

- Copyright for test papers and marking guides remains with *West Australian Test Papers*.
- The papers may only be reproduced within the purchasing school according to the advertised conditions of sale.
- Test papers must be withdrawn after use and stored securely in the school until Friday 12<sup>th</sup> June, 2020.



# HUMAN BIOLOGY

## Unit 1

**2020**

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

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

### Time allowed for this paper

Reading time before commencing work: ten minutes  
Working time: 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: non-programmable calculators approved for use in this examination

### 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 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 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	90	106	50
Section Three Extended answer Part 1	2	1	50	40	20
Part 2	2	1			
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 2020*. 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.

**SEE NEXT PAGE**

## Section One: Multiple-choice

30% (30 Marks)

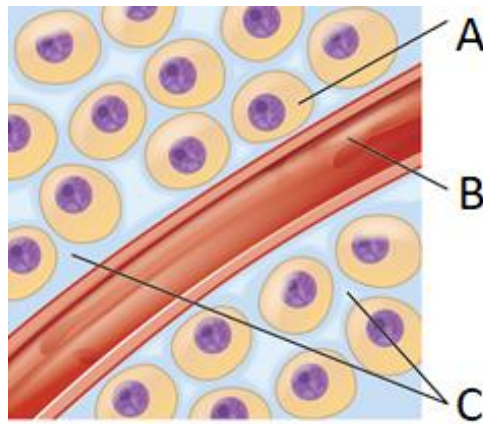
This section has **30** questions. Answer **all** questions on the separate Multiple-choice answer sheet provided. For each question shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that 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. A scientist was measuring the weights of 100 athletes; however, the scale she used was measuring one kilogram higher than the true value. This is an example of
  - (a) user error.
  - (b) human error.
  - (c) random error.
  - (d) **systematic error.**
  
2. If a measuring cylinder reading is said to be  $33.45 \pm 0.05 \text{ cm}^3$ , which of the following values is **not** possible for the given reading?
  - (a)  **$33.39 \text{ cm}^3$**
  - (b)  $33.50 \text{ cm}^3$
  - (c)  $33.47 \text{ cm}^3$
  - (d)  $33.42 \text{ cm}^3$
  
3. Pancreatic cells produce and release lipase. Which of the following adaptations would you expect to find in these cells?
  - (a) Mitochondria with small internal membranes
  - (b) **Large numbers of ribosomes**
  - (c) A small surface area to volume ratio
  - (d) Cilia and flagella to allow for movement
  
4. Which of the following is the actual length of a cell that is 1 cm in length at a magnification of 100X?
  - (a) 0.01 mm
  - (b) **0.1 mm**
  - (c) 1 mm
  - (d) 10 mm

Question 5 refers to the diagram below of the fluid compartments in the human body.



5. The fluid compartment represented by the letter A is referred to as
- (a) lymph.
  - (b) **intracellular fluid.**
  - (c) interstitial fluid.
  - (d) extracellular fluid.
6. Which of the following correctly states the organic compound that, when aerobically catabolised, produces the most ATP?
- (a) Protein
  - (b) **Lipid**
  - (c) Carbohydrate
  - (d) Deoxyribose nucleic acid (DNA)
7. Gastroesophageal reflux disease (GERD) is a condition that results in the liquid contents of the stomach to enter the oesophagus. The regurgitated liquid can cause damage to the oesophagus due to
- (a) pepsin and amylase.
  - (b) nucleases and saliva.
  - (c) **hydrochloric acid and pepsin.**
  - (d) bile acids and proteases.
8. In which two body organs does the absorption of water take place?
- (a) Kidneys and liver
  - (b) **Large intestine and kidneys**
  - (c) Liver and nephrons
  - (d) Kidneys and small intestine

