Servite College
Semester One Examination, 2021

Question/Answer Booklet

HUMAN BIOLOGICAL SCIENCE

Unit 1

Name:

Student Number: In figures | | | | | | | | |

In words _____

_____

Time allowed for this paper
Reading time before commencing work: Ten minutes
Working time for paper: Two hours 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, pencils, eraser or correction fluid, ruler, highlighter, ruler.
- Special items: Calculators satisfying the conditions set by the Curriculum Council for this subject.

IMPORTANT NOTE 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 notes or other items of a non-personal nature in the examination room. 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 attempted	Suggested working time (minutes)	Marks available	Percentage of examination
Section One Multiple-choice	30	30	40	30	30
Section Two Short answer	7	7	85	90	50
Section Three Extended answer	1	1	25	20	20
				Total	100

Instructions to candidates

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2021*. 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 answers to the specific questions asked and to 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.

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1. Cardiac muscle cells are joined end to end by structures known as

   (a) intercalated discs.
   (b) sarcomeres.
   (c) synapses.
   (d) striations.

2. The test for Covid-19 analyses samples for the presence of antibodies in the body. The cells, which produce these antibodies and act to protect the body from foreign invaders, are known as

   (a) thrombocytes.
   (b) erythrocytes.
   (c) platelets.
   (d) leucocytes.

3. Sebaceous glands in our skin secrete an oily substance known as sebum that contains lipids. Which cell organelle would you expect to find in high numbers within the cells of these glands?

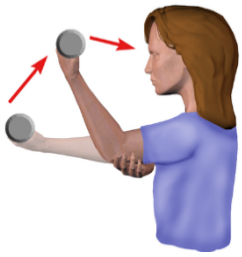
   (a) Ribosomes
   (b) Mitochondria
   (c) Smooth endoplasmic reticulum
   (d) Golgi body

4. The human diet contains acid producing foods. Which of the following occur to hydrogen and ammonium ions in the kidney to maintain blood pH within its normal range of 7.4-7.5?

   (a) Both would be secreted into the filtrate.
   (b) Both would be reabsorbed into the filtrate.
   (c) Only hydrogen would be secreted into the filtrate.
   (d) Only ammonium ions would be reabsorbed into the filtrate.

SEE NEXT PAGE

Questions 5 - 7 refer to the diagram below of a person undertaking a common exercise known as a bicep curl.



5. What motion is shown by the bicep curl?

   (a) Extension
   (b) Rotation
   (c) Flexion
   (d) Abduction

6. Which of the following structures connects the bones of the arm together to help stabilise the motion of the bicep curl?

   (a) Tendons
   (b) Ligaments
   (c) Insertions
   (d) Joints

7. As the bicep muscle contracts, the tricep muscle will relax. These pair of muscles are referred to as

   (a) antagonists.
   (b) agonists.
   (c) prime movers.
   (d) extensors.

8. The proximal and distal tubules of the nephron are convoluted. These convolutions allow for

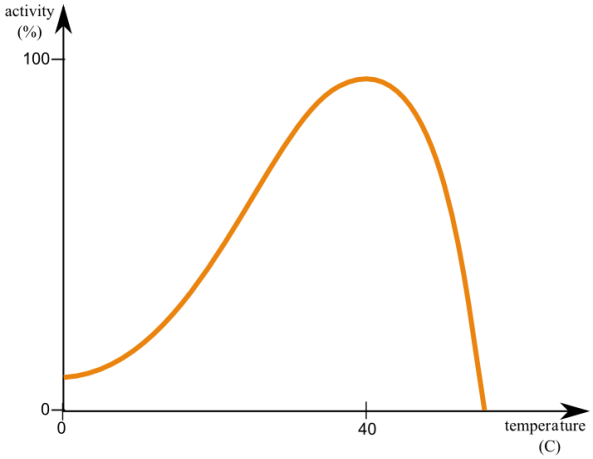
   (a) decreased concentration gradients for better reabsorption.
   (b) an increase in surface area for reabsorption and secretion.
   (c) a rise in blood pressure for increased filtration.
   (d) minimal loss of filtrate during urine production.

