**Insert School Logo**

# Semester One Examination 2023 Answers

# HUMAN BIOLOGY UNIT 1

Name: _____

Teacher: _____

## Time allowed for this paper

Reading time before commencing work: ten minutes
Working time for the paper: three hours

## Materials required/recommended for this paper

***To be provided by the supervisor***
This Question/Answer booklet
Multiple-choice answer sheet

***To be provided by the candidate***
Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: up to three calculators, which do not have the capacity to create or store programmes or text, are permitted in this ATAR course examination

## *Important notice to candidates*

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

## Structure of this paper

| Section | Number of questions available | Number of questions to be answered | Suggested working time (minutes) | Marks available | Percentage of examination |
|---|---|---|---|---|---|
| Section One Multiple-choice | 30 | 30 | 40 | 30 | 30 |
| Section Two Short answer | 7 | 7 | 90 | 110 | 50 |
| Section Three: Extended Answer | 2 | 1 | 50 | 20 | 20 |
| | 2 | 1 | | 20 | |
| | | | | **Total** | 100 |

## Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2023: Part II Examinations.* Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.

3. Answer the questions according to the following instructions.

   Section One: Answer all questions on the separate Multiple-choice answer sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

   Section Two: Write your answers in this Question/Answer booklet. Wherever possible, confine your answers to the line spaces provided.

   Section Three: Consists of two parts each with two questions. You must answer one question from each part. Tick the box next to the question you are answering. Write your answers in this Question/Answer booklet.

4. You must be careful to confine your responses to the specific questions asked and follow any instructions that are specific to a particular question.

5. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

**Section One: Multiple-choice** **30% (30 Marks)**

This section has **30** questions. Answer **all** questions on the separate Multiple-choice answer sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 40 minutes.

| | |
|---|---|
| **1** | b |
| **2** | d |
| **3** | a |
| **4** | c |
| **5** | a |
| **6** | b |
| **7** | a |
| **8** | d |
| **9** | b |
| **10** | c |
| **11** | a |
| **12** | d |
| **13** | b |
| **14** | a |
| **15** | b |
| **16** | d |
| **17** | c |
| **18** | d |
| **19** | a |
| **20** | c |
| **21** | d |
| **22** | c |
| **23** | c |
| **24** | b |
| **25** | a |
| **26** | b |
| **27** | c |
| **28** | a |
| **29** | d |
| **30** | c |

**Section Two: Short answer** **50% (109 Marks)**

This section has **seven** questions. Answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 90 minutes.

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**Question 31** **(14 marks)**

In 2002, a controlled trial was performed to determine if two procedures performed during arthroscopic surgery for osteoarthritis were effective in relieving knee pain. Participants were aged 75 or less, with 93% male and 60% Caucasian. 60 participants were given a placebo operation, whilst the other two-thirds had either one of the two procedures: a lavage or debridement. The trial ran for 2 years, with knee pain scores recorded. The results are shown below.

| | **Procedure (Average Scores on Knee Pain Scale)** | | |
|---|---|---|---|
| **Time (Weeks)** | *Placebo* | *Lavage* | *Debridement* |
| 0 | 60 | 61 | 58 |
| 26 | 57 | 59 | 56 |
| 78 | 52 | 56 | 51 |
| 104 | 55 | 55 | 53 |

(a) Explain why the researchers included a placebo operation in this study. (2 marks)

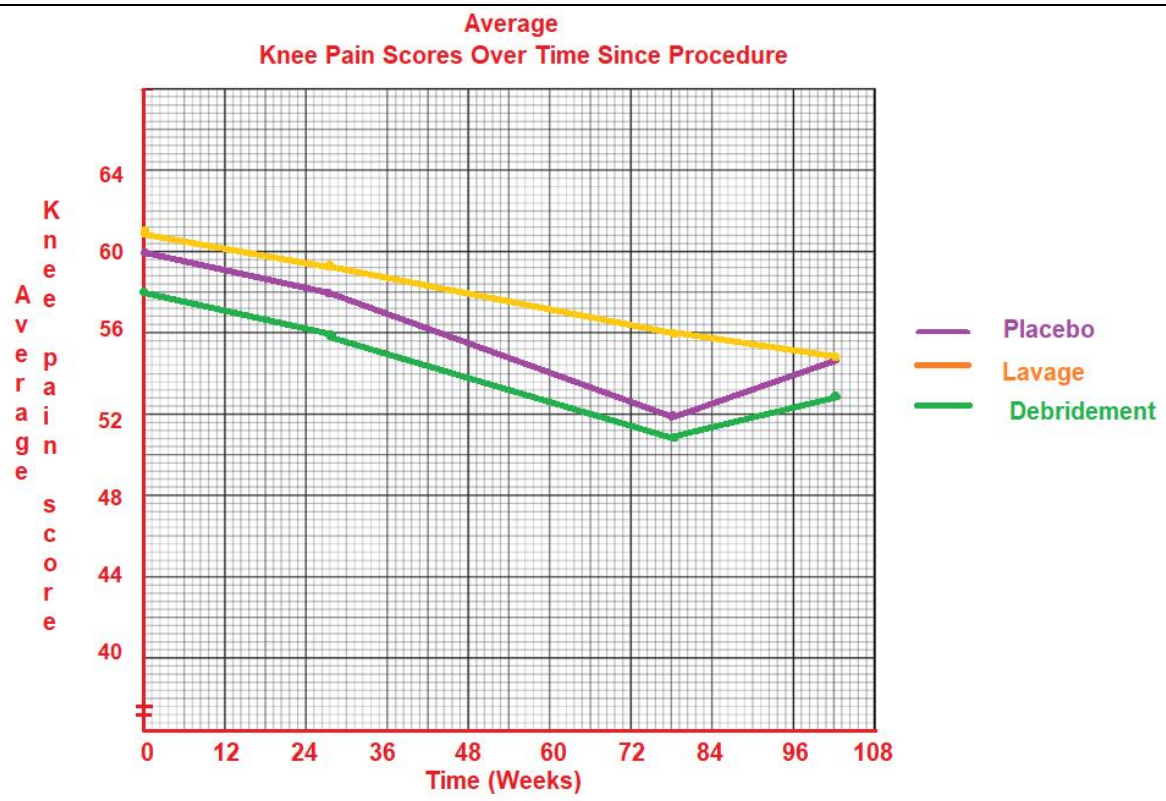
| **Description** | **Mark** |
|---|---|
| Remove any possible placebo effect / remove psychological bias of participants | 1 |
| Clear comparison between experimental groups and control group can be made | 1 |
| **Total** | **2** |

