles* ⟶ Cells ⟶ *Tissues* ⟶ *Organs* ⟶

2. a) [1 mark for each correct grouping of organelle, feature and function:]

| | | | | | | |
|---|---|---|---|---|---|---|
| | cleus | → | b) | Double membrane with pores | → | x) |
| 2. | Mitochondria | → | f) | Folded inner cristae | → | ix) |
| 3. | Cell-surface membrane | → | k) | Phospholipid bilayer | → | xi) |
| 4. | Golgi apparatus | → | a) | Flattened sacs that bud into vesicles | → | iii) |
| 5. | Lysosomes | → | c) | Small vesicles | → | vi) |
| 6. | Ribosomes | → | i) | Small proteins | → | ii) |
| 7. | Rough ER | → | g) | Thin tubes coated in ribosomes | → | i) |
| 8. | Smooth ER | → | e) | Thin tubes with many vesicles | → | v) |
| 9. | Vacuole | → | h) | Large sac of liquid | → | vii) |
| 10. | Chloroplasts | → | d) | Double membrane, free DNA | → | iv) |
| 11. | Cell wall | → | j) | Rigid cellulose/chitin polymers | → | viii) |

   b) [1 mark for correct placement of following numbers:]



3. [1 mark for correct measurement of image diameter, accept any reasonable a

Diameter of nucleus is 20 mm

[1 mark for rearrangement and substitution into equation:]

$$\text{Object size} = \frac{\text{Image size}}{\text{Magnification}}$$

$$\text{Object diameter} = \frac{20}{1000}$$

[1 mark for diameter:]

Object diameter = 0.02 mm

[1 mark for equation for circumference

Circumference = π

[1 mark for calculation of circumference:]

Circumference = π × 0.02

Circumference = 0.0628318 mm

[1 mark for answer in standard form to 3 sf:]

Circumference = $6.28 \times 10^{-2}$ mm

4. Many cells are colourless, so detail cannot be seen unless stained (1)

5. a) 1 micrometer unit = 2.7 graticule units (1)
   Therefore, 1 micrometer unit = $\frac{10}{2.7}$ = 3.7 μm (1)
   b) [1 mark for calculation:] Length=20830 × 3.7]
   = 77 071 $\mu m$

   [1 mark for correct conversion to 3 sf:]
   = 77.1 $mm$

6. a) *a* is the nucleus (1), *b* is vesicles (1), *c* is the Golgi apparatus (1)
   b) Rough endoplasmic reticulum (1) [Do not accept rough ER or r ER for fi

7. a) Plasmid (1)
   b) Single circular DNA [Accept DNA] (1)
   c) Capsule (1)
   d) Cell wall (1)
   e) Flagellum [Accept flagella ever

8. Any two from the [1 mark each]
   Prokaryotic cells have a single, circular DNA; eukaryotic cells have multiple
   Prokaryotic cells have no membrane-bound organelles; eukaryotic cells have
   [Accept eukaryotic can have nucleus, mitochondria and chloroplasts; prokary
   Prokaryotic cell has a capsule; eukaryotic cells do not (1)
   Prokaryotes have 70s ribosomes while eukaryotes have 80s ribosomes (1)
   Prokaryotic cells are much smaller than eukaryotic cells (1)

9. a) RNA (1) [Accept genetic material or DNA as some viruses contain DNA
   b) Capsid / protein coat (1)
   c) Lipid membrane / phospholipid bilayer (1)

## 3. Cell Membranes and Transport

1. a) *i*: Glycoprotein (1)
   *ii*: Cholesterol (1)
   *iii*: Glycolipid (1)
   b) Receptors for hormones (1) and cell signalling (1)
   c) Adds strength/rigidity to membrane by holding surrounding molecules

2. Fluid part means membrane is not fixed / is flexible (1), mosaic part means it of small molecules (1)

3. a) Increasing temperature increases kinetic energy (1); therefore, the compo more (1) and can cause the membrane to 'leak' / substances to ente
   b) pH (1) or alcohol/solvents (1)