9. The function of the cilia found in the epithelial cells of the trachea is to help move

   (a) mucus and debris out of the lungs.
   (b) air into the bronchioles.
   (c) mucus into the lower respiratory tracts.
   (d) air out of the mouth and nose.

SEE NEXT PAGE

Question 10 refers to the following graph showing the activity of an enzyme over a range of temperatures.



10. Which of the following explains the reduction in enzyme activity in the graph shown above?

    (a) Action of inhibitors increases
    (b) Substrates begin to break down
    (c) Active site changes shape
    (d) Product concentration increases

11. During a scientific investigation, several trials are run. Which of the following is the best reason to explain this?

    (a) Increase validity
    (b) Reduce effect of random errors
    (c) For the scientist to improve their skills
    (d) Increase accuracy

12. Which of the following is **not** an example of an appendicular bone?

    (a) Humerus
    (b) Fibula
    (c) Vertebrae
    (d) Pelvis

13. A typical pair of adult human lungs contains 480 million alveoli. The reason for this high number is to

    (a) increase surface area for gas exchange.
    (b) increase the number of muscles to breath.
    (c) maintain the shape and keep the lungs inflated.
    (d) decrease pressure allowing air to be inspired.

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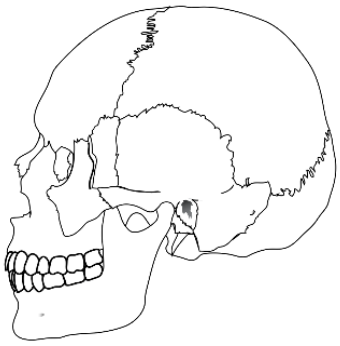
14. In a disorder called familial hypercholesteremia, specific receptors on the cell membrane allow low-density lipoproteins to be engulfed and transported into the cell. The movement of these lipoproteins into the cells is best known as

    (a) facilitated transport.
    (b) exocytosis.
    (c) active transport.
    (d) endocytosis.

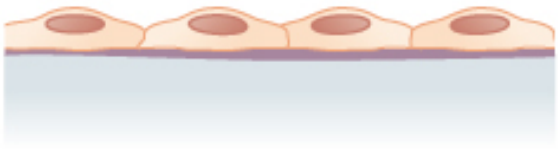
Question 15 refers to the diagram below of a human skull.



15. The irregular lines on the skull indicate where different bones join. What is the name given to this type of joint found in the skull?

    (a) Synovial
    (b) Fibrous
    (c) Cartilaginous
    (d) Plate

Question 16 refers to the diagram below that shows a sample of epithelial tissue.



16. In which of the following structures would you expect to find this type of epithelial tissue?

    (a) Oesophagus, to protect from abrasions whilst breathing
    (b) Urethra, to allow for expansion during excretion
    (c) Distal convoluted tubule, allowing for secretion and absorption
    (d) Lymphatic vessels, to allow materials to pass via diffusion

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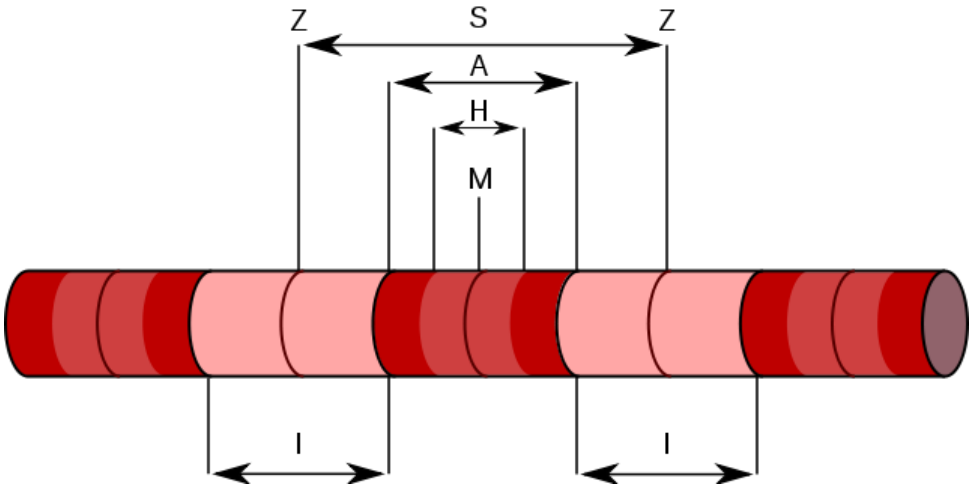
17. The enzyme found in the human mouth starts the digestion of carbohydrates. Which of the following correctly identifies the name and optimal pH for this enzyme?