(b) State whether the results of this study would be applicable to everyone with knee pain. Justify your answer.

(2 marks)

| **Description** | **Mark** |
|---|---|
| Not applicable. | 1 |
| Small trial group / higher percentage of males / majority Caucasian / only tested on those with osteoarthritis | 1 |
| **Total** | **2** |

(c) Graph the results from the 2002 trial on the grid provided below. (5 marks)

| Description | Mark |
|---|---|
| Correctly constructs axes using appropriate scale (pain scale on Y axis, time on X axis) | 1 |
| Correctly plots points and joins points to form a line | 1 |
| Labelling of axes with correct name and unit | 1 |
| Identifies lines using key/label | 1 |
| Title appropriate with both independent and dependent variables included | 1 |
| **Example below:** | |
|  | |
| **Total** | **5** |

**Question 31 (continued)**

(d) By the age of 70, everyone will have some symptoms of osteoarthritis. Outline the cause of the joint pain that osteoarthritis sufferers experience.

(3 marks)

| Description | Mark |
|---|---|
| Ends of bones are not protected/(articular) cartilage is degraded | 1 |
| Bony spurs develop | 1 |
| These extend into the joint cavity/reducing space in the joint cavity | 1 |
| **Total** | **3** |

(e) Osteoporosis is another musculoskeletal disease associated with ageing. How does osteoporosis differ from osteoarthritis?

(2 marks)

| Description | Mark |
|---|---|
| Loss of bone mass, compared to loss of cartilage | 1-2 |
| Increases chances of bone fractures, which is not an effect in osteoarthritis | |
| No bony spurs produced, compared to bony spurs being produced | |
| Obesity / overuse has no effect in osteoporosis, however, does contribute to osteoarthritis | |
| **Total** | **2** |

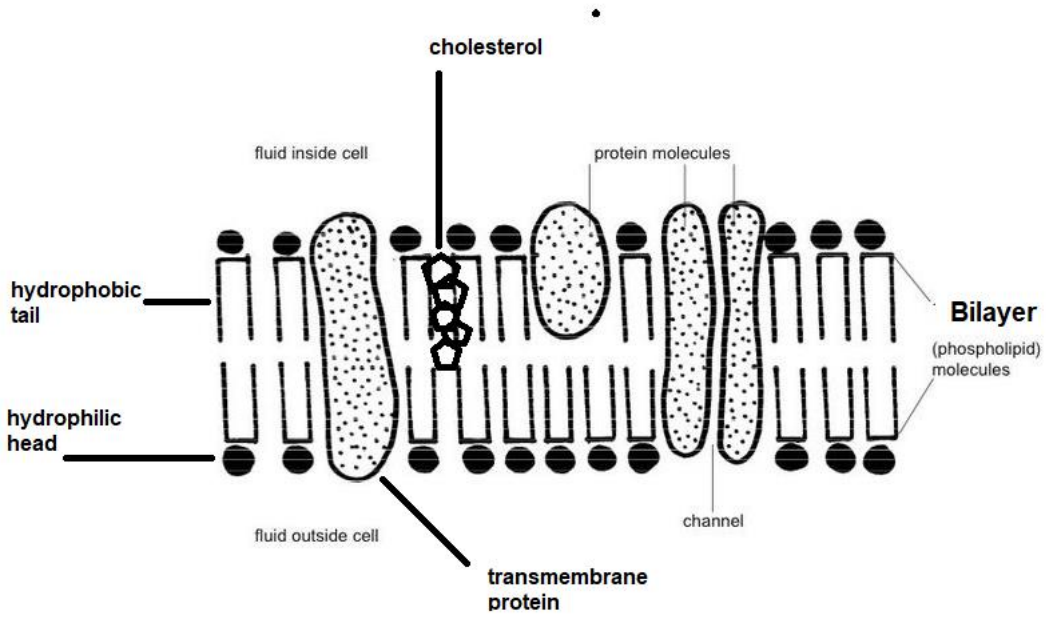
**Question 32** **(16 marks)**

The human body is made up of approximately 37.2 trillion cells, each of these with a set of specific cell organelles that maintain life processes. The production of proteins is one such important process occurring within a cell.

