

**Semester One**

**Examination 2024**

**Question/Answer booklet**

**HUMAN BIOLOGY**

**UNIT 1**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Time allowed for this paper**

Reading time before commencing work: ten minutes

Working time for the paper: two hours and thirty minutes

**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 | 25 | 25 | 30 | 25 | 30 |
| Section Two  Short answer | 6 | 6 | 80 | 80 | 50 |
| Section Three  Extended Answer  Part 1  Part 2 | 2 | 1 | 40 | 20 | 20 |
| 2 | 1 | 20 |
|  |  |  |  | **Total** | 100 |

**Instructions to candidates**

1. The rules for the conduct of Western Australian examinations are detailed in the *Year 12 Information Handbook 2024: Part II Examinations.* Sitting this examination implies that you agree to abide by these rules.
2. 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 preferably using a blue/black pen. Do not use erasable or gel pens. 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 preferably using a blue/black pen. Do not use erasable or gel pens.

1. You must be careful to confine your responses to the specific questions asked and follow any instructions that are specific to a particular question.
2. 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.

This section has **25** 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: 30 minutes.

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1. The Fluid Mosaic Model of the cell membrane refers to the
2. variety of proteins that are found within the membrane
3. ability of substances to pass through the membrane
4. arrangement of the phospholipids into a bilayer
5. diverse number of components and their ability to move position
6. Which of the structures associated with pulmonary circulation carries oxygenated blood?
   1. pulmonary vein
   2. vena cava
   3. pulmonary artery
   4. right ventricle
7. Which of the following structure and organisation levels are **not** correctly matched?

|  |  |  |
| --- | --- | --- |
|  | **Structure** | **Organisation** |
| a. | sperm | cell |
| b. | neuron | tissue |
| c. | skin | organ |
| d. | immune | system |

1. Muscles work in pairs known as
   1. agonistic pairs
   2. antagonistic pairs
   3. synergistic pairs
   4. stabilising pairs

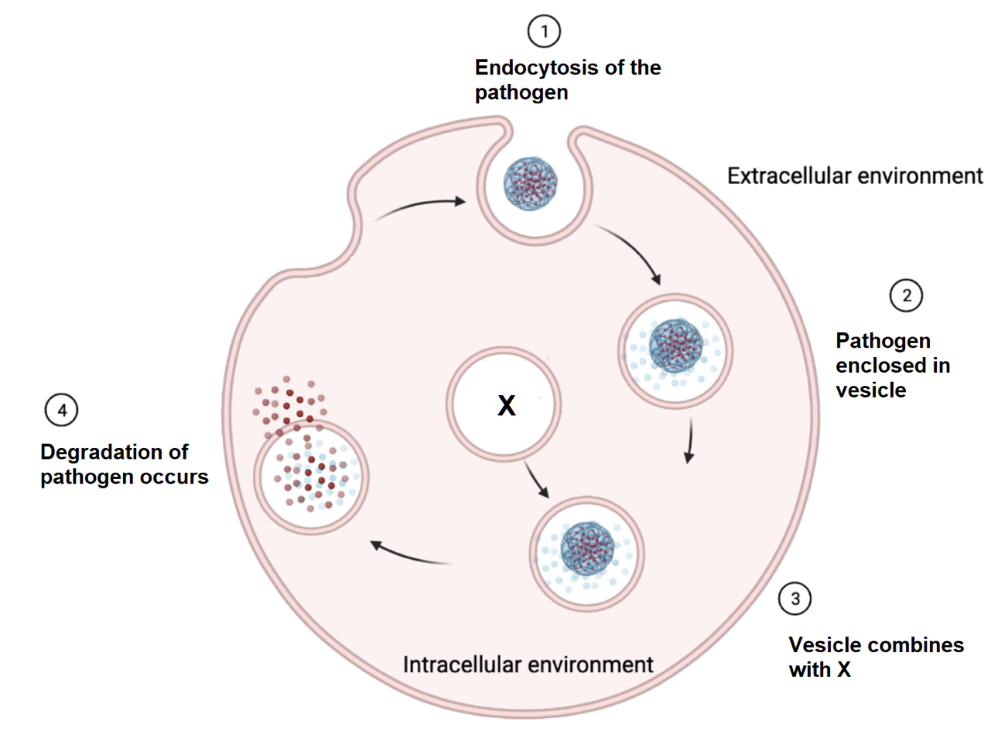
Question 5 refers to the diagram below.:

A diagram of cell size

Description automatically generated with medium confidence

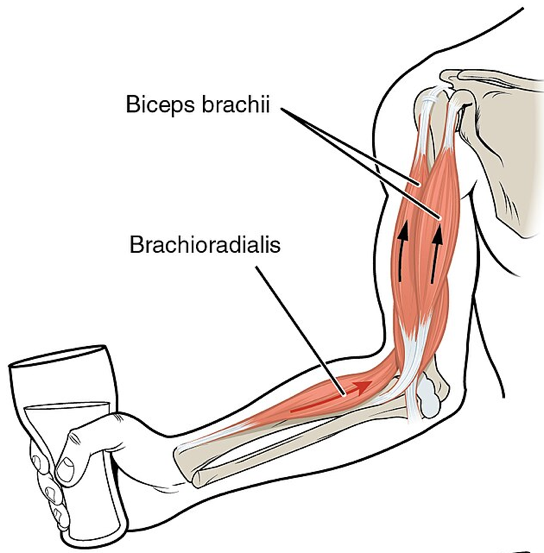
1. The surface area (SA) to volume (V) ratio of the 2 cm cell would be
   1. 6:1
   2. 4:1
   3. 3:1
   4. 2:1
2. Which of the following would be a correct hypothesis for an investigation into the effect of exercise on heart rate?
   * 1. Heart rate decreases after exercise
     2. Heart rate increases exercise
     3. Is heart rate increased by exercise?
     4. Exercise affects heart rate
3. Where does the Krebs cycle (citric acid cycle) take place?
   * 1. cytosol of the cell
     2. matrix of mitochondria
     3. ribosomes within the cell
     4. inner membrane of mitochondria
4. Carbon dioxide is transported around the body through the circulatory system. Which of the following is **not** a way in which it is transported?
   * 1. dissolved in plasma
     2. bicarbonate ions in plasma
     3. attached to hydrogen ions
     4. bound to haemoglobin

Question 9 refers to the diagram of phagocytosis below.



1. The structure identified by the letter X is most likely to be a
   * 1. vacuole
     2. ribosome
     3. centriole
     4. lysosome
2. Patients suffering from spinal cord injuries are often bed ridden for long periods of time and can develop swelling. Which of the following reasons explains why?
   * 1. blood pressure increases due to their injury and forces fluid from blood vessels into the tissue
     2. the lymphatic vessels are not stimulated due to the decrease in activity, causing lymph to pool in the nodes
     3. proteins are lost from muscle cells due to the lack of movement, causing water to following the osmotic gradient
     4. lack of skeletal muscle activity causes lymph to pool as it cannot be moved through the lymphatic system
3. Lymph fluid has a composition most like
   * 1. interstitial fluid.
     2. serum.
     3. blood.
     4. cytosol.
4. What controls the rate of chemical reactions in the cytoplasm?
   * 1. endoplasmic reticulum
     2. pH
     3. enzymes
     4. temperature
5. The function of the ribosome is to
   * 1. synthesise proteins
     2. modify proteins
     3. provide sites for chemical reactions
     4. assist with cell reproduction
6. The role of ligaments is best explained as
   * 1. reducing friction at the joint during movement
     2. attaching muscles to bones during movement
     3. absorbing shock during movement
     4. keeping joints stable during movement
7. Which of the following is **not** a function of the skeleton?
   1. blood cell formation
   2. protection and support
   3. heat production
   4. movement
8. The production of urea occurs predominantly in the
   1. liver
   2. blood
   3. kidneys
   4. urine

Questions 17 and 18 refer to the diagram below that shows some of the muscles involved when drinking a glass of water.