    (a) Amylase; pH 5
    (b) Maltase; pH 9
    (c) Amylase; pH 7
    (d) Maltase; pH 5

Questions 18 and 19 refer to the diagram below of a unit of muscle fibre.



18. Which of the following are located in the zone indicated by the letter H?

    (a) Actin only
    (b) Myosin only
    (c) Actin and myosin
    (d) Calcium ion receptors

19. What happens to the zone indicated by the letter A when muscles contract?

    (a) Stays the same width
    (b) Decreases in width as actin slides over myosin
    (c) Increases in width as actin slides over myosin
    (d) Decreases in width as myosin slides over actin

20. Which of the following tissue types would **not** be classified in the same category as bone?

    (a) Adipose tissue
    (b) Fibrocartilage
    (c) Blood
    (d) Muscle

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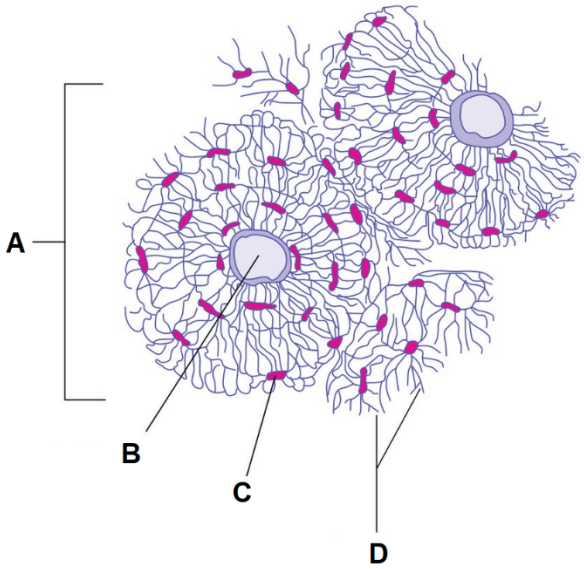
21. Which of the following statements **correctly** identifies the difference between elimination and excretion?

    (a) Excretion occurs mainly through faeces, whilst elimination occurs through urine.
    (b) Excretion removes indigestible material, whilst elimination removes metabolic wastes only.
    (c) Elimination occurs in several different organs, whilst excretion occurs only in the kidneys.
    (d) Elimination is the removal of indigestible material and metabolic waste, whilst excretion removes metabolic wastes only.

Question 22 refers to the diagram below that illustrates a section of bone.



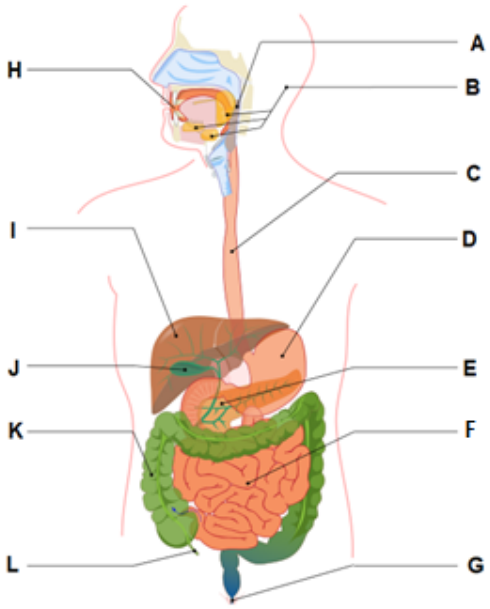
22. Transport of nutrients and wastes between osteocytes, shown at label D, occur through the

    (a) lacunae.
    (b) canaliculi.
    (c) osteons.
    (d) haversian canals.

23. Calcium is deposited by bone cells along with collagen to give bone its stiffness. Which of the following **correctly** identifies where this deposition occurs?

    (a) Lamellae
    (b) Periosteum
    (c) Lacunae
    (d) Haversian Canal

Questions 24 and 25 refer to the diagram below that shows the different organs associated with the digestive system.