(a) Briefly outline the function of the following organelles in regards to protein production.
(3 marks)

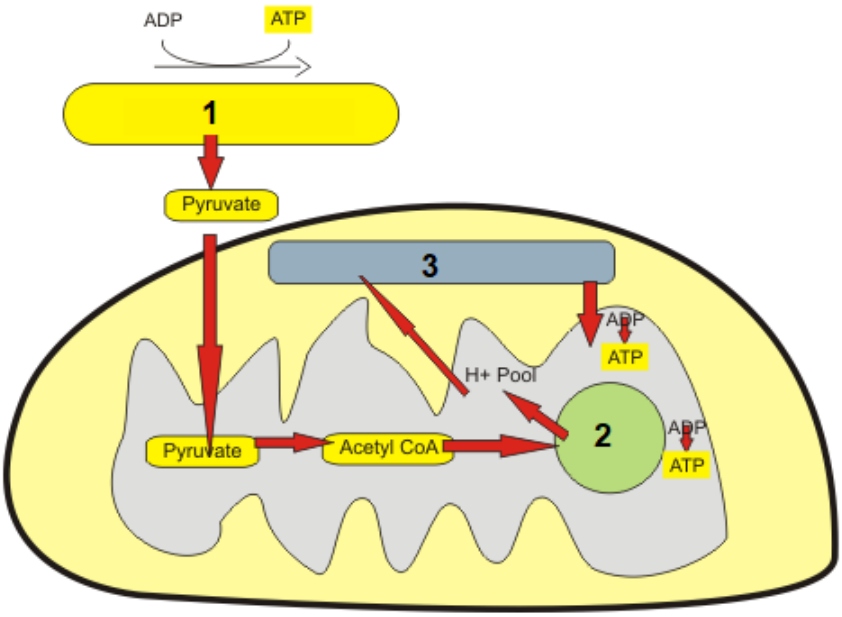
| Description | Mark |
|---|---|
| Nucleus – controls the types of proteins made | 1 |
| Ribosomes – site of protein production | 1 |
| Golgi body – modifies proteins and packages protein for secretion | 1 |
| **Total** | **3** |

(b) Proteins can become integrated within the cell membrane. In the space below, draw a fully labelled diagram of the fluid mosaic model to represent the structure of a cell membrane.
(5 marks)

| Description | Mark |
|---|---|
| Phospholipid bilayer drawn and labelled | 1 |
| Hydrophilic heads and hydrophobic tails correctly identified | 1 |
| Individual phospholipid labelled | 1 |
| Cholesterol molecule drawn embedded into phospholipid bilayer and labelled | 1 |
| Minimum of **one** protein molecule drawn and labelled (channel protein, carrier protein, cell-identity marker, receptor protein) | 1 |
| **Example below:** | |
|  | |
| **Total** | **5** |

**Question 32 (continued)**

The diagram below is a representation of cellular respiration within a cell.




(c) Name the processes, as well as the corresponding amount of ATP produced, at the locations identified by the numbers 1, 2 and 3.

(3 marks)

| Location | Process | Amount of ATP produced |
|---|---|---|
| 1 | Glycolysis | 2 |
| 2 | Krebs / Citric Acid Cycle | 2 |
| 3 | Electron Transport Chain | 34 (accept 26 – 34) |

Molecular malfunctions within cell organelles are the cause of many human illnesses, such as Mitochondrial Disease. The main symptoms of Mitochondrial Disease are muscle fatigue and weakness.

(d) Give a reason why muscle is the tissue most affected by mitochondrial disease.

(1 mark)

| **Description** | **Mark** |
|---|---|
| Muscle tissue contains more mitochondria / muscle requires a large amount of ATP/energy to function | 1 |
| **Total** | **1** |

(e) Describe how ineffective mitochondria would affect a cell's general function within the body.
(4 marks)

| Description | Mark |
|---|---|
| Mitochondria creates/stores energy in the form of Adenosine Triphosphate (ATP) | 1 |
| If a cell does not have sufficient amount of ATP, other organelles cannot function | 1 |
| This would affect the input of materials and output of waste / cell would not be in homeostasis/unable to carry out its function optimally | 1 |
| Function of the cell would drastically reduce / cell would die | 1 |
| **Total** | **4** |

**Question 33** **(16 marks)**

Penicillin was discovered in 1928, with the first patient treated with the antibiotic in 1948. It works through the process of enzyme inhibition, stopping bacteria from synthesising a cell wall and therefore causing it to die.

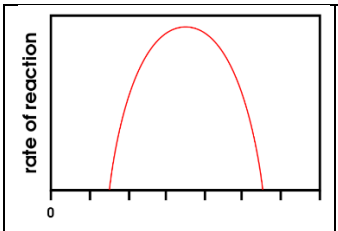
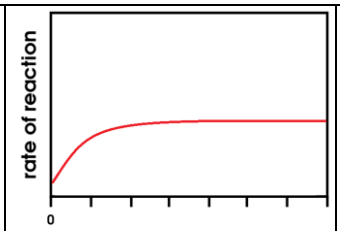
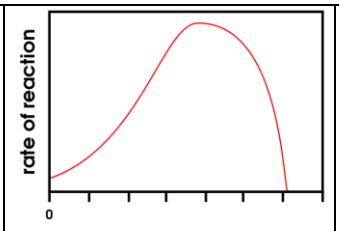
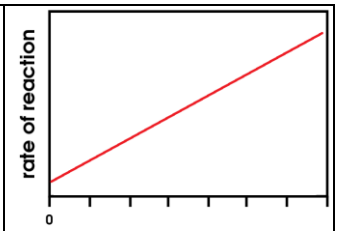
(a) Outline how an enzyme reaction would differ in the presence of an enzyme inhibitor.

(6 marks)

| Description | Mark |
|---|---|
| Enzymes active site and substrate have complementary shapes | 1 |
| Combination would create enzyme-substrate complex | 1 |
| Final product would be formed | 1 |
| Enzyme inhibitor has similar shape to (part of) active site | 1 |
| Inhibitor binds to (part of) the active site and | 1 |
| stops the enzyme-substrate complex / product from being formed | 1 |
| **Total** | **6** |

(b) Several other factors can also affect the function of enzymes. Match the appropriate reactivity graphs to the factors identified below.