1. What type of movement can be found at the elbow joint when drinking from the glass?
   * 1. adduction
     2. flexion
     3. rotation
     4. extension
2. When lifting the glass, the fixator muscles identified on the diagram above act to
   * 1. create movement
     2. co-ordinate movement
     3. stabilise during movement
     4. relax during movement
3. A patient with blood type A requires a transfusion. Which of the following lists the blood types that this patient can receive?
4. Blood types A and O
5. Blood types AB and A
6. Blood types AB and O
7. Blood types AB, A and O
8. Which organelle is associated with the modification and packaging of proteins in the cell?
   1. Golgi apparatus
   2. rough endoplasmic reticulum
   3. ribosomes
   4. smooth endoplasmic reticulum
9. Elimination differs from excretion because elimination
   1. only occurs in the kidneys
   2. involves the removal of metabolic waste from the body
   3. is the removal of unabsorbed materials from the digestive system
   4. removes the amino groups from amino acid molecules
10. High-intensity interval training (HIIT) is a type of anaerobic exercise. Which of these factors is commonly thought to cause the muscle pain often felt in anaerobic types of exercise?
    1. glycogen
    2. lactic acid
    3. pyruvic acid
    4. glucose
11. Blood clotting disorders, such as haemophilia, are often treated with blood transfusions containing
    1. plasma only
    2. whole blood
    3. platelet concentrates
    4. red cell concentrates
12. The inferior vena cava brings blood back to the heart from the
    1. lungs
    2. liver
    3. neck
    4. arms
13. The inner lining of the trachea and kidney tubules is made up of
14. epithelial tissue
15. nervous tissue
16. muscle tissue
17. connective tissue

**End of Section One**

**Section Two: Short answer 50% (80 Marks)**

This section has **six** 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: 80 minutes.

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**Question 26 (14 marks)**

Blood donations are essential in helping treat many different diseases and conditions, with donation drives often requesting donations from people with a diverse range of blood types.

(a) State the name given to the transfer of donated blood to another person and describe **one** named disease or condition that could be treated with donor blood.

(2 marks)

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Blood typing is required prior to treating a patient with donor blood.

(b) Compare and contrast ABO blood types and Rhesus factor blood types.

(2 marks)

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**Question 26** (continued)

(c) A patient with blood type B+ donated their blood. Identify the compatible blood type/s that the patient could donate to and outline what would happen if the blood types did not match.

(3 marks)

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(d) Explain why blood is classified as connective tissue.

(4 marks)

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(e) Describe how the shape of the red blood cell relates to its function.

(3 marks)

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**Question 27 (7 marks)**

During a check-up at their local doctors, a patient is told they have a heart murmur, an abnormal sound caused by turbulent flow of blood. It has been identified that this patient’s murmur is caused by the backwards flow of blood in the right side of the heart.

(a) Identify what structure of the heart may have caused this irregular flow of blood.

(1 mark)

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In some cases, a heart murmur can develop following a heart attack.

(b) What may happen to the cardiac output, the amount of blood pumped by the heart per minute, in a patient who has suffered a heart attack? Give a reason why.

(2 marks)

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(c) Why are people who suffer high blood pressure at a higher risk of bleeding in the brain?

(1 mark)

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(d) Reduction of dietary salt intake is suggested for patients with high blood pressure. Describe how salt affects the extracellular environment and the resulting transport of water molecules across the cell membrane.

(3 marks)

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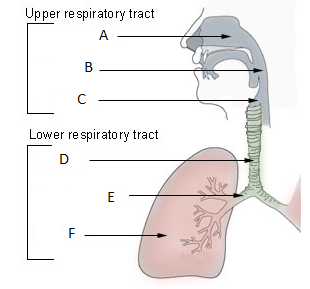
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**Question 28 (16 marks)**

Below is a diagram of the respiratory system.



(a) Draw and label an arrow on the diagram above that identifies the structure which prevents the entry of food into the trachea.

(2 marks)

(b) Explain how the structure of the alveoli and blood vessels within the lungs contributes to the efficient exchange of oxygen and carbon dioxide.