24. Achlorhydria is an autoimmune disease that damage parietal cells and can cause impaired digestion of food. In which organ would these cells be found?

    (a) Organ D
    (b) Organ E
    (c) Organ F
    (d) Organ J

25. Which of the following is **not** a function of the organ labelled K?

    (a) Absorption of water and vitamins
    (b) Formation and storage of faeces
    (c) Breakdown of organic matter
    (d) Production of enzymes for chemical digestion

26. Coenzyme Q10 is required for the synthesis of adenosine triphosphate. Which of the following **best** explains how a coenzyme works?

    (a) Small organic and inorganic molecules that bind to the enzyme and change the shape of the active site
    (b) Large protein molecules that permanently bind to enzymes and act as catalysts
    (c) Organic molecules that temporarily bind to an enzyme and change their shape
    (d) Inorganic molecules that produce chemical reactions between enzymes and substrates

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27. Which of the following **best** explains why eating less fat can help with weight loss?

    (a) Fats are nutrient dense, producing the most energy.
    (b) Fats are associated with heart disease and therefore less exercise.
    (c) Fats are used to create more cells in the body.
    (d) Fats are metabolised slower than other nutrients.

28. Pulmonary hypertension (high blood pressure), causes the blood vessels of the lungs to become narrowed or blocked. Although there is no cure, treatment can be given to help reduce the symptoms. Which of the following would you **not** expect to be a symptom of pulmonary hypertension?

    (a) Chest pressure and/or pain
    (b) Cyanosis (blue lips)
    (c) Decreased heart rate
    (d) Shortness of breath

29. A scientist receives a histopathology report regarding a patient with polychondritis, which causes recurrent episodes of inflammation within cartilage. The sample, taken from the trachea, was glossy in appearance, with no visible fibres present, and contained clusters of chondrocytes. Which of the following types of cartilage is this sample representative of?

    (a) Fibrocartilage
    (b) Hyaline
    (c) Connective
    (d) Elastic

30. The lymphatic structure which absorbs lipids into the intestine is known as a

    (a) lacteal
    (b) lymphatic duct.
    (c) collecting vessel.
    (d) vein.

End of Section One

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Section Two: Short answer **50% (90 Marks)**

This section has **7** 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.

Question 31 **(14 marks)**

Chronic fatigue is most common in people between 40 and 60 years of age. D-ribose supplementation helps chronic fatigue by providing a substrate for cellular respiration to occur.

(a) Complete the word equation for cellular respiration, which uses glucose as its substrate. (1 mark)

Glucose + _____ → _____ + Carbon Dioxide + _____

(b) Is the equation in part (a) an example of a catabolic or anabolic reaction? Justify your answer. (2 marks)

_____

_____

_____

(c) Wastes produced from cellular respiration needs to be excreted from the body. Identify which organ carbon dioxide is excreted from and describe how it is transported there.

(4 marks)

_____

_____

_____

_____

_____

_____

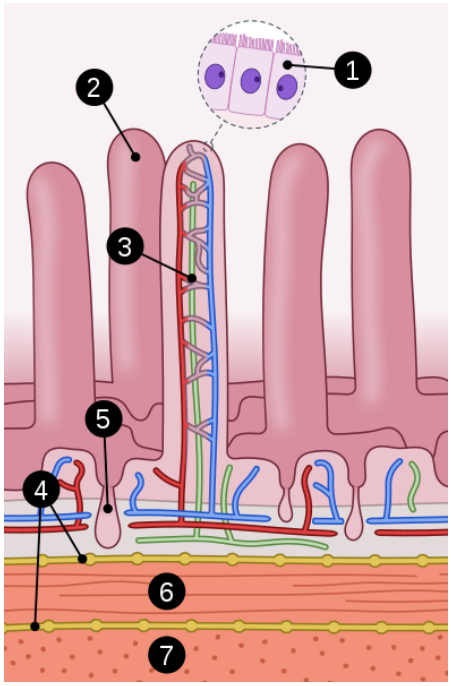
A study in Great Britain found that 70% of patients suffering from Chronic Fatigue Syndrome had irregular mitochondrial structures.

