Biology Model Paper 1 2025

Time Allowed: 2 hours 30 minutes
Total Marks: 120

You must bring a soft pencil (preferably type B or HB), a clean eraser, and a dark blue or black pen.

Before attempting the paper, write your name, candidate number, centre name, and centre number clearly in the designated spaces.

Instructions for Candidates

- **Section A** contains multiple choice questions. You are required to attempt all questions by selecting the most appropriate option and marking it on the separate MCQ answer sheet using a soft pencil.
- **Section B** comprises both theoretical questions and a practical component. All questions in this section are compulsory. Answers must be written in the space provided on the question paper using a dark blue or black pen.You may use an HB pencil for any diagrams or graphs.
- You may use a simple calculator if needed.
- You should show all your working and use appropriate units.
- Do not use an erasable pen or correction fluid.
- Avoid writing over any barcodes printed on the paper.

Information for Candidates

- This paper consists of a total of **120 marks**.
- **Section A** includes **30 multiple choice questions**, each carrying **1 mark**. There is no negative marking for incorrect answers.
- **Section B** carries a total of **90 marks**, divided as follows:
  Theoretical Questions: 55 marks
  Practical Component: 35 marks
- The number of marks for each question or part question is shown in brackets [ ].

Please read all questions carefully and follow the instructions exactly to ensure your responses are properly evaluated.

Section A: Multiple Choice Questions [Marks: 30]

Question 1

Identify which of the following statements about light microscopes are correct?

1 To calculate the magnification of a light microscope, the eyepiece lens and objective lens magnifications are added together
2 The resolution of a light microscope is limited by the wavelength of light
3 The divisions on the scale on a stage micrometer are closer together than the divisions on the scale on an eyepiece graticule

A 1, 2 and 3 **B** 1 and 2 only **C** 2 only **D** 3 only

Question 2

Apply your understanding of microscope technology to determine which statement correctly compares the magnification and resolution of an electron microscope to that of a light microscope:

A Magnification lower, resolution higher
B Magnification higher, resolution higher
C Magnification higher, resolution lower
D Magnification lower, resolution lower

Question 3

Specimens can be measured using eyepiece graticules and stage micrometers.

Which of the following correctly describes the role of a stage micrometer?

A Directly measuring the size of a specimen
B Determining the size of the eye piece graticule units
C Determining the magnification at which the object is being viewed
D A type of slide upon which a specimen can be prepared

Question 4

A microscope has a resolution of 200nm.

Identify which of the following organelles would not be resolved by this microscope?

A Mitochondria **B** Ribosome **C** Lysosomes **D** Chloroplast

Question 5

Identify the process that is not directly regulated by the specific heat of vaporization of water:

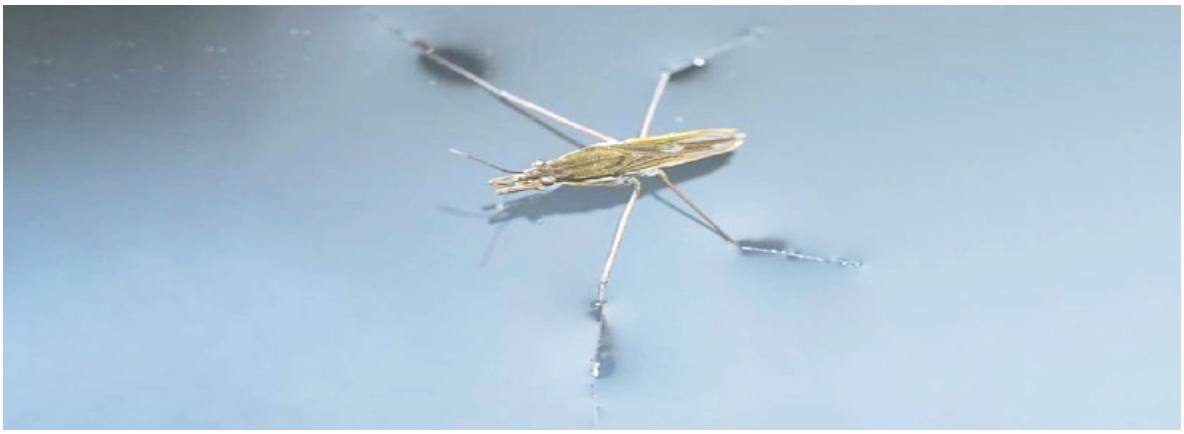
A Oxidation **B** Reduction **C** Redox **D** None of the above

Question 6

Evaluate which property of water enables pond skaters to remain on the surface of a pond:

A Ability to hold a lot of heat
B Ability to make hydrogen bonds
C Less dense when frozen
D Colourless and odourless

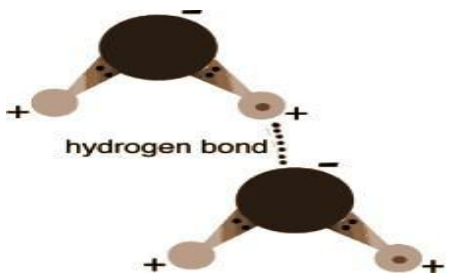
Question 7



Assess which of the following properties shown in this image demonstrates a biological benefit to living organisms.

A Adhesion **B** Cohesion
C Surface tension **D** Capillary Action

Question 8

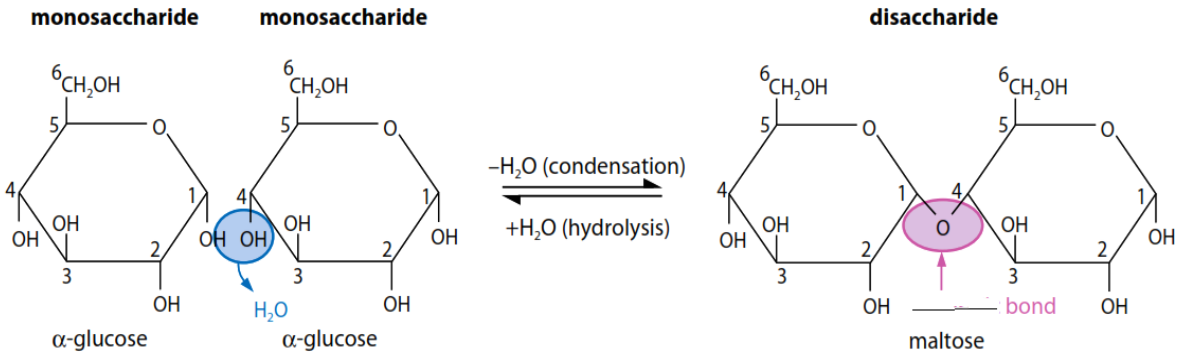


Which of the following best describes how hydrogen bonds are created?

A The negative charge of oxygen binds with the positive charge of hydrogen on an adjacent molecule
B The positive charge of oxygen binds with the negative charge of hydrogen on an adjacent molecule
C The negative charge of oxygen binds with the positive charge of hydrogen within the same molecule
D The positive charge of oxygen binds with the negative charge of hydrogen within the same molecule

Question 9

State the type of bond formed when two monosaccharide molecules join together to produce the disaccharide maltose.



A Glycosidic bond
B Peptide bond
C Hydrogen bond
D Ester bond

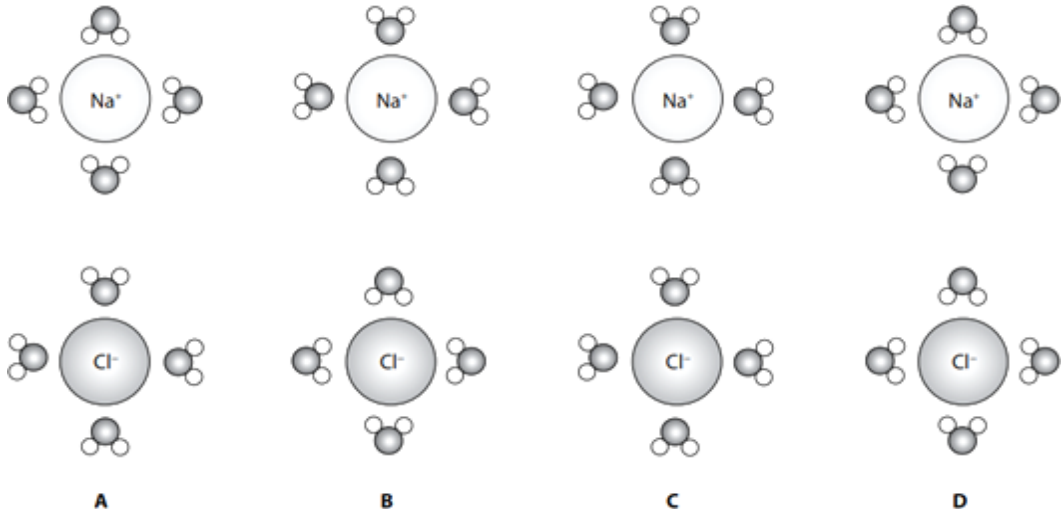
Question 10

State the term used to describe proteins like haemoglobin that fold into a compact, spherical shape:

A Fibrous
B Globular
C Poly
D Collagen

Question 11

Analyse the diagrams provided and determine which one best illustrates the orientation of water molecules around sodium (Na^+) and chloride (Cl^-) ions in aqueous solution.