(6 marks)

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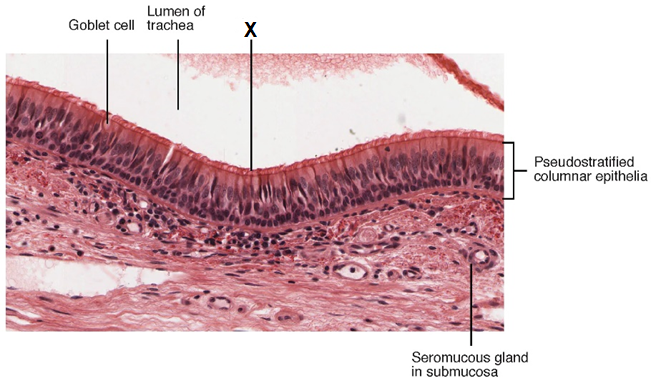
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**Question 28** (continued)

The image below shows the pseudostratified ciliated columnar epithelium of the trachea. The identified goblet cell, embedded in the epithelia, is involved in the secretion of protective mucus.



(c) Goblet cells release mucus into the respiratory tract via vesicular transport. Name the form of vesicular transport and explain the process.

(5 marks)

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(d) Describe how the small, hairlike structures, identified as X in the image, function with the mucus to protect the respiratory system.

(3 marks)

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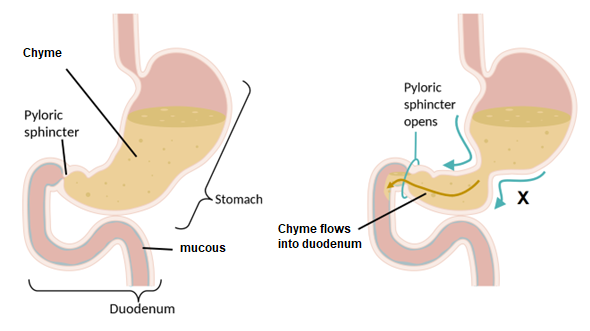
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**Question 29 (12 marks)**

The diagram below shows the emptying of the stomach into the duodenum through the pyloric sphincter.



(a) Pancreatic juices are released into the duodenum through the bile duct. Identify the pH level of pancreatic juice and state how this protects the small intestine.

(2 marks)

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**Question 29** (continued)

(b) State the name of the process identified by X and explain how the structure of the stomach assists in producing chyme.

(5 marks)

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(c) An adult small intestine has approximately 250 square metres of surface area. Why is this important for the functioning of the digestive system?

(1 mark)

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(d) State **four** ways in which the large internal surface of the small intestine is achieved.

(4 marks)

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**Question 30 (17 marks)**

Lactase, a bacterial enzyme that breaks down lactose sugar, is added to fresh milk to produce lactose free milk. The table below shows the results of an investigation on the effect of temperature on the lactase enzyme.

|  |  |
| --- | --- |
| **Temperature (oC)** | **Time taken to digest lactose (min)** |
| 25 | 28 |
| 30 | 21 |
| 35 | 12 |
| 40 | 9 |
| 45 | 18 |
| 50 | 28 |
| 55 | 39 |

(a) The concentration of lactase added at each temperature was kept the same. Describe why this variable would need to be controlled.

(2 marks)

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(b) Identify how you would make sure the results of this investigation would be reliable.

