



L-Università
ta' Malta

MATSEC
Examinations Board



Marking Scheme

IM Biology

First Session 2025


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In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits and will have consulted with the MATSEC Examinations Board when in doubt.

SECTION 'A'

Question No		Solution	Marks	Additional comments	
1	a	Fluid- the phospholipids are not (tightly) bonded together , and so molecules can move sideways / move around each other in the membrane. Mosaic- proteins are scattered about the membrane and resemble a mosaic OR made up of different types of molecules, dispersed and arranged in the bilayer	2 1	3	
	b	The cell membrane consists of a phospholipid bilayer which is formed when the hydrophilic heads of the phospholipids face the outside of the membrane and are in contact with water on both sides while the hydrophobic tails face each other and face the inside of the membrane away from water .	1 2 1	4	
	c	Proteins Cholesterol Carbohydrates Glycoprotein Lipoprotein Glycolipid	1 mark each for any three	3	
			Total:	10	
2	a	Blood Vessel	Name	Reason for choice	6
		A	Artery	thick walls / the narrower lumen diameter	
		B	Capillary	consists of a single layer of endothelial cells / narrowest lumen / narrowest blood vessel	
		C	Vein	thinner walls / wider lumen	
	b	i	Tissue fluid allows the diffusion of substances between the body cells and the blood. Oxygen and nutrients pass into the cells and waste products, and carbon dioxide are removed. OR Allows white blood cells to move to tissues.	1 1	2
	ii	This is important for blood flow to slow down. Therefore, ensure enough time for diffusion to occur. OR	1 1	2	

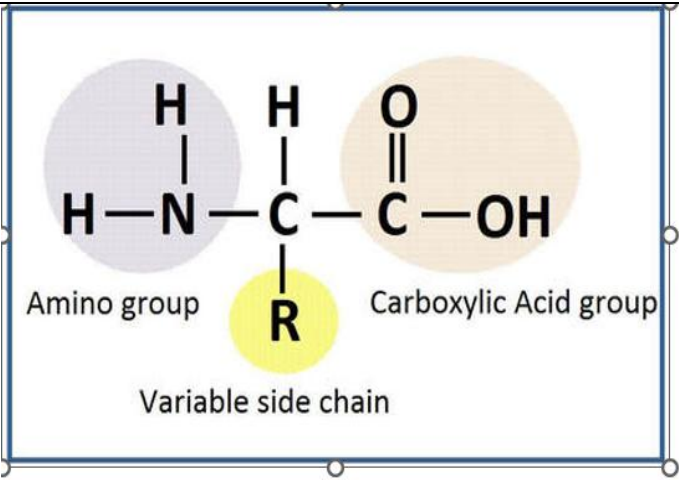
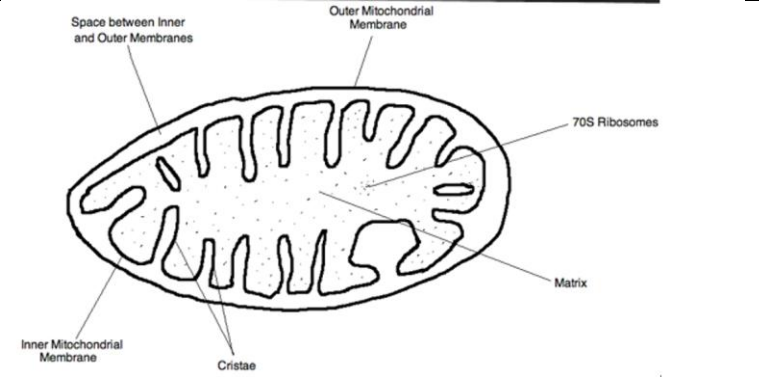
			<p>Fluid moves out of the capillary So, there is a lower volume of blood pressing against the capillary wall.</p> <p>OR</p> <p>Blood spreads out from artery / large blood vessel into several capillaries which are smaller ones / are narrower.</p> <p>OR</p> <p>To prevent bursting of capillary wall As it is too thin to withstand high pressure.</p>		
				Total:	10
3	a		<p>True</p> <p>Recombinant DNA technology involves combining DNA from different sources to create a new set of genes. One of its applications is the production of proteins. Scientists can insert a gene that codes for a specific protein into a host organism</p>	1	2
			<p>True</p> <p>These overhanging sequences have unpaired bases that can easily form hydrogen bonds with complementary sticky ends of other DNA fragments.</p>	1	
	c		<p>False</p> <p>Ligase is used to join DNA from different sources together.</p>	1	2
			<p>False</p> <p>Different types of vectors exist (e.g. viruses are also used as vectors.)</p>	1	
	e		<p>True</p> <p>The gene for human insulin is inserted into a plasmid and then into bacteria which start producing the human insulin protein.</p>	1	2
			1		
				Total:	10
4	a	i	<p>Banana trees, Coconut trees</p>	1	2
		ii	jaguar		
	b		<p>Correct</p> <p>When jaguar feeds on monkeys, it is a secondary consumer.</p> <p>When jaguar feeds on frogs, it is a tertiary consumer.</p>	1	3
			1		