9. Osteoporosis is associated with a loss of bone density. Which of the following bone cells would have excessive activity in a patient with this disease?
- (a) **Osteoclasts**
  - (b) Osteoblasts
  - (c) Osteocytes
  - (d) Osteocrypts
10. A patient is diagnosed with cholecystitis, obstructing bile salt passage into the small intestine. As a result, the patient is unable to eat too much fat at one sitting. Which of the following organs does cholecystitis affect?
- (a) Pancreas
  - (b) Liver
  - (c) **Gall bladder**
  - (d) Appendix
11. Ossification, or osteogenesis, is the process of creating new bone. This reaction is an example of
- (a) catabolism.
  - (b) **anabolism.**
  - (c) metabolism.
  - (d) respiration.
12. Which of the following statements regarding the kidney is **correct**?
- (a) **The glomerulus along with the Bowman's capsule is known as the renal corpuscle**
  - (b) The section of the kidney known as the medulla consists of separate renal pelvis'
  - (c) The renal pyramid collects the filtrate to transport to the ureters
  - (d) The section of the nephron, known as the Loop of Henle, is found within the renal cortex
13. In which section of mitochondria does the Krebs (Citric Acid) cycle take place?
- (a) Cristae
  - (b) Outer membrane
  - (c) **Matrix**
  - (d) Inner membrane

14. Which of the following groups correctly lists molecules which undergo facilitated diffusion?
- (a) Water, oxygen and glucose
  - (b) Amino acids, glucose and sodium ions
  - (c) Glucose, fatty acids and oxygen
  - (d) Sodium ions, amino acids and carbon dioxide
15. The skeletal system has several functions. During a rugby tackle, which of the following functions would be **most** important?
- (a) Storage
  - (b) Movement
  - (c) Support
  - (d) Protection
16. A Year 11 student suffered a broken leg after a skateboarding accident, with the X-ray showing the fracture in the shaft of the bone. What is the anatomical name given to this part of the bone?
- (a) Epiphysis
  - (b) Diaphysis
  - (c) Metaphysis
  - (d) Periosteum
17. Elimination differs from excretion in that elimination
- (a) includes undigested materials as well as metabolic wastes.
  - (b) only consists of metabolic wastes.
  - (c) only consists of undigested materials.
  - (d) includes digested and undigested materials.
18. The lymphatic capillary found in the small intestine that absorbs dietary fats is known as the
- (a) duodenum.
  - (b) lacteal.
  - (c) villi.
  - (d) intestinal gland.

Question 19 refers to the table below.

Table 1. Weight of two babies at monthly intervals in their first 6 months after birth

	Weight (kg)	
Month	Baby #1	Baby #2
0	3.2	2.7
1	4.1	2.9
2	5.4	3.4
3	5.8	3.9
4	6.2	4.6
5	6.6	5.5
6	7.2	6.4

19. Which of the following graphs is the most appropriate way to represent the data in the table above?

- (a) Histogram
- (b) Bar graph
- (c) **Line graph**
- (d) Pie chart

20. Humans require nutrients for biochemical processes to occur efficiently. Which of the following is **not** a metabolic reason as to why the body is made up mostly of water?

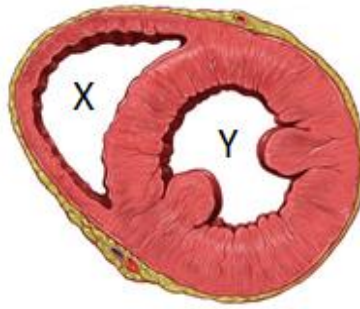
Water acts as a

- (a) reactant in metabolic reactions.
- (b) universal solvent.
- (c) medium for metabolic reactions.
- (d) **transport medium.**

21. A defibrillator uses a high energy electric shock to the heart to restart it beating. Which type of tissue does the defibrillator act on?