Question 12

Analyze the mitotic index (MI) which was calculated for several different samples of cells. Which sample contains cells that are undergoing the highest amount of division?

A Sample 1 MI= 0.18
B Sample 2 MI= 0.32
C Sample 3 MI= 0.28
D Sample 4 MI= 0.03

Question 13

Apply your understanding of membrane structure to identify the most abundant type of molecule found in the cell surface membranes of plant cells:

A Cholesterol
B Glycolipids
C Phospholipids
D Proteins

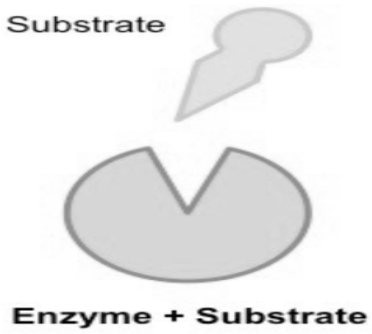
Question 14

State which of the following locations contain enzymes which control cellular respiration.

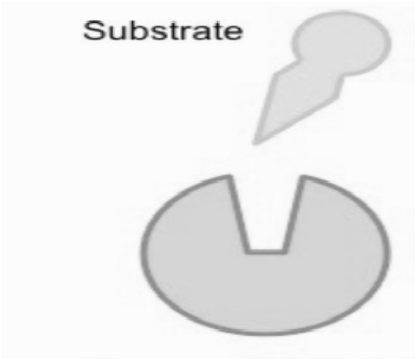
A Mitochondria
B Ribosome
C Chloroplast
D Nucleus

Question 15

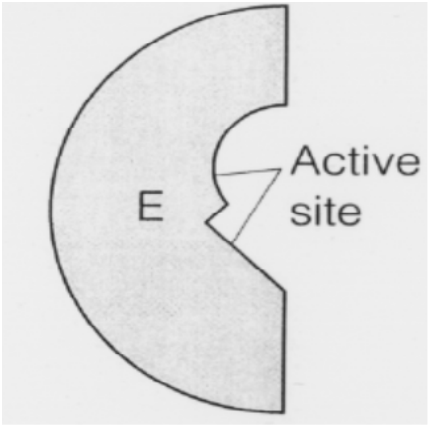
Identify the diagram of induced fit model from the four different images given below:



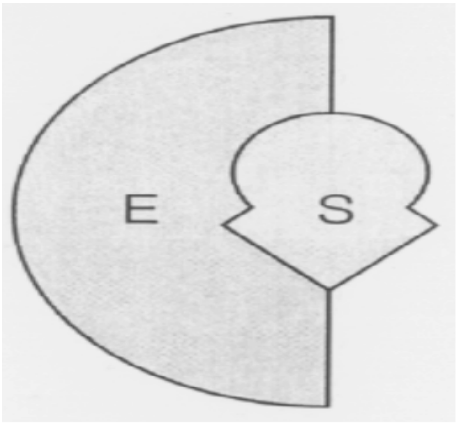
A



B



C



D

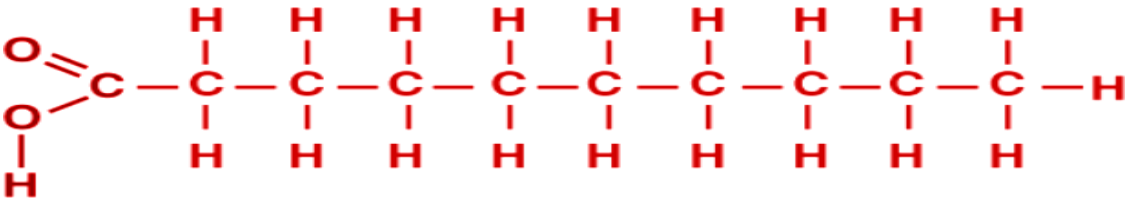
Question 16

What impact does a non-competitive inhibitor have on the activity of an enzyme during a catalyzed reaction?

A It binds to the active site, preventing substrate binding
B It binds to a site other than the active site, changing the active site's shape
C It increases the activation energy of the reaction
D It decreases the reaction rate by consuming the substrate

Question 17

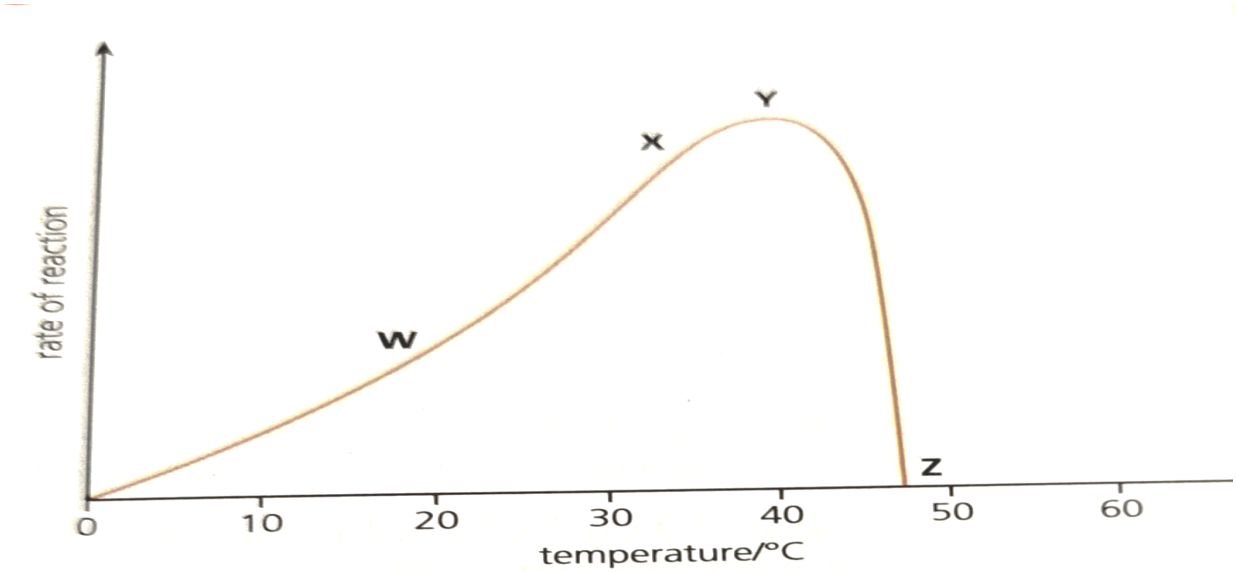
Name the bond formed during a condensation reaction between a fatty acid and glycerol.



A Ester bond
B Hydrogen bond
C Ionic bond
D Dipeptide bond

Question 18

The graph shows the effect of temperature on the rate of an enzyme-catalysed reaction.



Select the statement that accurately describes the graph:

A The enzyme starts to become denatured at point W
B The enzyme starts to become denatured at point X
C The enzyme starts to become denatured at point Y
D The enzyme starts to become denatured at point Z

Question 19

A student examines a plant cell under a light microscope and notes that the length of the cell wall appears to be 20 mm long in the photomicrograph. The scale bar on the image shows that this corresponds to an actual length of 50 micrometers (μm). What is the magnification of the image?