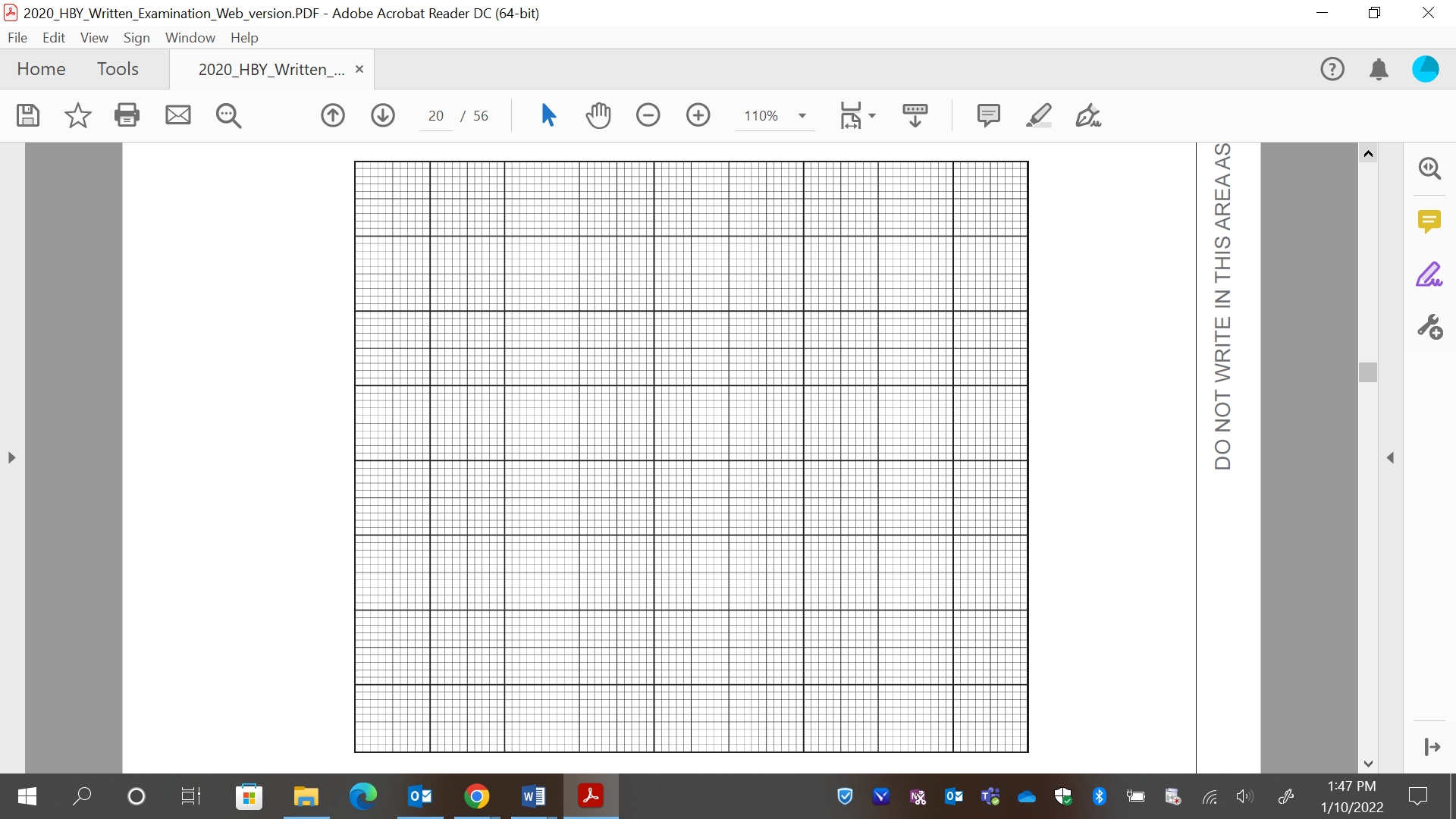
(1 mark)

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(c) On the grid below, graph the time taken for lactose to be digested at different temperatures.

(4 marks)



A spare grid is provided at the end of this Question/Answer booklet. If you need to use it, cross out this attempt and indicate that you have redrawn it on the spare grid.

(d) Explain the trend of the graph you constructed in part (c).

(4 marks)

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**Question 30** (continued)

The investigation was repeated to investigate the effect of substrate concentration on the time taken to digest lactose.

(e) What would you expect to happen to the time taken to digest lactose as the concentration of lactose was increased? Explain your answer.

(3 marks)

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(f) Explain why people with lactose intolerance often experience diarrhoea as a symptom.

(3 marks)

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**Question 31 (14 marks)**

The diagram below shows the components of a typical animal cell.



(a) The structure labelled 14 is described by the fluid mosaic model. Explain what fluid mosaic means and describe the main structures of this model.

(6 marks)

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**Question 31** (continued)

(b) The membrane of the nucleus is similar to the cell membrane; however, it consists of many pores. What is the purpose of these nuclear pores?

(1 mark)

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(c) Identify the number that a mitochondrion is labelled in the diagram on the previous page. Why would you expect to find a high concentration of mitochondria in epithelial cells of the intestine?

(3 marks)

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(d) Describe how cells work together to form multicellular organisms.

(4 marks)

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**End of Section Two**

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

This section contains **four** questions. You must answer **two** questions.