- (a) Connective
- (b) Epithelial
- (c) Muscle
- (d) **Nervous**

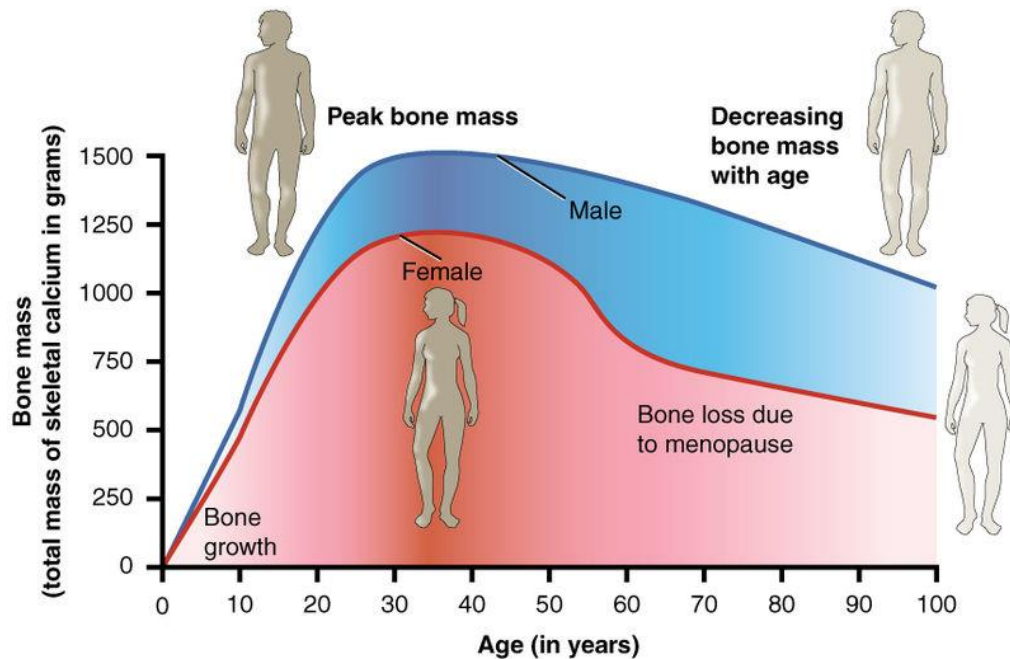
Question 22 refers to the short axis (horizontal cut) section diagram of the anterior view of the heart below.



22. The section of the heart labelled as Y is the

- (a) right ventricle.
- (b) **left ventricle.**
- (c) right atrium.
- (d) left atrium.

Question 23 refers to the information about age and bone mass below.

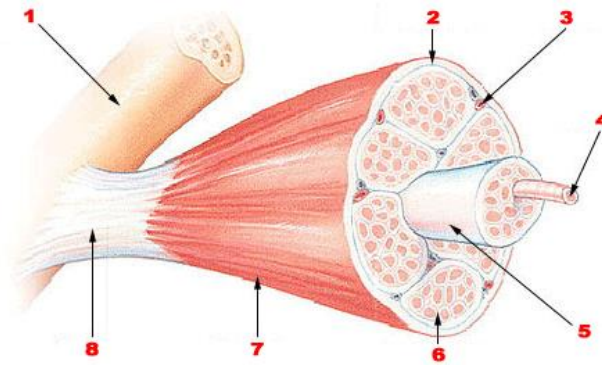


23. The average yearly rate of bone loss in women between the ages of 60 and 100 is

- (a) 5.
- (b) 5.5.
- (c) **6.25.**
- (d) 6.75.



Question 24 and 25 refer to the diagram of the skeletal muscle below.



24. The section of the muscle identified at number 4 is known as a

- (a) myofibril.
- (b) myofilament.
- (c) sarcomere.
- (d) **muscle fibre.**

25. Damage to the structure identified at number 8 would result in

- (a) muscle spasms, causing repetitive contraction and relaxation of the joint.
- (b) **inability to move the affected arm or leg.**
- (c) decreased transportation of nutrients between muscle and bone.
- (d) less protection of the adjacent muscle causing more damage to the structure.