A X4000
B X40000
C X400
D X0.4

Question 20

Which of the following most accurately explains the role of cholesterol in the cell membrane?

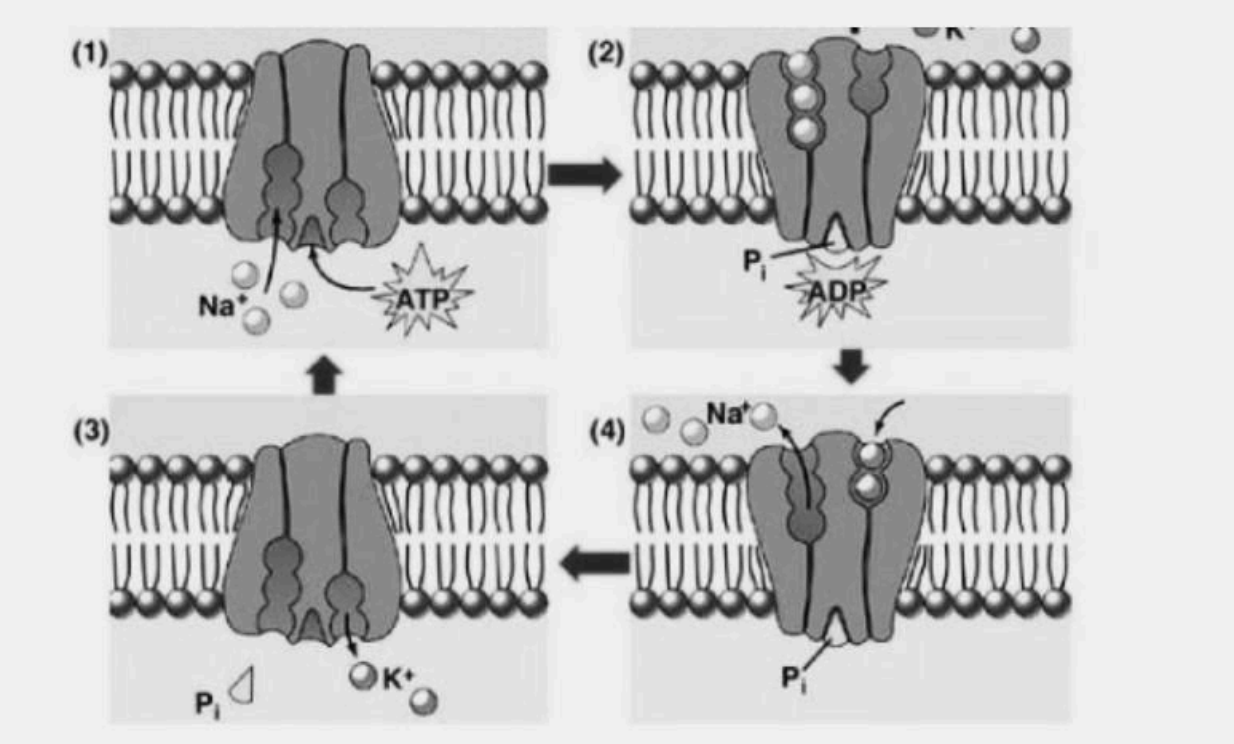
A It is responsible for producing DNA and other genetic materials
B It forms the passageway of water to move across the membrane
C It stabilizes the membrane's fluidity, preventing it from becoming too rigid or excessively fluid under varying temperature changes
D It serves as the primary source of energy for the cell

Question 21

Name the type of molecules that can move across the cell membrane using simple diffusion.

A Small non polar molecule
B Larger molecules
C Large non polar ions
D Ions

Question 22



What is depicted in the diagram of cell membrane?

A A sodium potassium pump
B Vesicle moving
C A sodium glucose cotransport
D A simple diffusion

Question 23

Apply your understanding of transport mechanisms which of the following shows three main types of passive transport.

A Facilitated diffusion, osmosis, channel protein
B Facilitated diffusion, osmosis, simple diffusion
C Facilitated diffusion, carrier protein, channel protein
D Simple diffusion, osmosis, carrier protein

Question 24

A student is observing a diagram of a eukaryotic cell. Using the structural features of rough endoplasmic reticulum and its connection to surrounding organelles, deduce its primary function.

A Producing steroid hormones
B Processing and packaging proteins for export
C Breaking down toxic substances
D Generating ATP for cellular energy

Question 25

Explain the functional significance of the difference in the composition of membranes of the nucleus and the mitochondrion in a eukaryotic cell.

A The nuclear membrane has pores, the mitochondrial membrane regulates ATP production
B The nuclear membrane has ribosomes for protein synthesis; the inner mitochondrial membrane is folded for electron transport
C The nuclear membrane is single; the mitochondrial membrane is double, which increases the surface area
D The nuclear membrane regulates passage of substances; the mitochondrial membrane is responsible for lipid synthesis

Question 26

Analyze the key structures of sperm cells. What is present in the midpiece of the sperm cell?

A Ribosome
B Tail
C Nucleus
D Mitochondria

Question 27

Determine which type of molecule is most abundant in the cell surface membranes of plant cells:

A Cholesterol
B Glycolipids
C Phospholipids
D Proteins

Question 28

Which term accurately describes both collagen and haemoglobin?

A Enzymes
B Fibrous proteins
C Globular proteins
D Macromolecules

Question 29

Identify which one of the following structures is found in animal cells, but not in plant cells?

A Cell surface membrane
B Centriole
C Chloroplast
D Golgi body

Question 30

Calculate the total magnification of a microscope with eyepiece 15X and objective lens 45X:

A 675
B 671
C 576
D 575

SECTION B [Marks:90]
Theoretical Questions [Marks:55]

1 (a) Outline the role of hydrogen ions (H+ ions) in the production of ATP during both aerobic respiration and photosynthesis.

……

……

……

……

……

……

……

……

……

……

……**[4]**

(b) Explain why deficiency in iron contributes to fatigue in mammals?

……

……

……

……

……

.....

.....

.....

.....[3]

2 Polymers are broken down into monomers by a process shown in the Fig. 2.1.

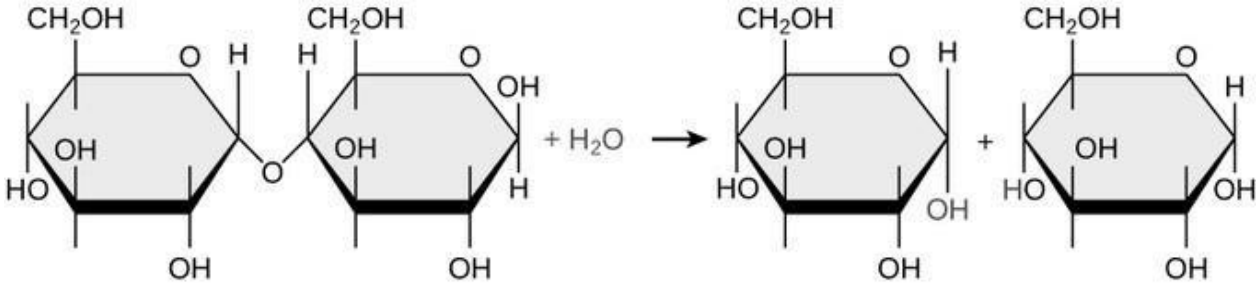


Fig. 2.1

(a) Describe the process illustrated in Figure 2.1, and include the names of the polymer and the monomers involved.

……

……

……

……

……

……

……

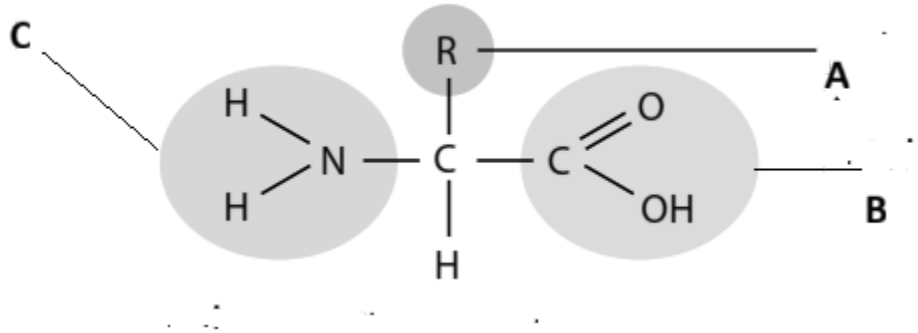
……

……

……

……**[3]**

(b) The diagram below shows a general structure of an amino acid.