(4 marks)

|  |  |  |  |
|---|---|---|---|
| **Graph A** | **Graph B** | **Graph C** | **Graph D** |

(i) Substrate concentration: Graph B

(ii) Temperature: Graph C

(iii) pH: Graph A

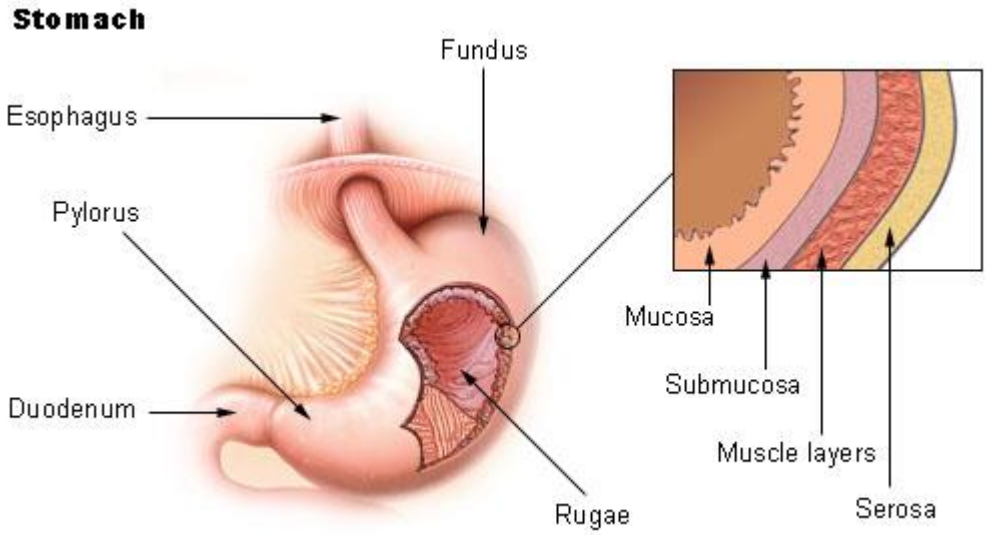
(iv) Enzyme concentration: Graph D

(c) Some enzymes require prior activation before they can work effectively. Identify the cell in the stomach lining that produces pepsinogen and outline how it becomes an active enzyme.

(4 marks)

| Description | Mark |
|---|---|
| (Gastric) chief cells | 1 |
| Presence of Hydrochloric acid in the gastric juice | 1 |
| causes a low pH environment in the stomach (pH 1.5 – 2) | 1 |
| allowing pepsinogen converted to active enzyme pepsin | 1 |
| **Total** | **4** |

A diagram of the parts of the stomach is shown below.




(d) Unlike the rest of the alimentary canal, the stomach has a third muscle layer. State the name of this muscle layer and outline why it is only found in the stomach.

(2 marks)

| Description | Mark |
|---|---|
| Oblique muscle layer | 1 |
| Allows contraction in multiple ways / to churn food and mix with gastric juice / allows for increase mechanical digestion | 1 |
| **Total** | **2** |

**Question 34** **(17 marks)**

*Helicobacter pylori* is a bacterium that damages the protective mucous coating of the digestive system. This damage can lead to the formation of peptic ulcers in the duodenum.

(a) Why are peptic ulcers more likely to be found in the duodenum? (2 marks)

| Description | Mark |
|---|---|
| Duodenum is the first part of the small intestine | 1 |
| to be exposed to the damaging effects of gastric acid and enzymes | 1 |
| **Total** | **2** |

(b) *H. pylori* infections can also cause chronic diarrhoea in early infancy. Define diarrhoea and explain its cause.

(5 marks)

| Description | Mark |
|---|---|
| Frequent defecation of watery faeces | 1 |
| Caused by irritation of intestine (small or large) | 1 |
| that increases peristalsis, | 1 |
| which increases speed of substance movement through intestine | 1 |
| resulting in inadequate absorption of water | 1 |
| **Total** | **5** |

LDL cholesterol, often referred to as “bad” cholesterol, is transported in to cells of the body through vesicular transport.

(c) Outline the steps involved in taking up cholesterol in to a cell.

(3 marks)

| Description | Mark |
|---|---|
| Cell membrane folds around cholesterol | 1 |
| Cholesterol becomes fully enclosed in the vesicle | 1 |
| Vesicle pinches off and is suspended in the cell’s cytoplasm | 1 |
| **Total** | **3** |

(d) Is the uptake of cholesterol considered to be a passive or active process? Justify your answer.

(2 marks)

| Description | Mark |
|---|---|
| Active | 1 |
| Energy is required to form the vesicles | 1 |
| **Total** | **2** |

(e) Cholesterol is produced in the liver.