	c	<div style="text-align: center;"> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">jaguar</div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 5px auto;">monkeys</div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 5px auto;">Banana trees</div> </div>	2 marks for shape 1 mark for labelling	3												
Total:				9												
5	a		½ mark each	2												
	b	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Hormone</th> <th style="width: 33%;">Site of production</th> <th style="width: 33%;">Function</th> </tr> </thead> <tbody> <tr> <td>Follicle stimulating hormone (FSH)</td> <td>Pituitary gland</td> <td>Production of sperm cells (spermatogenesis)</td> </tr> <tr> <td>Luteinizing hormone (LH)</td> <td>Pituitary gland</td> <td>Production of testosterone</td> </tr> <tr> <td>Testosterone</td> <td>Testes</td> <td>Production of sperm cells (spermatogenesis) OR Gives rise to secondary sexual male characteristics</td> </tr> </tbody> </table>	Hormone	Site of production	Function	Follicle stimulating hormone (FSH)	Pituitary gland	Production of sperm cells (spermatogenesis)	Luteinizing hormone (LH)	Pituitary gland	Production of testosterone	Testosterone	Testes	Production of sperm cells (spermatogenesis) OR Gives rise to secondary sexual male characteristics	1 mark each	6
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Testosterone	Testes	Production of sperm cells (spermatogenesis) OR Gives rise to secondary sexual male characteristics														
	c	Epididymis Ejaculatory duct.	½ ½	1												
	d	Cervix Oviduct / Fallopian tube	½ ½	1												
	e	Flagellum		1												
Total:				11												

Section B

6	a	i	<p>Interphase: replication of DNA biochemical reactions / protein synthesis formation of organelles cell growth</p>	<p>1 mark each</p>	<p>3</p>
		ii	<p>Animal cell: The cytoplasm starts to pinch inwards Due to a ring of microfilaments. A cleavage furrow forms. The ring contracts until the two cells separate.</p> <div data-bbox="351 739 1085 1030" data-label="Diagram"> <p style="text-align: center;">Animal cell</p> <p style="text-align: center;">Microfilaments ring Cleavage furrow</p> </div> <p>Plant cell: Golgi apparatus releases vesicles (filled with cellulose and pectins) The vesicles gather at the centre of the cell / equator of the spindle Forming a cell plate. The vesicles fuse together until a continuous cell wall forms.</p> <div data-bbox="343 1545 1101 1870" data-label="Diagram"> <p style="text-align: center;">Plant cell</p> <p style="text-align: center;">Cell plate joins to the plasma membrane</p> <p style="text-align: center;">Cell plate Middle lamella Cell wall</p> </div>	<p>1 1 1 2 1 1 1 2</p>	<p>10</p>
b	i		<p>Nuclear material (chromatin) in nucleus condenses. Chromosomes become visible. Nuclear membrane disintegrates.</p>	<p>1 1 1, 1</p>	<p>6</p>

