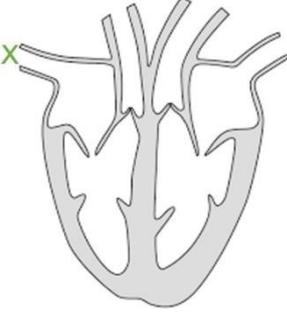


Question Number	Answer	Marks
1.1	<ul style="list-style-type: none"> • Prokaryotic cell is smaller • Prokaryotic cell has no nucleus • Prokaryotic cell has a single loop of DNA/ plasmids/ genetic material is free in cytoplasm 	3
1.2	<ul style="list-style-type: none"> • 1.5 μm 	1
1.3	<ul style="list-style-type: none"> • Protein synthesis 	1
1.4	<ul style="list-style-type: none"> • Light microscopes use light and lenses to form a magnified image of a specimen • Electron microscopes have higher magnification and higher resolution • Therefore, scientists can view subcellular structures such as the mitochondrion which could not previously be visualised • Due to the higher resolving power, even structures such as the nuclei could be viewed at a higher resolution which led to greater biological knowledge and understanding 	3
1.5	<ul style="list-style-type: none"> • Magnification= Image size/actual size • $2.6 \times 10^{-4} \times 1500 = 0.39\text{m}$ • $0.39\text{m} = 39\text{cm}$ 	3
1.6	<p>Indicative content:</p> <ul style="list-style-type: none"> • Use tweezers to peel the epidermal tissue from an onion • Add a drop of water to a clean slide, place the epidermal tissue on the slide and add an iodine stain to ensure that the structures can be observed • Slowly place the cover slip over the epidermal tissue, ensuring that no air bubbles become trapped • Place slide under a microscope onto the stage and ensure that the lowest powered objective lens is used first • Adjust using the coarse focus until the sub-cellular structures start to become viewable • Look down the eyepiece and move to the highest-powered objective lens • Adjust the fine focus until an image of high resolution is produced 	6

2.1	• Differentiation	1
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Question Number	Answer	Marks
2.2	<ul style="list-style-type: none"> Cells differentiate and obtain new structural features that enable them to carry out specific functions. 	2
2.3	<ul style="list-style-type: none"> Has extensions (dendrites) and an elongated structure that carries electrical impulses over great distances The branched structure provides a large surface area and forms a network with other neurons so that it can transfer electrical impulses Impulses travel along the central axon which is insulated by a fatty sheath that enables speeds up the rate of transfer of impulses. 	4
2.4	<ul style="list-style-type: none"> $7 \times 60 = 420$ minutes $420 / 35 = 12$ SO: $2^{12} = 4096$ $4096 - 1 = 4095$ 	2
2.5	<ul style="list-style-type: none"> Bacterial cells divide via binary fission (asexual reproduction) which produces genetically identical daughter cells 	2
2.6	<p>Pre-inoculation :</p> <ul style="list-style-type: none"> Petri dish and agar sterilised before use to kill unwanted bacteria inoculating loop passed through flame / sterile swab to sterilise / kill (other) bacteria <p>Inoculation:</p> <ul style="list-style-type: none"> loop/swab used to spread/streak bacterium onto agar lid of Petri dish opened as little as possible to prevent microbes from air entering <p>Post-inoculation</p> <ul style="list-style-type: none"> sealed with tape to prevent microbes from air entering incubate to allow the growth of bacteria 	4
3.1	<p>Indicative content:</p> <ul style="list-style-type: none"> The greater the temperature the greater the rate of diffusion. Particles move faster and have greater kinetic energy. Rate of diffusion is faster as they spread apart at a greater rate Steep concentration gradient= increased rate of diffusion Greater surface area= greater rate of diffusion e.g., more 'entry gaps' and 'exit' points so greater rate of particle movement 	4

Question Number	Answer	Marks
3.2	<ul style="list-style-type: none"> • $SA/V = 6 \cdot (5 \times 10^{-9})^2 / (5 \times 10^{-9})^3 = 1200000000 = 1.2 \times 10^9$ • $1.2 \times 10^9 : 1$ 	3
4.1	<ul style="list-style-type: none"> • 0.81 	1
4.2	<ul style="list-style-type: none"> • Concentration of the sugar solution 	1
4.3	<ul style="list-style-type: none"> • The student should pat the potato cylinders dry as excess water may affect the outcome of the results 	2
4.4	<ul style="list-style-type: none"> • Water entered via osmosis from a dilute solution in the test tube to a more concentrated solution inside the potato cylinder via a partially permeable membrane 	3
4.5	<ul style="list-style-type: none"> • Use five or more different concentrations of sucrose solution in test tubes • Plot the percentage change in mass and volume using a graph • Determine the concentration where the curve touches the x axis 	3
4.6	Plots correct graph using data from table - Correct LOBF	4
4.7	<ul style="list-style-type: none"> • The partially permeable membrane is destroyed/damaged 	1
5.1	<ul style="list-style-type: none"> • Bile is alkaline to neutralize the stomach acid • Emulsifies fats to form small droplets which increase the surface area 	2
5.2	<ul style="list-style-type: none"> • Conversion of glucose to starch, glycogen and cellulose • Used to produce amino acids for protein synthesis. • The formation of lipid molecules from a molecule of glycerol and three molecules of fatty acids • The use of glucose and nitrate ions to form amino acids which in turn are used to synthesise proteins • Breakdown of excess proteins to form urea for excretion. • Uses of glucose produced in photosynthesis - respiration, storage, to produce fat or oil for storage, to strengthen the cell wall 	4