(d) Explain why an abnormal inner membrane of a mitochondria could lead to symptoms of fatigue. (4 marks)

(e) During exercise, chronic fatigue patients often experience a burning sensation in their muscles along with a lack of strength. Explain why this occurs. (3 marks)

Question 32 **(9 marks)**

The diagram below shows a cross section of an organ within the digestive system.



(a) Identify the organ of the digestive system illustrated in the diagram above. Justify your answer. (2 marks)

(b) Name the cell identified by label 1 and explain why these cells are lined with microvilli. (2 marks)

(c) Describe the shape and appearance of the muscle cells you would find in this digestive organ, as identified by labels 6 and 7. (2 marks)

(d) Describe how the longitudinal and circular (transverse) muscles move ingested food through the digestive system. (3 marks)

Question 33 **(9 marks)**

In 2010, a patient at Westmead hospital in New South Wales, Australia, received the incorrect blood during a transfusion resulting in an ABO incompatibility reaction.

(a) Describe how type A and type B blood types differ. (4 marks)

(b) Describe what occurs to the newly transfused blood during an ABO incompatibility reaction. (1 mark)

Movement of substances, such as water and ions, can occur through several different processes.

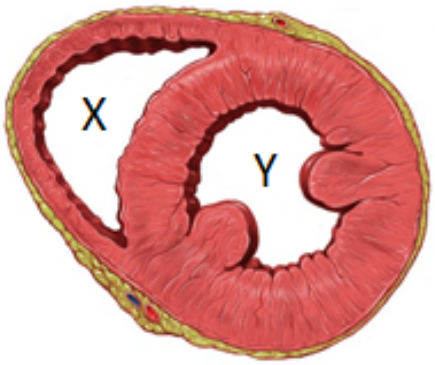
(c) Compare and contrast the processes of simple and facilitated diffusion. (4 marks)

Question 34 **(17 marks)**

Covid-19 leads to blood clots in an estimated 30% of critically ill patients.

(a) Identify the component of blood that is associated with clotting and give a reason why it is important that blood clots. (2 marks)

The inferior view of a heart, which has been dissected horizontally across its short axis, is shown below.



(b) Identify the section labelled X and explain why its structure differs to that of the section labelled Y. (3 marks)

(c) Covid-19 has also been shown to cause enlargement of the heart muscles. Describe how this would affect the structure and function of the section labelled Y.

(3 marks)

(d) Identify and contrast the two main types of blood vessels in the human body.

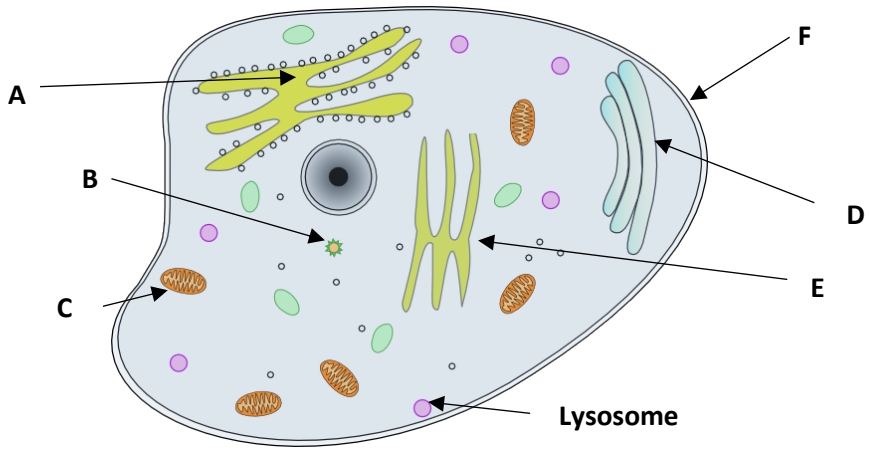
(5 marks)

Stenosis refers to the abnormal narrowing of a blood vessel or other tube-like organ in the body.

(e) State **one** lifestyle factor that may cause stenosis within the cardiovascular system and briefly outline the effects of this disease on the body. (4 marks)

Question 35 **(12 marks)**

The diagram below illustrates a simplified version of an animal cell.



(a) Describe how Organelle A and Organelle D work together to create lysosomes. (2 marks)

(b) Describe the relationship between body systems and specialised cells. (3 marks)

A group of Year 11 students were asked to investigate the effect of surface area to volume ratio on the exchange of materials across a cell membrane.