(i) Name the labelled parts:

A ……..
B ……..
C …….. **[3]**

(ii) Describe the role of the part A in the above diagram in differentiating between the 20 standard amino acids.

……

……

……

……

……

……

……

……

……

……**[4]**

3 Summarise the structure of globular and fibrous proteins. Provide examples for both structures.

……

……

……

……

……

……

……

……

……

……**[4]**

4 Differentiate between eukaryote and prokaryote cells.

……

……

……

……

……

……

……

……

……

……..

……

……

……**[5]**

5 (a) Calculate the magnification of a plant cell labelled P in the following Fig.5.1. The real length of the cell is 80 µm.

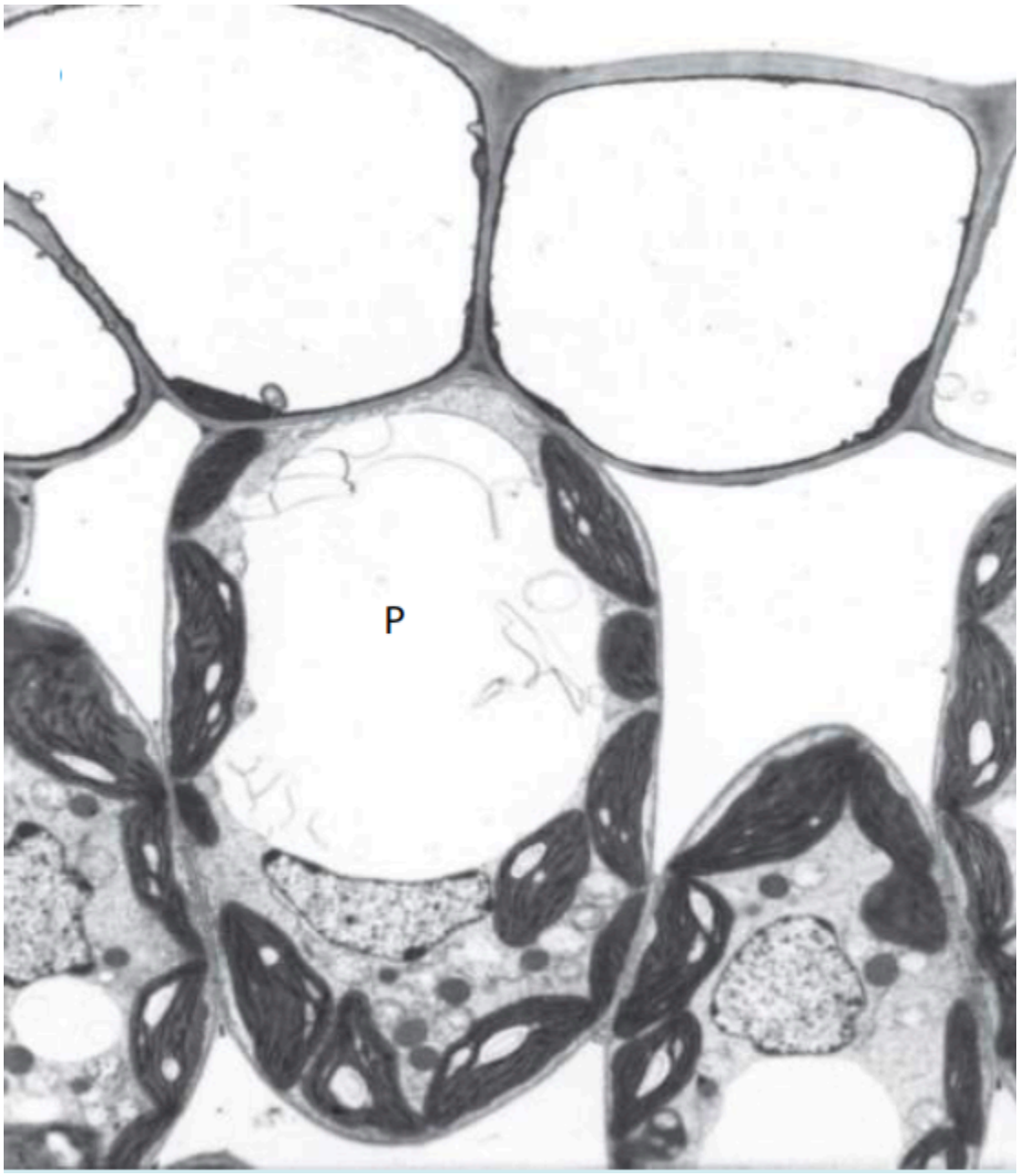


Fig. 5.1

Space for magnification calculation:

Show your working :

Length of cell P should be measured in μm.

Magnification ……. [4]

(b) Differentiate between magnification and resolution.

……

……

……...[2]

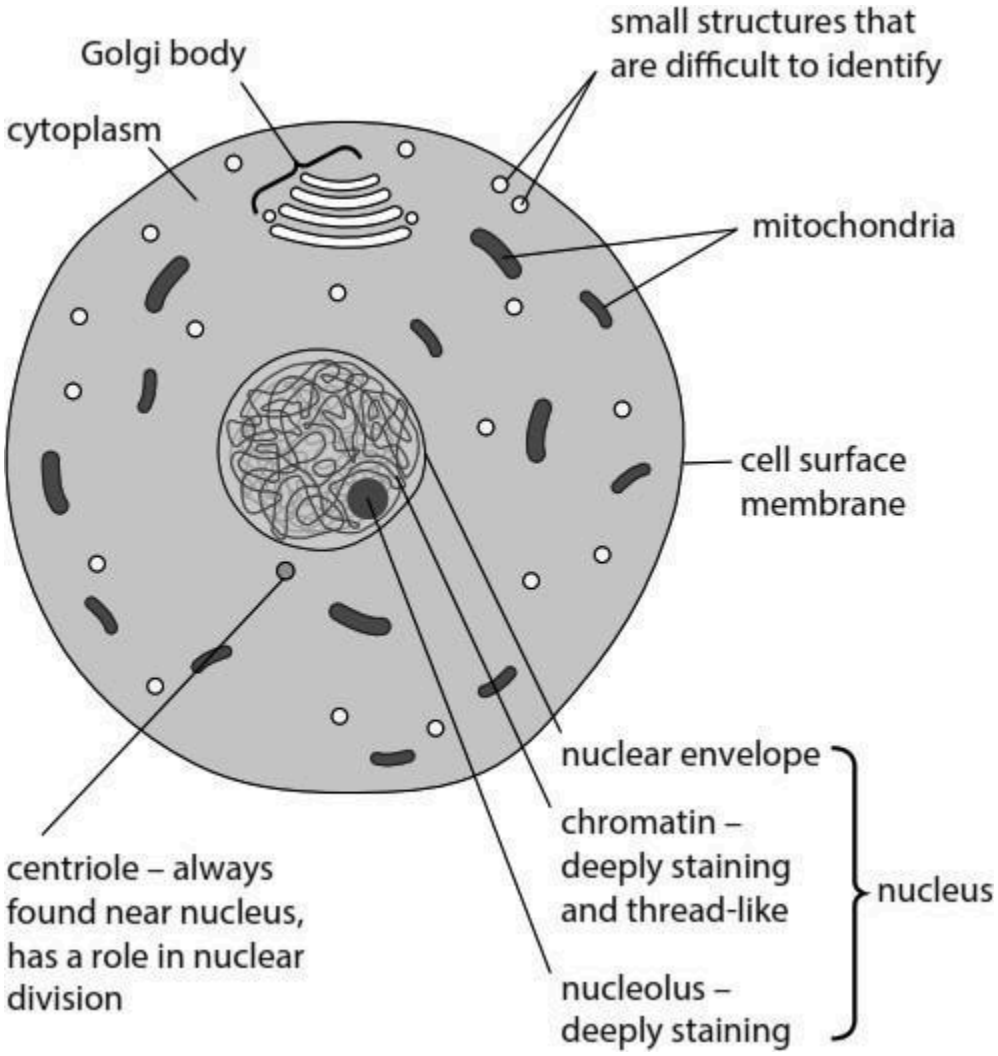


Fig. 6.1 Structure of a generalised animal cell (diameter about 20 µm) as seen with a very high quality light microscope.