(i) What digestive substance is produced using cholesterol from the liver and where is it stored?
(2 marks)

| Description | Mark |
|---|---|
| Bile | 1 |
| Gallbladder | 1 |
| **Total** | **2** |

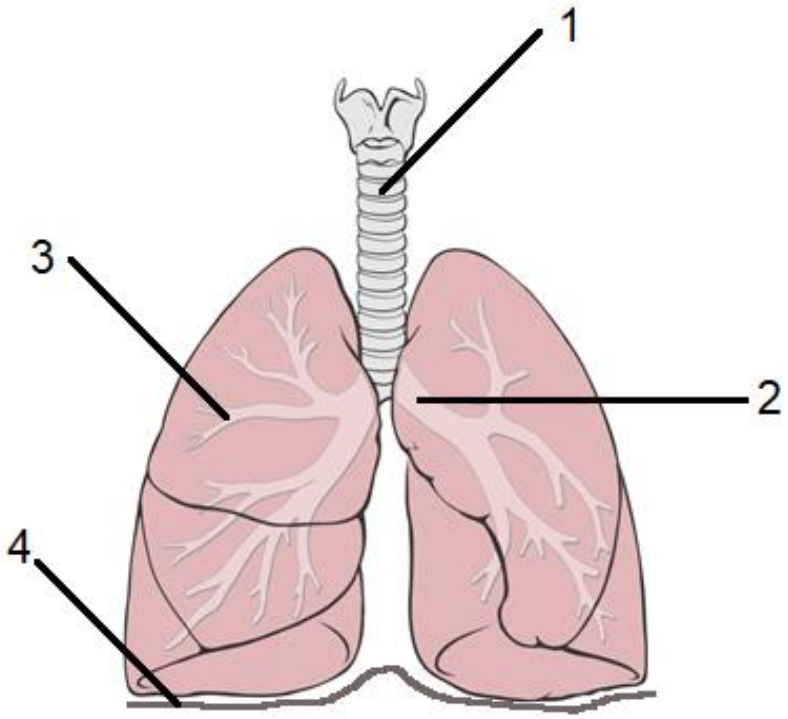
(ii) Explain how a blockage in the duct leading into the small intestine would affect digestive function.

(3 marks)

| Description | Mark |
|---|---|
| Emulsification of fats wouldn't occur / mechanical digestion of fat wouldn't occur | 1 |
| No increase in surface area for lipase to act / SA to small for lipase to act | 1 |
| Reduction of the chemical digestion of fats / decrease of fatty acids + glycerol produced | 1 |
| **Total** | **3** |

**Question 35** **(16 marks)**

The diagram below illustrates the respiratory system.




(a) Identify the organs labelled by the following numbers:

(2 marks)

| Description | Mark |
|---|---|
| 1: Trachea | 1 |
| 3: Bronchioles | 1 |
| **Total** | **2** |

(b) Describe how the muscle identified at label 4 in the image above is involved in inspiration.

(3 marks)

| Description | Mark |
|---|---|
| **Any three of the following:** | |
| Diaphragm contracts | 1-3 |
| Extending chest cavity downwards | |
| Increasing lung volume / increase volume of thorax | |
| which decreases pressure of the thorax | |
| **Total** | **3** |

(c) Describe the structure of the cartilage that gives the bronchi their strength.

(3 marks)

| Description | Mark |
|---|---|
| Closely packed collagenous fibres | 1-3 |
| Embedded in a matrix/chondrin | |
| Fibres are fine and not visible | |
| Chondrocytes embedded | |
| **Total** | **3** |

(d) Outline how oxygen and carbon dioxide are exchanged between alveoli and blood capillaries.

(5 marks)

| Description | Mark |
|---|---|
| Blood contains high concentration of carbon dioxide and low concentration of oxygen | 1 |
| Oxygen diffuses out of alveoli into blood | 1 |
| Travels down concentration gradient/moves from high concentration in lungs to low concentration in blood | 1 |
| Carbon dioxide diffuses out of blood into alveoli | 1 |
| Travels down concentration gradient/moves from high concentration in blood to low concentration in lungs | 1 |
| **Total** | **5** |

(e) Blood is both a tissue and a fluid. Explain why blood can be classified as a connective tissue.

(3 marks)

| Description | Mark |
|---|---|
| A tissue is a group of cells with a similar function | 1 |
| Blood is a connective tissue as it connects all the body systems | 1 |
| Consists of different type of cells surrounded by a matrix/plasma | 1 |
| **Total** | **3** |

**Question 36** **(16 marks)**

Approximately 10% of a person's body weight is made up of blood, equating to about 5L. A loss of 40% or more of your blood volume will result in death, with blood transfusions required to stop this from occurring.

(a) Outline how molecules found on the surface of red blood cells and in the plasma are important in blood transfusions.

(5 marks)

| Description | Mark |
|---|---|
| Antigens A and/or B found on RBC surface<br>**OR**<br>Rhesus antigens found on RBC surface | 1 |
| Antibodies A and/or B found within the plasma<br>**OR**<br>Antibodies for Rhesus found within the plasma | 1 |
| Body produces antibodies for the antigen not expressed on their RBC | 1 |
| If blood containing opposing antibodies is transfused | 1 |
| Patients' blood will agglutinate/haemolysis will occur | 1 |
| **Total** | **5** |

One of the functions of blood is to transport oxygen to cells and carbon dioxide away from cells.

(b) Explain how carbon dioxide is transported in the blood. (3 marks)

| Description | Mark |
|---|---|
| dissolved in plasma | 1 |
| combines with haemoglobin / forms carbaminohemoglobin | 1 |
| carried in plasma as bicarbonate ions ($HCO_3^-$) | 1 |
| **Total** | **3** |

Carbon dioxide is a cellular waste removed from the body via the lungs. Other wastes created in the body are removed via urine. Normal urine is composed of water, solutes and wastes, with approximately 2% being urea.

(c) What would you expect to happen to the percentage of urea in a person's urine if they ate a high-protein diet? Justify your answer.

(2 marks)

| Description | Mark |
|---|---|
| Increase | 1 |
| Urea is due to the breakdown of proteins / deamination process | 1 |
| **Total** | **2** |

Nutrients and wastes are transferred between cells and extracellular space via transport mechanisms.

(d) Complete the table below identifying the transport mechanism associated with each of the stated processes.