		<p>Microtubules (spindle) move chromosomes to the centre of the cell.</p> <p>The microtubules move the chromosomes apart – towards opposite poles / ends of the cell.</p> <p>The nuclear membrane reforms around each group of chromosomes.</p>	1 1													
	ii	<p>Growth</p> <p>Replacement of cells</p> <p>Asexual reproduction</p>	1 1 1	3												
	iii	<table border="1"> <thead> <tr> <th></th> <th>Mitosis</th> <th>Meiosis</th> </tr> </thead> <tbody> <tr> <td>Number of cells formed</td> <td>2</td> <td>4</td> </tr> <tr> <td>Cells are genetically identical or genetically different.</td> <td>Identical</td> <td>Different</td> </tr> <tr> <td>Types of cells formed.</td> <td>Somatic (any type of cell except gamete)</td> <td>Gametes</td> </tr> </tbody> </table>		Mitosis	Meiosis	Number of cells formed	2	4	Cells are genetically identical or genetically different.	Identical	Different	Types of cells formed.	Somatic (any type of cell except gamete)	Gametes	1 1 1	3
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			Total:	25												
7	a		2 marks for drawing 1 mark for each label	5												
	b	<p>i</p> <p>Transparency: Allows light through</p> <p>Allows photosynthesis to proceed</p> <p>Photosynthetic organisms can support the aquatic ecosystem.</p>	1 1 1	3												
		<p>ii</p> <p>Water acts as a habitat for a wide variety of organisms.</p> <p>Water acts as a transport medium. (allow reference to both external and internal role)</p> <p>Water acts as a solvent, providing an environment where chemical reactions may occur.</p>	1 1 1	3												
		<p>iii</p> <p>Water temperature is relatively constant (thermal buffer)</p> <p>Less energy is spent by organisms to maintain a constant body temperature (i.e. thermoregulation)</p>	1 1	2												

	c	Water (in sweat) evaporates from the skin surface. Due to a high latent heat of vaporisation It absorbs a lot of heat from the body / skin to evaporate. This brings about a cooling effect .	1 1 1 1	4	
	d	i	Carbon, Hydrogen, Oxygen, Nitrogen	½ mark each	2
		ii		1 mark for diagram 2 marks for labels	3
		iii	Fibrous proteins are long, strand-like proteins whereas globular proteins have a spherical shape . Fibrous: Collagen or Keratin or equivalent Globular: Haemoglobin, any named enzyme	1 1 0.5 0.5	3
			Total:	25	
8	a		2 marks for diagram 1 mark for labels	7	
	b	Krebs cycle: occurs in the matrix Electron transport chain: occurs on the inner (mitochondrial) membrane	1 1 1 1	4	
	c	i	NAD accepts hydrogen from different molecules Allowing their oxidation.	1 1	2

		ii	Pyruvate is the product of glycolysis. It enters the mitochondrion, allowing the remaining stages of aerobic respiration to proceed.	1 1	2
		iii	ATP provides energy for the first part of glycolysis to proceed. ATP traps energy released from glucose.	1 1	2
		d	Electrons flow along the electron transport chain. Energy is released. Energy is used to pump H⁺ from the matrix to the intermembrane space . H ⁺ flow back to the matrix down the concentration gradient Through ATP synthase . The flow of H⁺ releases energy and Drives ATP synthesis.	1 1 1 1 1 1 1 1	8
				Total:	25
9	a		Biodiversity refers to the number of different species of organisms which exist. Organisms are classified into 5 kingdoms 1. Kingdom Prokaryota single- celled organisms / having no nucleus / no membrane- bound organelles E.g. bacteria. 2. Kingdom Protoctista mostly unicellular / eukaryotic organisms / lacking complex organ systems and most are aquatic. All other eukaryotic kingdoms evolved from ancestors of these organisms. E.g. algae/ <i>Amoeba</i> / <i>Euglena</i> / <i>Paramecium</i> . 3. Kingdom Fungi eukaryotic organisms / consist mainly of thread-like hyphae/ cell wall is made of chitin. Have a saprophytic mode of nutrition e.g. mushrooms/ yeast/ moulds. 4. Kingdom Plantae	1 ½ ½ 1 ½ ½ ½ ½ ½ ½ ½ ½	15