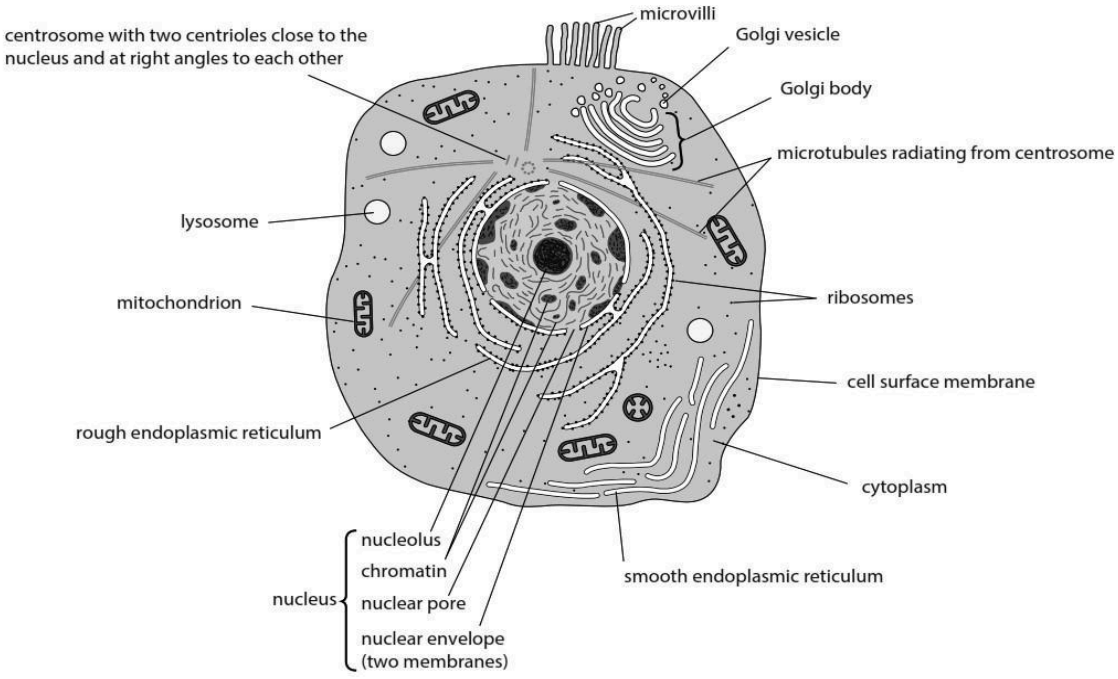


Fig. 6.2 Ultrastructure of a typical animal cell as seen with an electron microscope. In reality, the ER is more extensive than shown, and free ribosomes may be more extensive. Glycogen granules are sometimes present in the cytoplasm.

Name the structures in an animal cell which can be seen with the electron microscope but not with the light microscope. Include the reference of Fig.6.1 and 6.2. in your answer.

……

……

……

……

……

……

……

……

……

……**[5]**

7 (a) Discuss the key functions of a cell membrane

……

……

……

……

……

……

……

……

……

……

……

……[5]

(b) Analyse how water's role as a reactant in hydrolysis and photosynthesis contributes to cellular metabolism.

……

……

……

……

……

……

……

……

……

……[3]

(c) Evaluate the significance of water's polarity in enabling it to act as a universal solvent for life.

……

……

……

……

……

……

……

……

……[3]

(d) Analyse how water's high latent heat of vaporisation supports thermoregulation in mammals.

……

……

……

……

……

.....

.....

.....

.....[3]

8 (a) Name the organelle present in plant cell not in animal cell and bounded by two membranes (an envelope)

…….[1]

(b) Compare a light microscope and an electron microscope using the headings provided below.

(i) Source of radiation
(ii) Maximum resolution
(iii) Lenses

Headings	Light microscope	Electron microscope

[3]

Practical Questions [35 Marks]

1 A student investigated the effect of temperature on the rate of an enzyme-controlled reaction. At each temperature, he started the reaction using the same volume of substrate solution and the same volume of enzyme solution.
The following Fig.1.1 shows his result.

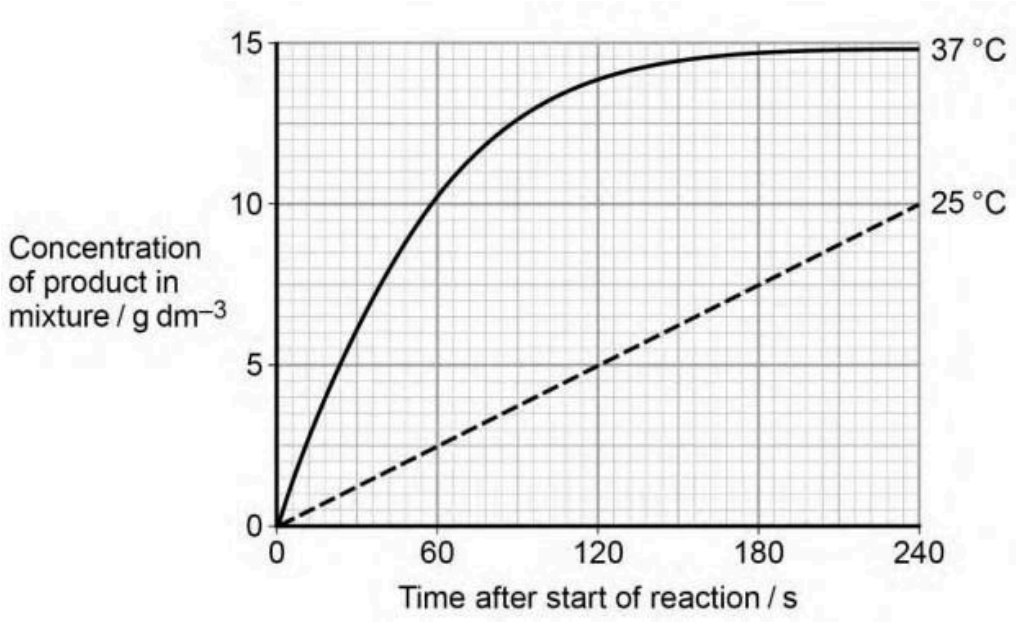


Fig.1.1

(a) State one other factor the student would have controlled.

……..[1]

(b) Calculate the rate of reaction at 25 ^{0}C .

……

……

……

……[2]

(c) Differentiate between the two curves.

……

……

.....

.....

.....

.....

.....

.....[5]

2 A student investigated the hydrolysis of starch. He added amylase to a suspension of starch and measured the concentration of maltose in the reaction mixture at regular intervals. Her results are shown in Fig.2.1.

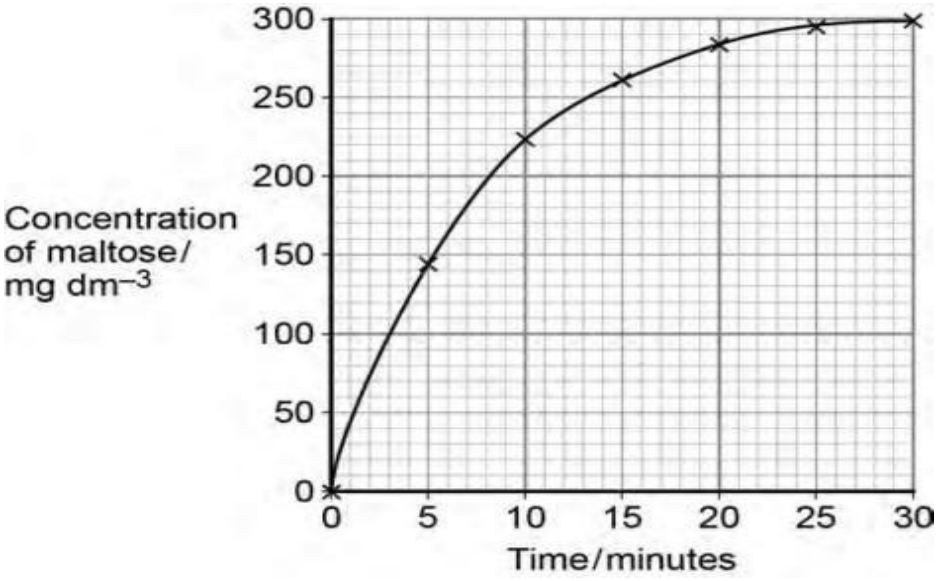


Fig. 2.1

A quantitative Benedict's test produces a colour whose intensity depends on the concentration of reducing sugar in a solution. A colorimeter can be used to measure the intensity of this colour. The student used quantitative Benedict's tests to produce a calibration curve of colorimeter reading against concentration of maltose.