4. Diffusion is the net move of molecules/ions (1) from a region of higher concentration (1)

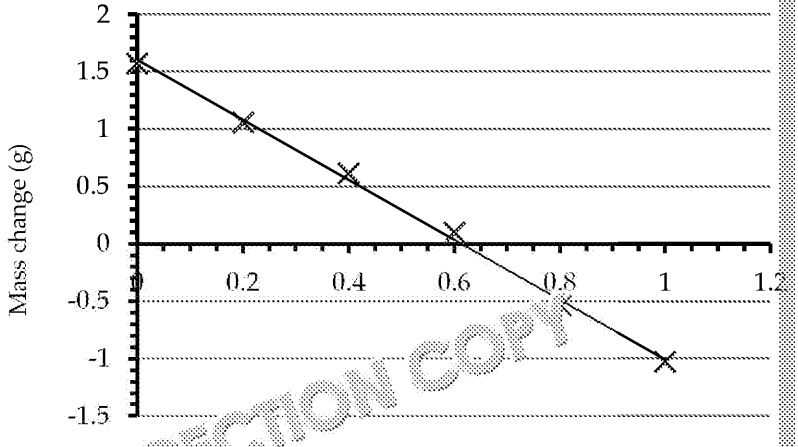
5. Small ( harged/non-polar (1) lipid soluble (1)

6. Osmosis is the movement of water molecules (1) across a partially permeable potential to low water potential (1)

7. Unlike simple diffusion, facilitated diffusion requires carrier/channel protein too big to pass through the membrane (1)

8. a) Line c shows active transport (1)
   b) Respiration produces ATP (1), ATP is required by the membrane protei
   c) Potassium cyanide (1)

9. a) To maintain a constant temperature and to increase rate of movement /
   b) [½ mark for each point, 1 mark for line of best fit:]




   c) Sucrose co or is approximately 0.62 mol dm$^3$ (1). There should b
   c at ; therefore, the water potential of the solution and potato t

d) [1 mark for equation:]

$$\%\ error = \frac{maximum\ error}{measured\ value\ recorded} \times 100$$

[½ mark for each correct calculation of % error for final mass:]

$$0.0\ conc.: \%\ error\ mass = \frac{0.01}{4} \times 100 = 0.25$$

$$0.2\ conc.: \%\ error\ mass = \frac{0.01}{3.43} \times 100 = 0.29155$$

$$0.4\ conc.: \%\ error\ mass = \frac{0.01}{3.18} \times 100 = 0.\dot{3}$$

$$0.6\ conc.: \%\ error\ mass = \frac{0.01}{2.24} \times 100 = [illegible]$$

$$0.8\ conc.: \%\ error\ mass = \frac{0.01}{2.25} \times 100 = 0.\dot{4}$$

$$1.0\ conc.: \%\ error\ mass = \frac{0.01}{1.26} \times 100 = 0.8$$

[1 mark for calculation of total error to 3 sf:]

$$Total\ \%\ error = 0.25 + 0.29155 + 0.\dot{3} + 0.446\dot{4} + 0.\dot{4} + 0.8$$

$$Total\ \%\ error = 2.57\%$$ [Accept between 2.54 and 2.57]

10. a) Endocytosis and exocytosis can be used for bulk transport (1)
    b) ATP is used to make membranes 'pinch off' to form vesicles (1) and to m

11. a) As temperature increases, the permeability of the membrane increases (1
    red pigment found extracellularly in the tube increased (1)
    b) Time *or* temperature (1)

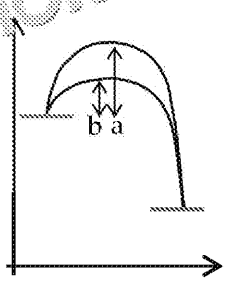
## 4. Biological reactions are regulated by enzymes

1. Tertiary structure provides a 3D active site (1)
   Spherical shape allows easy transport out of cells (1)

2. It would affect the functioning of an enzyme (1) because different amino acid
   structure of the enzyme to change (1)

3. Increase the chemical reaction (1) without being consumed / permanently ch

4. a) The minimum energy required to [illegible] a chemical reaction (1)
   b) [1 mark for both arrows]




   c) Line b (1)

5. Induced fit model (1); Induced fit model states the active site is flexible / can

6. a) Extracellular (1)
   b) Intracellular (1) breaks down hydrogen peroxide into water and oxygen
   product of many metabolic reactions (1)
   c) [Extracellular:] Digestive enzymes, such as amylase/lipase/protease, in t
   example including:] lysozymes, DNA polymerase, DNA helicase [etc.] (1

7. a: Not enough substrate to fill all available enzyme active sites [and] subst
   b: Most active sites are becoming occupied, reducing excess substrate (1)
   c: All active sites filled; therefore, excess substrate cannot increase rate of r

8. a: Increased kinetic energy increases encounters between enzyme and subs
   b: Enzymes start to denature (1); therefore, active s anges and substra
   c: Enzymes are fully denatured (1)

9. a) [1 mark for correct calculation: pH]
   $pH = -\log_{10}[H^+]$
   [1 mark for correct answer to 2 dp:]
   pH = 6.03 (1)

   b) 3.60 g $min^{-1}$ (1)

   c) [1 mark for equation:]
   $\text{Rate} = \frac{\text{change in y}}{\text{change in x}}$