(c) Complete the following table by calculating the missing values. (3 marks)

Length of each side (mm)	**Volume (mm^3)**	**Surface Area (mm^2)**	**SA: Vol ratio**
2	8	24	
4		96	3:2
6	216		1:1

(d) Explain the importance of cells being small. (4 marks)

Question 36 **(16 marks)**

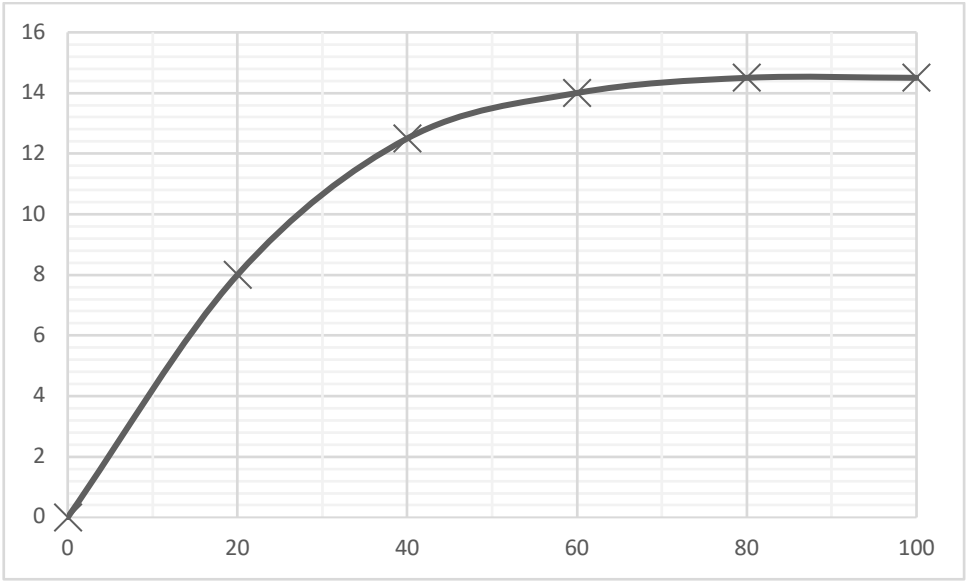
Digestion of proteins occurs in the stomach and small intestine through the activity of pepsin and trypsin enzymes, respectively.

(a) Would you expect pepsin to have a higher or lower optimal pH level as compared to saliva? Give a reason for your answer. (2 marks)

(b) Enzymes are specific to certain molecules. Draw a labelled diagram to illustrate the lock and key model during an anabolic reaction. (4 marks)

(c) From the above, describe three other characteristics of enzyme. (3 marks)

The enzyme catalase breaks down hydrogen peroxide (H_2O_2) to form water and oxygen. The reaction rate can be calculated by measuring the height of bubbles formed per second. The incomplete graph below shows the results of an experiment that investigated the effect of substrate concentration in percentage on the activity of catalase.



(d) Using the data points from the graph, construct a table to illustrate the results. (5 marks)

(e) Identify the saturation point for catalase in this experiment and describe how enzyme function is affected once saturation point is achieved. (2 marks)

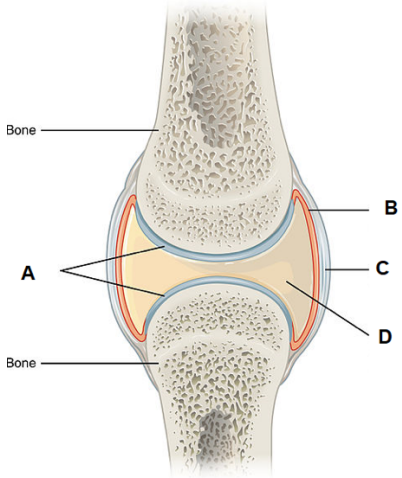
SEE NEXT PAGE

Question 37 **(13 marks)**

(a) It is often said that a broken bone is better than a tear in cartilage. Discuss why bone heals faster than a tear in cartilage. (3 marks)

(b) State the differences in structure between compact and spongy bone. (3 marks)

(c) The following diagram illustrates the structure of a knee joint.