(a) Describe how the student would have produced the calibration curve and used it to obtain the results in Fig.2.1.

……

……

……

……

……

……

……

……**[3]**

(b) Describe how you could perform a Benedict's test. Include a precautionary measure in your answer.

……

……

……

……

……

……

……**[3]**

3 Photosynthetic pigments absorb light energy, which is used during the production of ATP and NADPH in the light-dependent reactions of photosynthesis.

(a) Fig. 3.1 shows a paper chromatogram produced with four photosynthetic pigments.

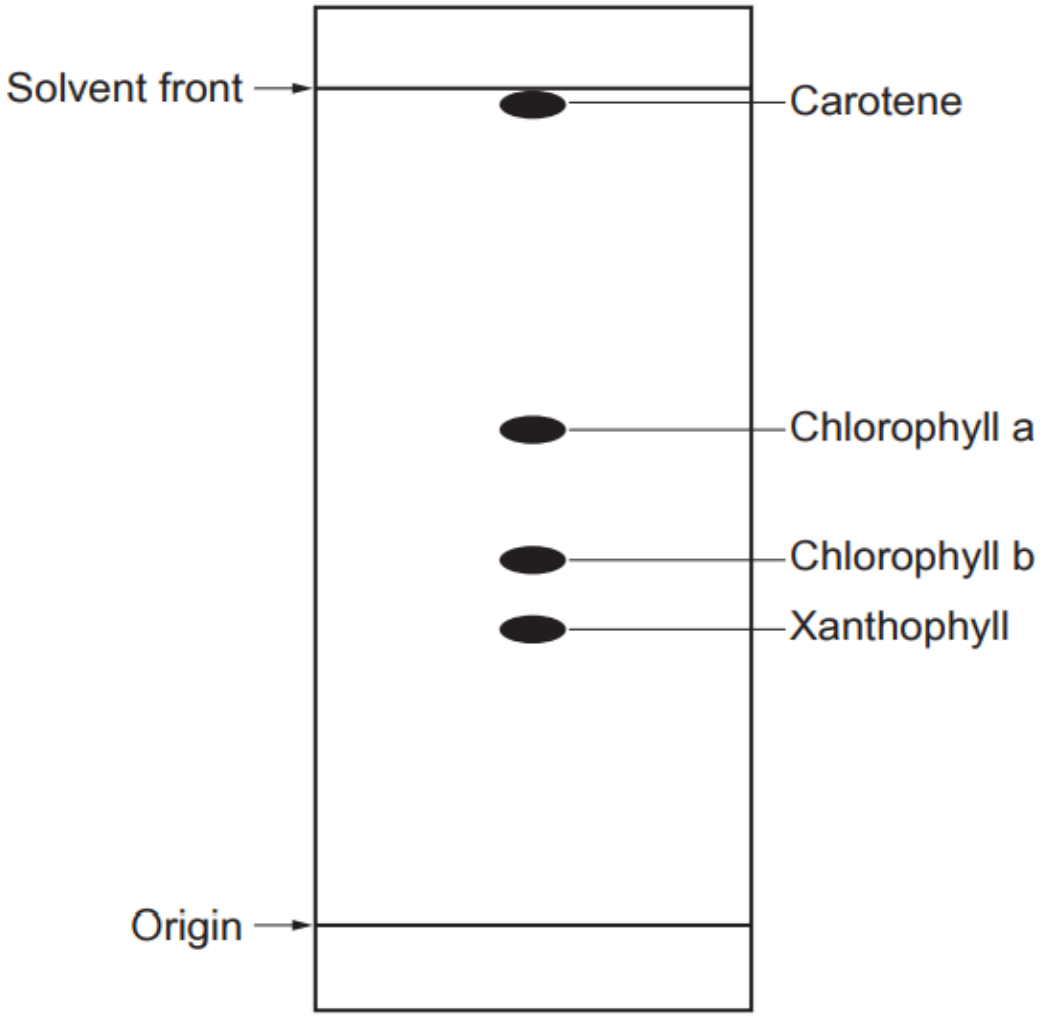


Fig. 3.1

(i) Use Fig. 3.1 to calculate the Rf value of chlorophyll a. Give your answer to 2 significant figures.

Rf = ... [2]

(ii) Another student carried out paper chromatography on the four photosynthetic pigments but they used a different solvent.
Analyse why the Rf values obtained by the student may not match those shown in Fig. 3.1.

.....

.....

.....

.....

.....

.....

.....

.....**[1]**

4 A calibration curve is a graph that is used to work out the concentration of an unknown substance by comparing it with previous measurements of samples with known concentrations.

A group of researchers are developing a potential drug to treat type II diabetes. They assess the performance of each drug sample by measuring the absorbance of samples of blood plasma using a colorimeter. They use a calibration curve to find the concentration of insulin in the blood plasma.

(a) Suggest how the scientists could obtain the data to produce a calibration curve and use it to find the concentration of insulin in the blood plasma.

.....

.....

.....

.....

.....

.....

.....

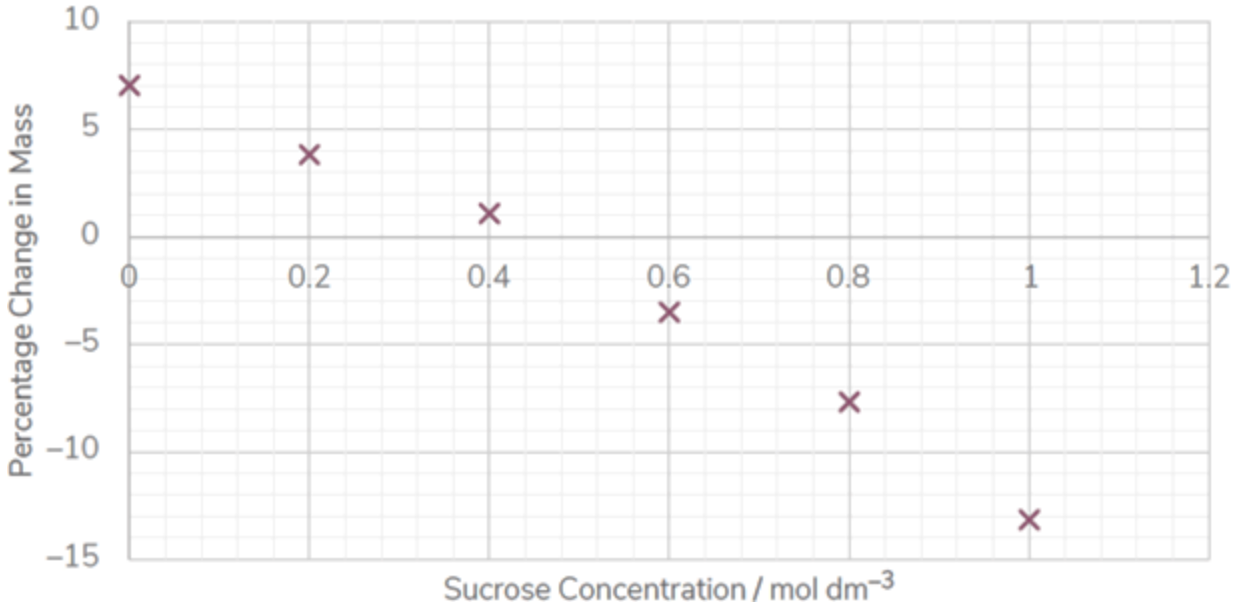
.....

.....

.....

. **[4]**

(b) A scientist wants to determine the water potential of apple tissue. They produce the calibration curve shown below.