Question Number	Answer	Marks
5.3	<p>• Indicative content:</p> <p>Preparing the food sample:</p> <ul style="list-style-type: none">• Break up the food using a pestle and mortar• Transfer to a test tube and add distilled water• Mix the food with the water by stirring with a glass rod• Filter the mixture using a funnel and filter paper, collecting the solution• Proceed with the food tests <p>Testing for proteins:</p> <ul style="list-style-type: none">• Add biuret solution• purple colour indicates the presence of proteins <p>Safety</p> <ul style="list-style-type: none">• Wear safety goggles.• Biuret solution A can be corrosive/ irritating• Avoid contact with skin and eyes.	6
6.1		1

6.2	<p>Indicative content:</p> <ul style="list-style-type: none">• The walls of the ventricles are thicker than those of the atria as they have to pump high pressure blood around the body• There are two sets of valves inside the heart which function to prevent the backflow of blood in the heart:• The atrioventricular valves separate the atria from the ventricles• The semilunar valves are found in the two blood arteries that come out of the top of the heart• They are unusual in that they are the only two arteries in the body that contain valves• These valves open when the ventricles contract so blood squeezes past them out of the heart, but then shut to avoid blood flowing back into the heart• The heart is made from cardiac muscle that does not fatigue as quickly• The coronary arteries supply the tissue of the heart with oxygenated blood - the heart needs a constant supply of oxygen (and glucose) for aerobic respiration to release energy to allow continued muscle contraction• The heart is separated with a septum that preventing the mixing of oxygenated and deoxygenated blood	4
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Question Number	Answer	Marks
6.3	<ul style="list-style-type: none"> • The wall of a capillary is very thin / only one cell thick (whereas the wall of an artery is much thicker) • The wall of a capillary is only made from an endothelial cell whereas artery walls contain layers of muscle and elastic tissue; • The lumen of a capillary is extremely narrow / only wide enough for blood cells to pass through one at a time • Neither has valves 	3
6.4	<ul style="list-style-type: none"> • The external intercostal muscles contract, causing the ribcage to move up and out • The diaphragm contracts and flattens so the volume of the thorax increases • There is an inverse relationship between pressure and volume so when volume increases, pressure decreases • Air is drawn into the lungs 	4
7.1	<ul style="list-style-type: none"> • They do not fulfil the seven life processes (MRS GREN) 	1
7.2	<ul style="list-style-type: none"> • Direct sexual contact • Exchange of bodily fluids • Drug users who share needles • From mother to child during birth or in breastmilk 	3
7.3	<p>Indicative content</p> <ul style="list-style-type: none"> • Dead / inactive pathogen • Introduced to the body • White blood cells respond • Produce antibodies • Antibodies are specific to pathogen • Antibodies produced quickly (on reinfection) / rapid response • In larger quantities • Killing the pathogen 	4
8.1	<ul style="list-style-type: none"> • Endothermic 	1
8.2	$ \begin{array}{ccccccc} 6 \text{ CO}_2 & + & 6 \text{ H}_2\text{O} & \xrightarrow[\textit{Chlorophyll}]{\textit{Sunlight}} & \text{C}_6\text{H}_{12}\text{O}_6 & + & 6 \text{ O}_2 \\ \text{Carbon Dioxide} & & \text{Water} & & \text{Carbohydrate} & & \text{Oxygen} \end{array} $	2
8.3	<ul style="list-style-type: none"> • Used for respiration (both aerobic and anaerobic) • Converted into insoluble starch for storage in the stems, leaves and roots • Used to produce fat or oil for storage • Used to produce cellulose, strengthening the cell wall • Combined with nitrate ions absorbed from the soil to produce amino acids for protein synthesis 	4

Question Number	Answer	Marks
8.4	Indicative content: <ul style="list-style-type: none"> • The temperature of the environment affects the kinetic energy of the particles • The lower the temperature, the less kinetic energy particles have, so fewer collisions per unit of time • Increasing temperature increases the kinetic energy of particles, so increased frequency of particle collisions • At higher temperatures, however, enzymes can denature so the shape of the active site is no longer complementary to the substrate which reduces the overall reactional rate • The intensity of the light available to the plant will depend on the amount of energy that it has to carry out photosynthesis • Greater light exposure means faster photosynthetic rate • This trend will continue until some other factor required for photosynthesis prevents the rate from increasing further because it is now in short supply Carbon dioxide is one the reactants as part of photosynthesis • Therefore, greater carbon dioxide present is faster rate of reaction up until a point • This trend continues until limiting factors contribute to the reduced rate of photosynthesis 	5
9.1	<ul style="list-style-type: none"> • Monoclonal antibodies can be bound to a radioactive substance that delivers a drug to the site of growth (typically a tumour). Therefore, new growth is inhibited, whilst surrounding bodily cells are not harmed 	3
9.2	Advantages: <ul style="list-style-type: none"> • Monoclonal antibodies have seen great development in the diagnosis and treatment of medical conditions. • They have a wide variety of uses ranging from laboratory applications to pregnancy tests and they do not affect healthy tissues • It is expected that they will be cheaper to produce as they become more widely available Disadvantages: <ul style="list-style-type: none"> • Unexpected side effects and complications • Expensive • Producing specific monoclonal antibodies presents a serious challenge 	4