(i) State the name given to this type of joint in the body. (1 mark)

_____

(ii) Briefly describe how the structures labelled B and D prevent injury to these types of joints. (2 marks)

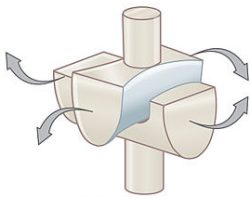
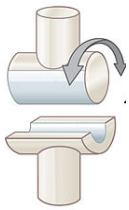
_____

_____

_____

_____

(iii) Complete the table below to identify the specific type of joint illustrated and provide **one** location for each. (4 marks)

		
Type of joint:		
Location of joint:		

End of Section Two

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

Section Three consists of **one** question.

Use black or blue pen for this section. Only graphs and diagrams may be drawn in pencil. Responses can include: labelled diagrams with explanatory notes; lists of points with linking sentences; labelled tables and/or graphs; and/or 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: 25 minutes.

Question 38 **(20 marks)**

(a) Kidney stones, which are crystals of urea, can form in the renal pelvis. One symptom associated with damage caused by kidney stones is the presence of proteins in the urine.

State how urea is produced and outline the route a kidney stone will take to be excreted. Explain why protein in the urine would be a sign that kidney stones have caused damage to the kidney.

(10 marks)

(b) The ketogenic diet is based on the premise that an intake of low-carbohydrate, high-fat foods will promote weight loss.

Explain how fats are digested in the small intestine and describe why a diet low in carbohydrates can be dangerous.

(10 marks)

SEE NEXT PAGE

Question number: _____

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Question number: _____

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Question number: _____

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Question number: _____

SEE NEXT PAGE

Question number: _____

SEE NEXT PAGE

Supplementary page

Question number: _____

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Acknowledgements

Question 5 – 7 Bruce Blaus. (2017). Illustration of bicep curl [image]. Retrieved October, 2020, from: https://commons.wikimedia.org/wiki/File:Exercise_Bicep_Curls.png

Question 10 Gal, M. (2007). Graph of Enzyme Activity against Temperature [image]. Retrieved September 2020, from: https://commons.wikimedia.org/wiki/File:Enzyme-temperature.png

Question 15 Paola it. (2017). Human Skull [image]. Retrieved October, 2020, from: https://commons.wikimedia.org/wiki/File:Human_skull_nocolors.svg

Question 16 Adapted from OpenStax College (2013). Summary of Epithelial Tissue [image]. Retrieved October, 2020, from: https://commons.wikimedia.org/wiki/File:423_Table_04_02_Summary_of_Epithelial_Tissue_CellsN.jpg

Question 18 – 19 JeeJeederivative work: Marek M. (2011). Myofibril diagram [image]. Retrieved October, 2020, from: https://commons.wikimedia.org/wiki/File:Myofibril_diagram.svg

Question 22 – 23 Adapted from Bartleby (2006). Transverse section of Bone [image]. Retrieved October, 2020, from: https://commons.wikimedia.org/wiki/File:Diagram_of_an_osteocyte_-_a_type_of_bone_cell_CRUK_031.svg

Question 24 – 25 Adapted from Termininja (2012). Digestive System [image]. Retrieved October, 2020, from: https://commons.wikimedia.org/wiki/File:Digestive_system.svg

Question 32 Kebert, T. (2020). Surface [image]. Retrieved September, 2020, from: https://commons.wikimedia.org/wiki/File:surface.svg

Question 34 Patrick J. Lynch. (2006). Heart normal short axis [image]. Retrieved September, 2020, from: https://commons.wikimedia.org/wiki/File:Heart_normal_short_axis_section.jpg

Question 35 Shared by OCAL. (2010). Animal Cell Clip Art [image]. Retrieved October, 2020, from: http://www.clker.com/clipart-animal-cell.html

SEE NEXT PAGE

Question 37 OpenStax College. (2013). Joint [image]. Retrieved October, 2020, from: https://commons.wikimedia.org/wiki/File:907_Joints.jpg

Question 37 Adapted from OpenStax College. (2013). Types of Joints. Retrieved October, 2020, from: https://commons.wikimedia.org/wiki/File:909_Types_of_Joints.jpg