(3 marks)

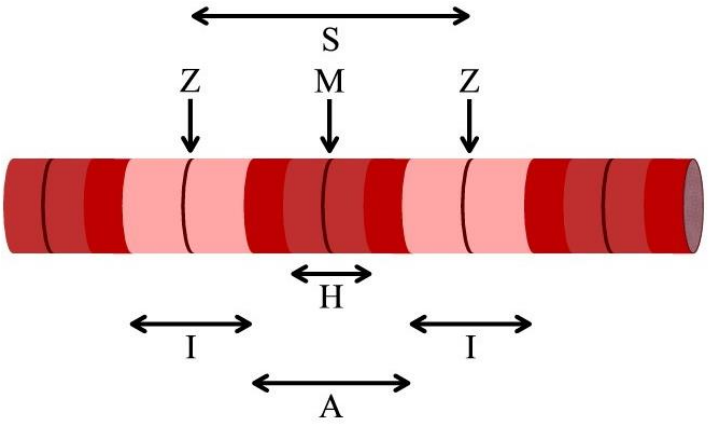
| Process | Transport Mechanism |
|---|---|
| Water-soluble vitamins being absorbed into the blood capillaries of the villi | Simple diffusion |
| Uptake of amino acids into the villi of the small intestine after a meal | Active transport |
| Water movement from the kidney tubules into the blood | Osmosis |

(e) Explain how fats are absorbed into the villi of the small intestine. (3 marks)

| Description | Mark |
|---|---|
| Fat broken down into fatty acids and glycerol | 1 |
| Simple diffusion into the cells of the villi | 1 |
| Enter the lacteals | 1 |
| **Total** | **3** |

**Question 37** **(14 marks)**

The diagram below is an illustration of a relaxed muscle fibre.




(a) When this muscle fibre contracts, the sarcomere will shorten though the A-band will remain the same length. Explain why this occurs.

(3 marks)

| Description | Mark |
|---|---|
| Sarcomere shortens as the thin and thick filaments slide over each other. | 1 |
| A band represents the length of myosin | 1 |
| As the myosin filaments don't change, neither does the A-band. | 1 |
| **Total** | **3** |

(b) Outline the role of troponin and tropomyosin in the contraction of muscle fibres.

(3 marks)

| Description | Mark |
|---|---|
| Both cover active sites on the actin molecule | 1 |
| Calcium attaches to troponin | 1 |
| Exposing a binding site on the actin where myosin can attach | 1 |
| **Total** | **3** |

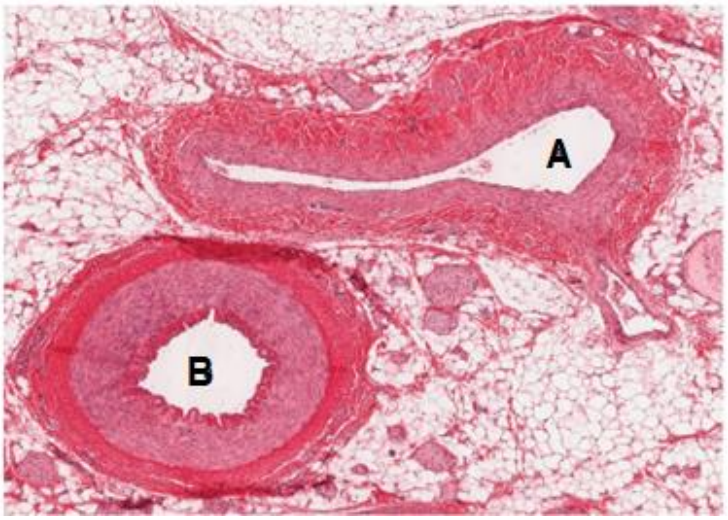
Cardiac muscle tissue is involuntary, ensuring that the muscle rhythmically contracts to pump blood around the body.

(c) Briefly describe the structure of cardiac muscle tissue. (2 marks)

| Description | Mark |
|---|---|
| Branched | 1-2 |
| Striated | |
| Presence of intercalated discs | |
| mononucleated / not multinucleated | |

| | |
|---|---|
| **Total** | **2** |

A microscopic image depicting two types of blood vessels is shown below.




(d) Identify the vessels labelled A and B. Justify your answer.

(2 marks)

| Description | Mark |
|---|---|
| A = Vein, B = Artery | 1 |
| B(artery) has thicker walls than A(vein) / smaller lumen / more muscle and elastic fibres | 1 |
| A(vein) is being flattened by surrounding tissue due to less pressure than in B(artery) / larger lumen / less thick walls / less muscle & elastic fibres | |
| **Total** | **2** |

(e) Erythrocytes have a very particular structure. How does the structure suit the function of the cells?

(4 marks)

| Description | Mark |
|---|---|
| **Any two of the following:** | |
| Biconcave | 1-2 |
| Increases cells surface area for gas exchange / increase flexibility | |
| Lack of nucleus | 1-2 |
| Allow for more haemoglobin | |
| Contains haemoglobin | 1-2 |
| Carries oxygen around the body | |
| **Total** | **4** |

**END OF SECTION TWO**

**Section Three: Extended answer** **20% (40 marks)**

This section consists of **four** questions. You must answer **two** questions.

Questions 38 and 39 are from Part 1. Question 40 and 41 are from Part 2. Answer **one** question from Part 1 and **one** question from Part 2.

Responses could include clearly labelled diagrams with explanatory notes; lists of points with linking sentences; clearly labelled tables and graphs; and annotated flow diagrams with introductory notes.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 50 minutes

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**Part 1**

Choose **either** Question 38 **or** Question 39.