Questions 32 and 33 are from Part 1. Question 34 and 35 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: 40 minutes

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**Part 1**

Choose **either** Question 32 **or** Question 33.

Indicate the question you will answer by ticking the box next to the question. Write your answer on pages 23–27. When you have answered your first question, turn to page 30 and indicate on that page the second question you will answer.

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**Question 32 (20 marks)**

1. Describe how the processes of digestion and absorption of dietary fats allows for the nutrient to be distributed to all the cells of the body.
2. marks)
3. Contrast anabolic and catabolic reactions in a cell, giving an example of each, and explain how these biochemical processes are controlled.

(7 marks)

**Question 33 (20 marks)**

Metabolic processes are constantly taking place in the body, with someone’s metabolism dependent on many factors, such as their age, gender, activity level, and lean body mass.

(a) Define metabolism and explain how metabolic reactions of food can be associated with weight gain.

(6 marks)

Cellular respiration is a metabolic pathway that uses nutrients to produce ATP.

(b) Outline the processes involved in aerobic respiration and describe how ATP is used to store energy.

(14 marks)

Question number: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Part 2**

Choose **either** Question 34 **or** Question 35.

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

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**Question 34 (20 marks)**

On an average day, an adult will drink approximately 2.5 L of water and lose around the same amount of water, with the majority excreted as urine.

(a) Explain why it is important that water output and water intake are equal and describe how the structure of the kidneys maximises the production of urine.

(15 marks)

(b) Juice detox diets, where only fruit and vegetable juices are consumed, often lead to nutrient deficiencies. Define what a nutrient is and describe the importance of minerals and vitamins in the body.

(5 marks)

**Question 35 (20 marks)**

Bone injuries heal much more rapidly than cartilage injuries.

1. Compare and contrast the structure and function of bone and cartilage.

(8 marks)

Enzymes participate in the healing of a fractured bone. They are also involved in digestion, ATP synthesis and a variety of other metabolic reactions within the human body.

1. Explain how enzymes work using the lock and key model and explain how so many unique enzymes can exist within our bodies.

(12 marks)

**End of Questions**

Question number: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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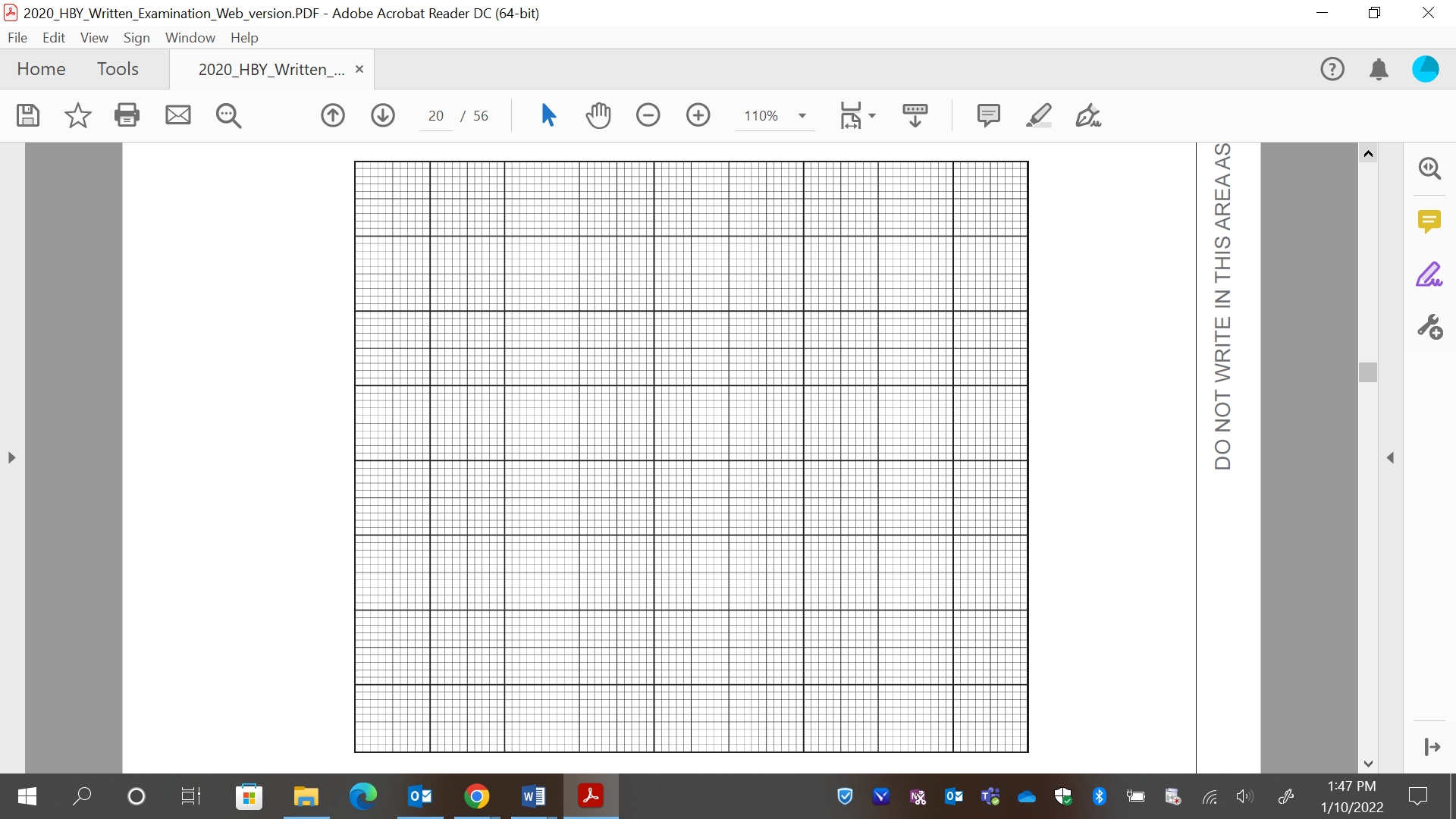
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Spare grid for Question 35(c).