Use the graph to determine the sucrose concentration of the apple tissue.

.....

.....

.....

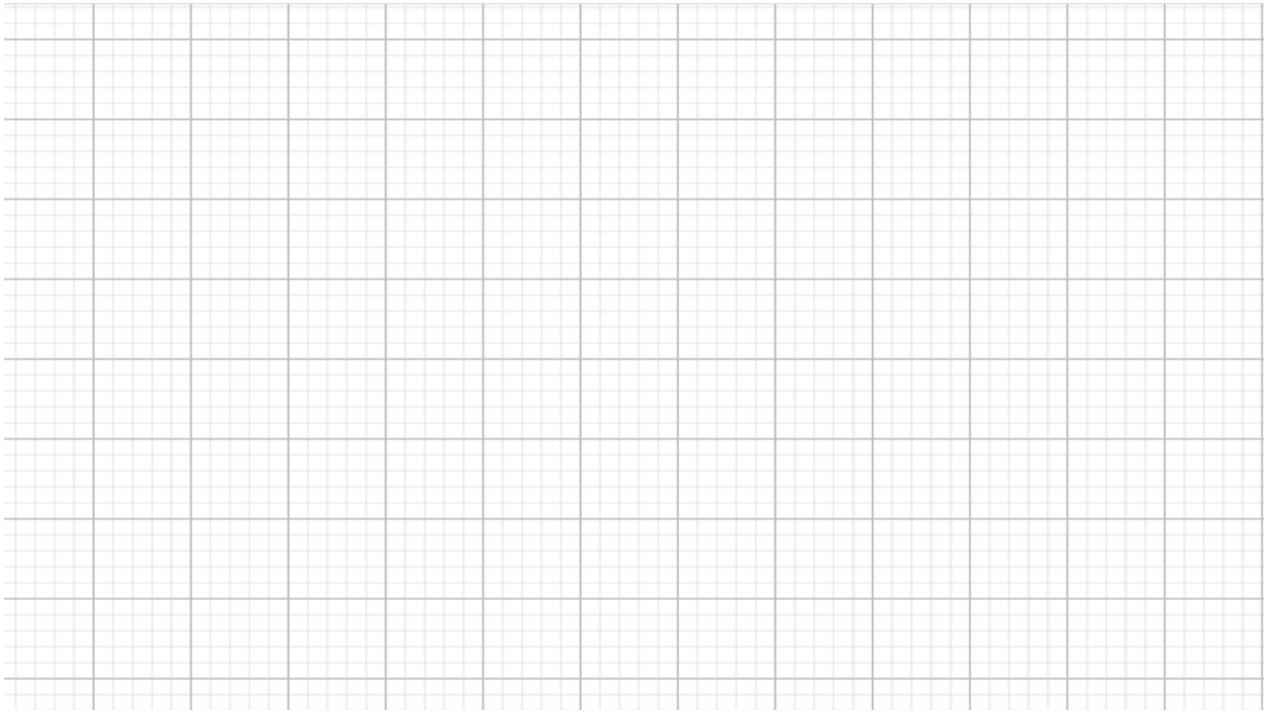
.....

.....[2]

(c) A dilution series of sucrose solution was prepared and a potato cylinder was soaked in each solution for 24 hours. The percentage change in mass of the potato cylinder in each solution was recorded. The results are shown below.

SUCROSE CONCENTRATION / MOL DM^{-3}	PERCENTAGE CHANGE IN MASS
0	3.92
0.25	0.88
0.5	-3.75
0.75	-8.75
1	-12.32

(i) Plot the result on a grid provided below.



[4]

(ii) Using the graph, determine the point where the water potential of the sucrose solution equals the water potential of the potato cells. Show your working on the graph.

…….

…….[2]

5 (a) Define hypotonic, hypertonic solutions.

……

……

……

……

……

…… **[2]**

(b) State one effect of each solution mentioned in part (a) on plant cells and animal cells.

……

……

……

……

……

……

…… **[4]**

Biology Model Paper 1 – Mark Scheme 2025

Section A

Multiple Choice Questions MCQs [30 Marks]

Question #	Answers	Marks
1	C	1
2	B	1
3	B	1
4	B	1
5	D	1
6	B	1
7	C	1
8	A	1
9	A	1
10	B	1
11	A	1
12	B	1
13	C	1
14	A	1
15	B	1
16	B	1
17	A	1
18	C	1
19	C	1
20	C	1

21	**A**	**1**
22	**A**	**1**
23	**B**	**1**
24	**B**	**1**
25	**B**	**1**
26	**D**	**1**
27	**C**	**1**
28	**D**	**1**
29	**B**	**1**
30	**A**	**1**

Biology Model Paper 1 – Mark Scheme 2025

Section B

Theoretical Questions [55 Marks]

Question #	Answers	Marks
1 a	**Respiration: In aerobic respiration, electrons are passed along the electron transport chain in the inner mitochondrial membrane. The energy released is used by protein pumps to actively pump H+cap H raised to the positive power *H*+ions from the mitochondrial matrix into the intermembrane space.** **Photosynthesis: In the light-dependent reactions, photolysis of water and electron transport within the thylakoid membrane generate a build-up of H+cap H raised to the positive power *H*+ions in the thylakoid lumen.**	**4**
1b	● **An iron deficiency would lead to lower levels of hemoglobin, reducing the blood's oxygen-carrying capacity.Oxygen is required for aerobic respiration to produce ATP.** ● **Since the transport of oxygen to tissues is reduced, the rate of aerobic respiration decreases.** ● **This results in less ATP being produced, which is the cell's energy currency.** ● **Consequently, the mammal's body cells and muscles receive less oxygen and energy, leading to a feeling of fatigue.**	**3**
2a	**In the hydrolysis reaction shown here, the disaccharide maltose is broken down to form two glucose monomers with the addition of a water molecule. One glucose gets a hydroxyl group at the site of the former covalent bond, the other glucose gets a hydrogen atom.**	**3**
2bi	**A = R group or side chain , this is varies in different amino acids,** **B= carboxalic acid group** **C= amine group**	**3**
2bii	● **Size and shape: Determines how the amino acid fits into protein structures.** ● **Polarity: Affects solubility and interactions with water or other**	**4**

	molecules. ● **Charge: Some R groups are positively or negatively charged, influencing protein folding and binding.** ● **Chemical reactivity: Certain R groups (like those in cysteine or serine) participate in enzymatic reactions or form structural bonds.**	
3	**Structure of Globular Proteins** ● **Globular proteins are round structures. Like their name, globular proteins have a round, spherical formation. This is because the hydrophobic parts of the protein fold inwards while the hydrophilic parts become arranged around the external surface.** ● **Examples:** **Hemoglobin : Carries oxygen throughout the body.** **Enzyme : Catalyze biochemical reactions.** **Immunoglobulins (Antibodies): Involved in the immune response.** **Structure of Fibrous Proteins** ● **Fibrous proteins are long chains. They are made up of repeated amino acid sequences that form long polypeptide chains. These chains twist together to form fibrous proteins.** ● **Examples:Collagen: A major component of connective tissues, skin, tendons, and bones.** **Keratin : The primary structural protein in hair, nails, and horns.** **Elastin : Found in tissues that need to stretch and recoil, like the skin and lungs.**	**4**

<table>
<tr>
<td>4</td>
<td>
<table>
<tr><th>Prokaryotes</th><th>Eukaryotes</th></tr>
<tr><td>average diameter of cell is 0.5–5 µm</td><td>cells commonly up to 40 µm diameter and commonly 1000–10 000 times the volume of prokaryotic cells</td></tr>
<tr><td>DNA is circular and lies free in the cytoplasm</td><td>DNA is not circular and is contained in a nucleus – the nucleus is surrounded by an envelope of two membranes</td></tr>
<tr><td>DNA is naked</td><td>DNA is associated with protein, forming structures called chromosomes</td></tr>
<tr><td>slightly smaller (70S) ribosomes (about 20 nm diameter) than those of eukaryotes</td><td>slightly larger (80S) ribosomes (about 25 nm diameter) than those of prokaryotes</td></tr>
<tr><td>no ER present</td><td>ER present, to which ribosomes may be attached</td></tr>
<tr><td>very few cell organelles – no separate membrane-bound compartments unless formed by infolding of the cell surface membrane</td><td>many types of cell organelle present (extensive compartmentalisation and division of labour):
■ some organelles are bounded by a single membrane, e.g. lysosomes, Golgi body, vacuoles
■ some are bounded by two membranes (an envelope), e.g. nucleus, mitochondrion, chloroplast
■ some have no membrane, e.g. ribosomes, centrioles, microtubules</td></tr>
<tr><td>cell wall present – wall contains murein, a peptidoglycan (a polysaccharide combined with amino acids)</td><td>cell wall sometimes present, e.g. in plants and fungi – contains cellulose or lignin in plants, and chitin (a nitrogen-containing polysaccharide similar to cellulose) in fungi</td></tr>
</table>
</td>
<td>5</td>
</tr>
<tr>
<td>5a</td>
<td>
Step 1 Measure the length in mm of the cell in the photograph using a ruler. You should find that it is about 60 mm.