   [1 mark for correct answer – example shown below – and 1 mark for cor

   $\text{Rate} = \frac{0.6 - 0.2}{9 - 3}$

   Rate = $0.0\dot{6}$ g $sec^{-1}$

   Rate = 4.00 g $min^{-1}$ (accept 4–6 g $min^{-1}$)

10. Buffers help maintain a constant pH (1) by absorbing excess hydrogen or hyd
    [Accept]: $H^+$ $OH^-$ ions

11. Competitive inhibitors bind to active site and block [and] non-competitive in
    shape of active site (1)

12. (a) Enzymes are bound/fixed/trapped (1) within an inert matrix (1) such as
    microfibrils (1)
    (b) [Any three from:]
    - Increased stability and funct ve wide range of temperature a
    - Products are not co d with the enzyme
    - Enzymes a covered for reuse
    - y easily added or removed, allowing more control over
    - quence of columns containing different enzymes with differen
      periment

    (c) [Any one from:]
    - Used in biosensors
    - Manufacture of high-fructose corn syrup
    - Manufacture of lactose-free milk

## 5. Nucleic acids and their functions (i)

1. a) A = nucleotide/mononucleotide (1)
   b) B = pentose/deoxyribose (1)
   C = phosphate group (1)
   D = organic/nitrogenous base (1) [Do not accept base pair]
   c) E = phosphodiester bond (1)
   d) Condensation reaction (1)

2. a) TTCGCAGA [1 mark for A-T pairing; 1 mark for C-G pairing]
   b) Hydrogen bond (1)
   c) [1 mark for two bonds between A-T pairs; 1 mark for three bonds betwe
   d) Double helix (1)

3. Provides genetic information / instr[illegible] for:
   Cell division (1)
   Protein synthesis (1)

4. RNA is [illegible]t, single strand; DNA is a long double strand (1)
   RNA contains ribose; DNA contains deoxyribose (1)
   RNA contains the base uracil; DNA contains the base thymine (1)

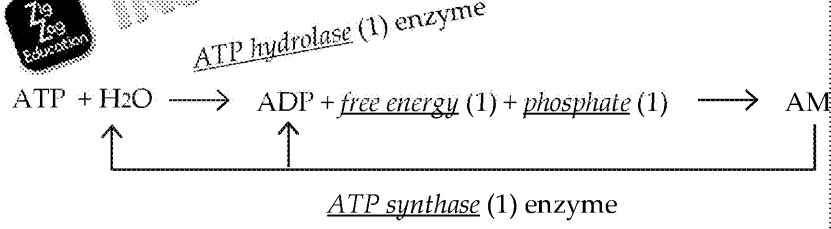
5. The enzyme *DNA helicase* unwinds the DNA strand and breaks the *hydrogen*
   *Free nucleotides* are attracted to and bond with their exposed complementary
   *Phosphodiester* bonds are formed when the enzyme *DNA polymerase* initiates
   deoxyribose phosphate backbone together.
   Half of the original DNA is now part of the new DNA fragment. This process is
   [1 mark for each]

6. DNA is made from new molecules (1) and the original DNA remains intact (1

7. a) $N^{14}$ parent and offspring all have light DNA (1)
   $N^{15}$ parent has heaviest DNA (1)
   1st generation has an intermediate band because DNA in the 1st generatio
   heavy $N^{15}$ bases (1) and one new strand of light $N^{14}$ bases (1)
   2nd generation has lighter and intermediate band because the original st
   $N^{14}$ bases (1); however, the new $N^{14}$ strands from the first generation are
   form entirely light DNA (1)
   b) The conservative model would have retained the original $N^{15}$ DNA with
   DNA would be all light $N^{14}$ DNA; therefore, no intermediate band woul

8. Adenosine triphosphate (1)

9. a) Adenosine (1)
   b) Ribose/pentose (1)
   c) Three inorganic phosphates (1)

10. a) 


    b) Condensation reactions synthesize ADP and the inorganic phosphates i
    remove inorganic phosphates from ATP to release energy (1)

11. [Any four from:]
    - Active transport to secrete substances (1)
    - Active transport to extract substances against a concentration gradient (1
    - Muscle contraction (1)
    - Provide activation energy in enzyme reactions (1)
    - Nerve cells / neurones (1)
    - Phosphorylating compounds / providing phosphorus for other reaction