**ACKNOWLEDGEMENTS**

**Question 5** Christinelmiller. (2020). *Unit Cell for SA to Vol Ratio with Tables*. CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0>, via Wikimedia Commons. Accessed on 29th September 2023, from:

<https://commons.wikimedia.org/wiki/File:Unit_cell_for_SA_to_V_ratio_with_tables.png>

**Question 10** GrahamColm at English Wikipedia. (2009). *Simplified illustration of the stages of phagocytosis.* CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons. Accessed on 29th September 2023, from:

<https://commons.wikimedia.org/wiki/File:Phagocytosis2.png>

**Question 16** OpenStax College. (2013). *Biceps Muscle.* CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons. Accessed on 29th September 2023, from: <https://commons.wikimedia.org/wiki/File:Biceps_Muscle_CNX.jpg>

**Question 33** Lord Akryl, Jmarchn. (2010). *Conducting Passages of the Respiratory System.* Public domain, via Wikimedia Commons. Accessed on 29th September 2023, from: <https://commons.wikimedia.org/wiki/File:Illu_conducting_passages.svg>

**Question 33** OpenStax College. (2019). *Pseudostratified Epithelium2.* CC BY 3.0 <https://creativecommons.org/licenses/by/3.0>, via Wikimedia Commons. Accessed on 29th September 2023, from: <https://commons.wikimedia.org/wiki/File:2304_Pseudostratified_Epithelium.jpg>

**Question 34** Jonathan Dyhr. (2022). *Stomach emptying into duodenum.* CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0>, via Wikimedia Commons. Accessed on 29th September 2023, from: <https://commons.wikimedia.org/wiki/File:Stomach_emptying_into_duodenum.svg>

**Question 34** DataBase Center for Life Science (DBCLS). (2021). *XXX muscle.* CC BY 4.0 <https://creativecommons.org/licenses/by/4.0>, via Wikimedia Commons. Accessed on 29th September 2023, from: <https://commons.wikimedia.org/wiki/File:202107_XXX_muscle.svg>

**Question 36** Kelvinsong. (2012). *Animal Cell.* CC0, via Wikimedia Commons. Accessed on 29th September 2023, from: <https://commons.wikimedia.org/wiki/File:Animal_Cell.svg>