Step 2 Convert mm to µm. (It is easier if we first convert all measurements to the same units – in this case micrometres, µm.) 1 mm = 1000 µm so 60 mm = 60 × 1000 µm = 60 000 µm Step

3 Use the equation to calculate the magnification,

$$\text{magnification, } M = \frac{\text{image size, } I}{\text{actual size, } A} = \frac{60\,000\,\mu\text{m}}{80\,\mu\text{m}} = \times 750$$
</td>
<td>4</td>
</tr>
<tr>
<td>5b</td>
<td>
Resolution is the ability to distinguish between two objects very close together; the higher the resolution of an image, the greater the detail that can be seen.

Magnification is the number of times greater that an image is than the actual object;

magnification = image size ÷ actual (real) size of the object.
</td>
<td>2</td>
</tr>
</table>

6	**rough er , smooth er, microvilli, lysosome, golgi vesicle , ribosome , microtubule, nuclear pore**	**5** **Max 5**
7a	• **Selective Permeability: The membrane allows certain molecules (like oxygen and nutrients) to pass through while blocking others, maintaining internal balance (homeostasis).** • **Structural Support: It provides shape and mechanical stability to the cell by anchoring the cytoskeleton.** • **Protection: Acts as a shield, separating the internal environment from external threats or fluctuations.** **Communication: Embedded proteins and sugars help cells recognize and respond to signals from other cells or the environment**	**5**
7b	**Hydrolysis is a catabolic *reaction* where water is used to break chemical bonds in large biomolecules, making their components available for cellular use.** **Photosynthesis is an anabolic process where water contributes electrons and protons necessary for synthesizing glucose, the primary energy source for cells.** **Water's dual role in hydrolysis and photosynthesis supports both energy release and energy storage.**	**3**
7c	• **Medium for biochemical reactions: Most metabolic reactions occur in aqueous environments where reactants are dissolved and mobile.** • **Transport of nutrients and waste: Water carries dissolved substances through blood, cytoplasm, and across membranes.** • **Cellular homeostasis: Water helps maintain pH balance, ion gradients, and temperature regulation.** • **Enzyme activity: Enzymes require aqueous environments to interact with substrates and catalyze reactions efficiently.**	**3**

<table>
<tr><td>7d</td><td>· Sweating Mechanism: When a mammal overheats, sweat glands release water onto the skin.

· Evaporative Cooling: As sweat evaporates, it absorbs a large amount of heat from the skin due to water’s high latent heat.

· Heat Removal: This process removes excess body heat, cooling the body effectively without a drastic loss of water.

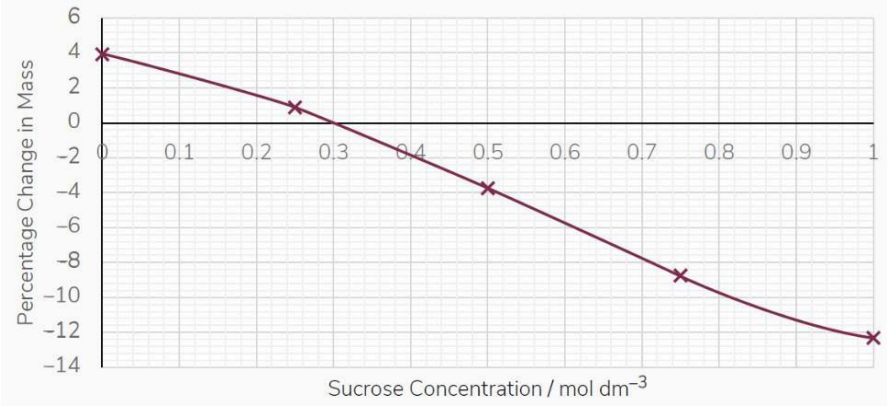
· Temperature Stability: It helps maintain a stable internal temperature, which is vital for enzyme function and overall metabolic processes.</td><td>3</td></tr>
<tr><td>8a</td><td>chloroplasts</td><td>1</td></tr>
<tr><td>8b</td><td><table><tr><th>Heading</th><th>Light Microscope</th><th>Electron Microscope</th></tr><tr><td>Source of Illumination</td><td>Uses visible light rays</td><td>Uses a beam of electrons</td></tr><tr><td>Lenses</td><td>Uses glass lenses</td><td>Uses electromagnetic lenses</td></tr><tr><td>Resolution</td><td>Lower resolution (~200 nm)</td><td>Much higher resolution (~0.1 nm)</td></tr></table></td><td>3</td></tr>
</table>

Biology Model Paper 1 – Mark Scheme 2025

Section B

Practical Questions [35 Marks]

Question #	Answers	Marks
1a	Concentration of substrate solution / of enzyme solution / pH	1
1b	1. 2.5/0.04; 2. g dm–3 minute–1 / g dm–3 s–1 1 mark for correct value 1 mark for related unit	2
1c	1. Initial rate of reaction faster at 37 °C; 2. Because more kinetic energy; 3. So more E–S collisions/more E–S complexes formed; 4. Graph reaches plateau at 37 °C; 5. Because all substrate used up;	5
2a	1. Make/use maltose solutions of known/different concentrations (and carry out quantitative Benedict's test on each); 2. (Use colorimeter to) measure colour/colorimeter value of each solution and plot calibration curve/graph described; 3. Find concentration of sample from calibration curve;	3
2b	1. Reaction: Benedict's reagent contains copper II IONS, which are reduced by reducing sugars in an alkaline solution. 2. Color Change: This reduction forms copper I oxide, a brick-red precipitate, and the remaining solution becomes less blue. 3. Quantification: The amount of red precipitate formed is directly proportional to the concentration of reducing sugars. A colorimeter measures the absorbance of the solution (or the amount of light transmitted through it) at a specific wavelength (often red light).	3
3ai	Rf value of chlorophyll a =	2

3aii	**The Rf values depend on how well each pigment dissolves in the solvent and interacts with the paper. Using a different solvent alters the solubility and affinity of the pigments, causing them to travel different distances. This means the separation pattern and Rf values will differ from those in Fig. 3.1 due to changes in polarity, solvent front movement, and pigment-solvent interactions.**	**1**
4a	**(Use a dilution series to) produce samples of known insulin concentrations.** **Measure the absorbance of each concentration / measure each concentration with a colorimeter.** **Plot a graph of absorbance against concentration and draw a line of best fit.** **Use the absorbance of the blood plasma to find the insulin concentration from the curve.**	**4**
4b	**Draw a line of best fit.** **Read the concentration where the line of best fit crosses the *x*-axis / where the percentage change is 0.**	**2**
4c i		**4**

4 c ii	**The point at which the percentage change in mass is 0 is the point at which the water potential of the sucrose solution is the same as the water potential of the potato cells.** **Show this on the graph**	**2**
5a	• **Hypotonic Solution: A solution with a lower concentration of solutes compared to the inside of the cell. Water moves into the cell by osmosis.** • **Hypertonic Solution: A solution with a higher concentration of solutes than inside the cell. Water moves out of the cell by osmosis.**	**2**
5b	**Hypotonic effects on plant cells: turgid water enters,** **Effects on animal cells : burst water enters** **Hypertonic effect on plant cells: plasmolysed water leaves** **Effects on animal cells: shrinks water leaves**	**4**