Indicate the question you will answer by ticking the box next to the question. Write your answer on pages 30–34. When you have answered your first question, turn to page 36 and indicate on that page the second question you will answer.

☐ **Question 38** **(20 marks)**

In every living cell, enzyme controlled chemical reactions take place continuously and are often linked together.

(a) State the name given to this set of reactions and describe the two types that occur in the body. Give an example of each type.

(7 marks)

| Description | Mark |
|---|---|
| Metabolism | 1 |
| Anabolic / Anabolism | 1 |
| Small molecules are built in to larger ones | 1 |
| Protein synthesis | 1 |
| Catabolic / Catabolism | 1 |
| Large molecules are broken in to smaller ones | 1 |
| Glycolysis | 1 |
| **Total** | **7** |

Cells require nutrients in order to undertake life processes, such as growth and repair. The digestive system extracts these nutrients from the food we eat through chemical and mechanical digestion.

(b) The mouth, stomach and small intestine utilise chemical and mechanical digestion. Differentiate between the two types of digestion and list the functions associated with the three named parts the digestive system.

(13 marks)

| Description | Mark |
|---|---|
| Mechanical digestion is a physical breakdown of food | 1 |
| Chemical digestion breaks complex molecules into simpler ones | 1 |
| **Mouth** | |
| Mechanical digestion breaks food into smaller particles (mastication) | 1-2 |
| Saliva / salivary amylase begins starch digestion | |
| Food dissolved in saliva so it can be tasted | |
| **Stomach** | |
| Waves of contraction churn food/chyme / mechanical digestion | 1-2 |
| Pepsin breaks down proteins into polypeptides | |
| Stores large quantities of food | |
| Absorb certain medication / alcohol / water | |
| **Small Intestine** | |
| Muscular contractions moves food | 1 |
| Bile salts emulsify lipids | 1 |
| Absorbs nutrients | 1 |
| Pancreatic amylase breaking starch into disaccharides | 1-4 |
| Pancreatic protease/trypsin breaking proteins/polypeptides into peptides | |
| Pancreatic nucleases/ribonuclease/deoxyribonuclease, digesting RNA and DNA | |
| Intestinal amylase breaking disaccharides into simple sugars | |
| Intestinal peptidases breaking peptides into amino acids | |
| Lipase, breaking lipids into fatty acids and glycerol | |
| **Total** | **13** |

**Question 39** **(20 marks)**

Crohn's disease is an autoimmune condition which damages the lining of the small intestine, leading to inflammation.

(a) Describe the lining of a healthy small intestine and outline why an individual with unmanaged Crohn's tend to lose weight.

(8 marks)

| Description | Mark |
|---|---|
| Inner lining/mucosa has folds that extend into the interior | 1 |
| Mucosa has small finger-like projections/folding called villi | 1 |
| Villi contain microvilli | 1 |
| Inside is a lacteal (lymph capillary) surrounded by blood capillaries | 1 |
| Villi are thin / 1 cell thick | 1 |
| Villi is the site of nutrient absorption | 1 |
| Damage to the villi mean nutrients would not be absorbed into the body | 1 |
| Surface area for absorption has decreased | 1 |
| **Total** | **8** |

Emphysema is a lung disease most often attributed to smoking. People with emphysema have damaged alveoli and decreased blood flow.

(b) Explain how the structure of the lungs allow for efficient gas exchange. Predict some of the symptoms that emphysema patients would exhibit.

(12 marks)

| Description | Mark |
|---|---|
| Lungs have a large internal surface area | 1 |
| So large amounts of gas can be exchanged in a short time | 1 |
| Alveolus is well supplied with blood vessels | 1 |
| Blood vessels are in close proximity to alveoli | 1 |
| Continuous blood flow maintains concentration difference between alveoli and blood | 1 |
| walls of alveolus are thin / 1 cell thick | 1 |
| Reduces the distance gases have to travel | 1 |
| Lungs positioned deep inside the body | 1 |
| Prevents excessive moisture evaporation | 1 |
| Which is needed as gases must be dissolved in fluid in order to diffuse | 1 |
| **Any two of the following symptoms:** | |
| • Coughing and/or wheezing<br>• Increased production of mucus<br>• Shortness of breath<br>• Tightness of chest | 1-2 |
| **Total** | **12** |

(12 marks)

**Part 2**

Choose **either** Question 40 **or** Question 41.

Indicate the question you will answer by ticking the box next to the question. Write your answer on the pages provided.

☐ **Question 40** **(20 marks)**

(a) Outline the structure of a nephron beginning at the renal corpuscle. State the activities which occur at each region.

(14 marks)

| Description | Mark |
|---|---|
| Renal corpuscle consists of the Bowman's / glomerular capsule | 1 |
| which almost completely encloses the glomerulus | 1 |
| Filters the blood / glomerular filtration occurs | 1 |
| Forms the filtrate | |
| Next is the proximal convoluted tubule | 1 |
| where passive reabsorption of potassium/chloride/bicarbonate ions | 1 |
| Active reabsorption of glucose/sodium/amino acids | 1 |
| Osmotic reabsorption of water occurs | 1 |
| Leads into the loop of Henle | 1 |
| Active reabsorption of sodium ions / chlorine ion | 1 |
| Osmosis of water occurs | 1 |
| Followed by the distal convoluted tubule | 1 |
| Secretion of hydrogen/potassium ions/creatinine/certain drugs | 1 |
| Joins to a collecting duct | 1 |
| active reabsorption of water | 1 |
| **Total** | **14** |

(b) Ammonia is highly toxic to cells. Describe how ammonia is produced and how the liver processes this toxic chemical into a safer form.