		<p>eukaryotic organisms / with cells having cellulose cell walls Are photosynthetic and so make their own food. Most are terrestrial and vascular. E.g. angiosperm/ flowering plants/ bryophyte/ mosses/ ferns/ conifers.</p> <p>5. Kingdom Animalia Multicellular eukaryotic organisms / with cells lacking cell walls. Animals are mobile and respond quickly to stimuli. Some are invertebrates and have no backbone e.g. jellyfish/ earthworm/ tapeworm/ spider/ crab, while others are vertebrates and have a backbone e.g. fish/ amphibians/ reptiles/ birds/ mammals.</p>	<p>1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2</p>	
b	i	<p>Variation means that individuals making up a species are genetically diverse. Therefore, they differ in their ability to find food, resist environmental conditions, escaping predators and finding mates. Genetic variation arises mainly by mutations many of which are harmful but occasionally will result in making individuals better adapted to surviving in its environment.</p>	<p>1 1 1 1</p>	4
	ii	<p>In the theory of natural selection, those organisms which show the best adaptations to survive will survive more, reproduce more and so pass on these characteristics to their offspring. In the example of the finches, the birds showing the beak size/ shape which was best at feeding on the food available on a particular island were the ones to survive. The weaker individuals with the less adapted beaks would have died or failed to reproduce. Therefore, the offspring would mostly inherit beaks which were better adapted at feeding on the food available. Over time, the finches on the particular island would all consist of birds having the well adapted beaks.</p>	<p>2 1 1 1 1</p>	6
			Total:	25

10	a	<p>A pathogen is an organism or particle which causes a disease.</p> <p>Viral disease e. g. influenza/ common cold/ covid-19</p> <p>Bacterial disease e.g. food poisoning/ Salmonella/ meningitis</p>	1	3
			1	
			1	
	b	<p>i</p> <p>The skin is a tough physical barrier which consists mainly of dead cells and has very little water making it difficult for microorganisms to grow therefore they tend to die.</p> <p>Skin is also constantly worn away therefore any pathogens on its surface are quickly removed before they penetrate the skin.</p> <p>Sweat and sebaceous glands in the skin produce secretions which contain substances such as lactic acid which kill pathogens.</p> <p>When the skin is cut it immediately forms a blood clot preventing entry of pathogens.</p> <p>If pathogens enter the mouth or nose, these are trapped by mucus produced by mucous membranes lining the digestive and respiratory tracts.</p> <p>Mucus contains lysozyme enzyme which breaks down bacterial cell walls.</p> <p>Cells lining the trachea and bronchi possess cilia which beat to move mucus with trapped microbes up to the mouth or swallowed into the stomach.</p>	1 mark each	5
	<p>ii</p> <p>These cells are the phagocytic leucocytes or phagocytes. They are able to destroy pathogens by engulfing them.</p> <p>These cells are non- specific meaning that they are able to attack a wide variety of pathogens without needing to recognize the specific type of pathogen.</p>	1	3	
	<p>iii</p> <p>In the specific immune response, two types of white blood cells are involved. These are the B and T lymphocytes.</p> <p>B lymphocytes are produced and mature in the bone marrow.</p> <p>B lymphocytes recognize specific pathogens from their antigens.</p> <p>Antigens are molecules such as proteins which are present on the surface of all cells including bacteria and viruses which act as identification tags.</p>	1	8	
			1	

		<p>Antigens enable our immune system cells to recognize cells which are self (belong to us) from those which are non- self.</p> <p>When a B cell recognizes a specific antigen by binding to it in the blood</p> <p>The B cell divides rapidly to produce a clone of B cells. These clones can then all secrete a huge number of antibodies in the blood to enable the pathogen to be destroyed.</p>	<p>1</p> <p>1</p> <p>1</p>	
	iv	<p>Our immune response is also able to produce memory cells.</p> <p>Memory cells survive in our bodies for a long time, and they are able to recognize pathogens which were previously encountered by the body.</p> <p>In this way, if a pathogen tries to invade a second time, memory cells will recognize it and immediately activate an immune response against it.</p> <p>This response is so quick that no symptoms of the disease develop.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	4
	v	<p>This is a weakened or dead pathogen which is injected into a person</p> <p>to allow the person to build up an immune response against the pathogen without the pathogen being able to cause the disease.</p>	<p>1</p> <p>1</p>	2
			Total:	25