## 5. Nucleic acids and their functions (ii)

1. The triplet code of *DNA* (1) codes for specific *amino acids* (1). The code is *univ* overlapping and *degenerate* (1), which means that most amino acids have mor [1 mark for each]

2. a) Exons code for amino acids (1)
   b) Introns are non-coding (1), consist of multiple base repeats (1), can act as sequences within a chromosome (1) and exons within genes (1)

3. mRNA forms a long helix; tRNA forms a short clover-leaf shape (1)
   mRNA just contains uracil, adenine, guanine, cytosine / the four bases; tRNA amino acid (1)

4. In *transcription* (1) the DNA strands are separated and free nucleotides are att *polymerase* (1) to form *messenger* (1) RNA.
   mRNA is formed directly in *prokaryotic* (1) cells, while the immature form *pre* eukaryotic cells. This molecule is then *spliced* (1) to remove introns.
   The mRNA leaves the *nucleus* (1).

5. a) Ribosomes hold the mRNA and tRNA in place (1)
   b) tRNA bonds to the mRNA with its complementary anticodon (1) and he
   c) ATP provides energy to create a peptide bond between the amino acids
   d) Amino acids join together to form a polypeptide/protein (1)

6. mRNA: GCUUAG (1)
   Amino acids: Alanine, (stop) (1)
   *i* = Transcription (1)
   *ii* = Translation (1)

7. This hypothesis suggests that each gene is a sequence of DNA bases (1) that co

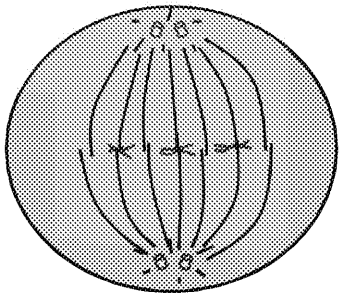
8. (a) Golgi
   (b) [Any two from:]
   - Addition of a carbohydrat[e] to form a glycoprotein (1)
   - Addition of a lipid (1) to form a lipoprotein (1)
   - Addition of a phosphate (1) to form a phosphoprotein (1)
   - Any other acceptable example

9. (a) The detergent destroys phospholipid cell membranes to release the DNA coagulates DNA to make it more visible (1).
   (b) Cellular enzymes are denatured at 60 °C (1). Any enzymes released dur will be prevented from destroying the DNA (1).
   (c) Add drops of trypsin (1) to the boiling tube to break down the histone p helix (1). Cold ethanol (1) is slowly added so it sits on top of the extract will be seen as a white precipitate (1) between the filtrate and ethanol la

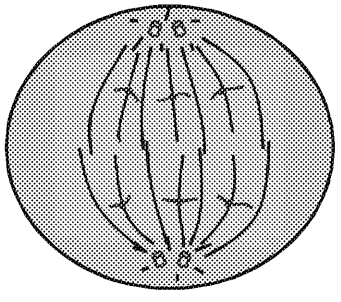
## 6. Genetic information is copied and passed onto daughter cells

1. a) Mitosis (1)
   b) [Any three of:]
   - Organism growth
   - Tissue repair
   - Cell turnover/replacement
   - Asexual reproduction

2. *Interphase* involves *DNA* replication and the organelles duplicate.
   In *prophase* the chromosomes become visible and the *nuclear envelope* disinteg
   During *metaphase* the chromosomes line up on the cell's equator.
   In anaphase the *chromatids* are split and pulled to op[illegible] poles of the cell.
   During *telophase* the nuclear envelope reform[illegible] the separated chromati
   Cytokinesis completes division wh[illegible] *toplasm* divides. [Do not accept ce
   [1 mark for each]
   [Drawing for meta[illegible] – 1 mark for including spindle fibres and centrioles, aligne[illegible] c[illegible]]



   [Drawing for anaphase – 1 mark for including spindle fibres and centrioles, 1 pulled away from centre:]



3. Spindle fibres attach to the centromeres (1), separate the chromatids (1) and d

4. Cancer is uncontrolled rapid division of cell (1) when the genes that regulate
   Cancer drugs interfere with the cell cycle to prevent division (1)

5. a) The diploid parent cell divides and hom[illegible] hromosomes split (1), divide again (1) forming four h[illegible] gametes (1)
   b) Mitosis produces two id[illegible] diploid daughter cells (1) with the same parent cell (1)
   c) Di[illegible] A[illegible] phase I, diagram B is Anaphase II [1 mark for anapha

6. Crossing over / Recombination between homologous chromosomes (1) wher exchange DNA and recombine (1)
   Independent segregation/assortment of homologous chromosomes (1) where independently (1)
   Random fertilisation (1)

## Preview of Answers Ends Here