(6 marks)

| Description | Mark |
|---|---|
| Deamination | 1 |
| Amino group ($NH_2$) is removed from amino acid | 1 |
| in the presence of oxygen | 1 |
| producing carbohydrates and ammonia | 1 |
| Ammonia mixes with carbon dioxide | 1 |
| To produce urea and water | 1 |
| **Total** | **6** |

**Question 41** **(20 marks)**

(a) The skeletal system is made up of bone that is far more than just a framework giving shape to the body. Outline the macroscopic structure of a long bone and describe how the features contribute to the functions of the human skeleton.

(14 marks)

| Description | Mark |
|---|---|
| **Macroscopic structure:** | |
| Diaphysis | 1 |
| Containing yellow bone marrow | 1 |
| Hollow cylinder of compact bone<br>Surrounding the medullary cavity | 1-2 |
| Epiphyses at the ends of the bone | 1 |
| Covered with articular cartilage | 1 |
| Compact bone on outside<br>Spongy/cancellous bone on inside | 1 |
| Red bone marrow found within cancellous bone | 1 |
| Periosteum is a fibrous outer covering of the bone | 1 |
| **Functions:** | |
| Gives strength to act as scaffold to support weight of the body | 1-5 |
| Points of attachment for muscles allowing movement (articulation) | |
| Protects internal organs | |
| Red bone marrow produces red blood cells | |
| Stores and releases minerals (in bone) / acid-base balance | |
| stores and releases fat (in yellow marrow) | |
| **Total** | **14** |

(b) The musculoskeletal system and lymphatic system are interrelated. State two functions of the lymphatic system and briefly describe how the two systems work together to achieve these functions.

(6 marks)

| Description | Mark |
|---|---|
| Return escaped/lost tissue fluid back to the circulatory system | 1-2 |
| Assist in defence against disease causing-organisms | |
| Fat absorption in the villi of the small intestine | |
| Red bone marrow produces some lymphocytes | 1 |
| lymphocytes travel through the lymph to kill/destroy microorganisms/foreign debris | 1 |
| Lymph is moved through the body due to movement of skeletal muscle | 1 |
| Muscle contracts forcing lymph towards the heart | 1 |
| **Total** | **6** |

**END OF QUESTIONS**

## ACKNOWLEDGEMENTS

**Question 11** Tissue type. Nicolas.Rougier, CC BY-SA 3.0 <http://creativecommons.org/licenses/by-sa/3.0/>, via Wikimedia Commons. Accessed on 4th October 2022, at https://commons.wikimedia.org/wiki/File:Neuron-figure-notext.svg

**Question 13** Weekly COVID-19 cases, hospitalisations and ICU Snapshot. WA Covid-19 Data Update. Access on 16th March 2023, at https://www.health.wa.gov.au/~/media/Corp/Documents/Health-for/Infectious-disease/COVID19/WA-COVID-19-data-updates/COVID-19-Weekly-Statistics-9-September-2022.pdf

**Question 16** Illustrations of bodies. Loneshieling, CC BY 4.0 <https://creativecommons.org/licenses/by/4.0>, via Wikimedia Commons. Access on 4th October 2022, at https://upload.wikimedia.org/wikipedia/commons/a/a8/Organ_Systems_rearranged.png

**Question 17** Cells in solution. OpenStax, CC BY 3.0 <https://creativecommons.org/licenses/by/3.0>, via Wikimedia Commons. Accessed on 4th October 2022, at https://upload.wikimedia.org/wikipedia/commons/5/5a/0346_Concentration_of_Solutions_labeled.jpg

**Question 20** Diagram of the Digestive System. Vive la Rosière, CC0, via Wikimedia Commons. Accessed on 4th October 2022, available at: https://commons.wikimedia.org/wiki/File:Diagram_of_the_digestive_system-VOID.png

**Question 25** Transverse section of bone. Source digital bitmap graphics: BDBRecreated in vector format: Nyq, CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0>, via Wikimedia Commons. Accessed on 4th October 2022, at: https://commons.wikimedia.org/wiki/File:Transverse_section_of_bone_en.svg

**Question 31** "A controlled trial of arthroscopic surgery for osteoarthritis of the knee," *New England Journal of Medicine.* 347 (2): 81-88. 2002, July 11. Available online at: https://www.nejm.org/doi/full/10.1056/nejmoa013259

**Question 32**

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Cellular Respiration. Zlir'a, CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0>, via Wikimedia Commons. Accessed on 3rd October 2022, at https://commons.wikimedia.org/wiki/File:Cellular_respiration_EN.svg

**Question 33**

Effect of factors on enzymes. domdomegg, CC BY 4.0 <https://creativecommons.org/licenses/by/4.0>, via Wikimedia Commons. Accessed on 3rd October 2022, at https://commons.wikimedia.org/wiki/File:Effect_of_temperature_on_enzymes.svg

Stomach. NIH / National Cancer Institute, Public domain, via Wikimedia Commons. Accessed on 3rd October 2022, at https://commons.wikimedia.org/wiki/File:Illu_stomach2.jpg

**Question 35**

Lungs, simple diagram. Patrick J. Lynch, medical illustrator, CC BY 2.5 <https://creativecommons.org/licenses/by/2.5>, via Wikimedia Commons. Accessed on 3rd October 2022, at https://commons.wikimedia.org/wiki/File:Lungs_diagram_simple.svg

**Question 37**

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Comparison of Blood Vessels. OpenStax College, CC BY 3.0 <https://creativecommons.org/licenses/by/3.0>, via Wikimedia Commons. Accessed 4th October 2022, at https://commons.wikimedia.org/wiki/File:2102_Comparison_of_Artery_and_Vein.jpg