26. Which of the following correctly lists the form and location that nutrients are absorbed in the digestive system?

(a)	Proteins	Blood capillary in small intestine
(b)	Glycerol	Lymph capillaries in the large intestine
(c)	<b>Sucrose</b>	<b>Blood capillaries in the small intestine</b>
(d)	Amino acids	Blood capillaries in the stomach

27. In which part of the digestive tract are Goblet cells, which secrete mucus, most common?

- (a) Oesophagus
- (b) Small intestine
- (c) Stomach
- (d) **Large intestine**

28. Ethanol can directly cross the cell membrane because it is a

- (a) hydrophobic molecule.
- (b) **small uncharged polar molecule.**
- (c) large uncharged polar molecule.
- (d) charged ion.

29. Energy in human cells is stored as

- (a) glycogen.
- (b) glucose.
- (c) ADP.
- (d) **ATP.**

30. If the epithelial cells of the respiratory system are damaged, which of the following will **not** occur?

- (a) **Filtration of particles of dirt and debris**
- (b) Reduced exchange of carbon dioxide and oxygen
- (c) Temperature of the air will remain too high or too low
- (d) Reduced movement of lungs during inhalation

**End of Section One**

**This page has been left blank intentionally**

## Section Two: Short answer

50% (106 Marks)

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

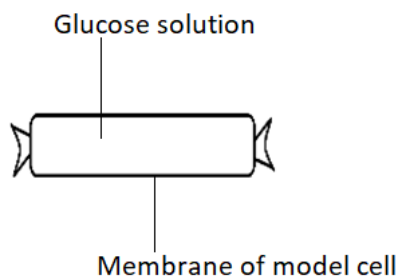
Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 90 minutes.

## Question 31

(14 marks)

The diagram below shows a model cell used by a student to investigate osmosis.



- (a) State a material that can be used as the membrane of the model cell and describe the feature that makes it suitable to use in this experiment. (2 marks)

Description	Mark
Dialysis Tubing / Cellulose Tubing	1
Differentially permeable / semipermeable / selectively permeable / allows only certain sized molecules to pass	1
<b>Total</b>	<b>2</b>

Four model cells, labelled A, B, C and D, were constructed and contained 0%, 5%, 10% and 20% glucose solutions respectively. The model cells were weighed then suspended in four test tubes containing a 10% glucose solution. One hour later the model cells were removed and reweighed.

- (b) In the space below, draw a labelled diagram of the experimental set up. (4 marks)

Description	Mark
Four test tubes with cell model inside	1
Test tubes / cell model labelled as A, B, C or D	1
Test tube solution labelled correctly	1
Model cell solution labelled correctly	1
<b>Total</b>	<b>4</b>

SEE NEXT PAGE

- (c) Predict which model, A, B, C or D, would have the greatest change in mass after the given hour. Give a detailed explanation for your answer. (5 marks)

Description	Mark
Model D	1
Glucose molecules are large so can't move through the membrane	1
Water molecules are small so can fit through pores in the membrane	1
Higher osmotic pressure/higher glucose(solute) concentration in the model cell	1
Water moves into the model cell by osmosis increasing its mass	1
<b>Total</b>	<b>5</b>

- (d) What is the name given to the type of solution in the test tube of Model C? (1 mark)

Description	Mark
Isotonic	1
<b>Total</b>	<b>1</b>

- (e) The student repeated the experiment three times. Describe why scientists undertake multiple tests and calculate mean results. (2 marks)

Description	Mark
Reduce effect of random errors	1
Increase overall reliability	1
<b>Total</b>	<b>2</b>

## Question 32

(16 marks)

Jasmine was interested in learning more about the digestive system. She took a bite of white bread and left it in her mouth for a long period of time. After it became mushy, it started to taste sweet.

- (a) Explain why bread becomes mushy and starts to taste sweet when left in the mouth for an extended period. (5 marks)

Description	Mark
Any 5 of the following:	
Salivary glands in mouth produce saliva	1-5
Saliva is majority water	
Moistens the bread making it soft/mushy	
Saliva also contains amylase	
an enzyme that breaks down carbohydrates/large starch molecules	
into maltose/smaller sugar molecules	
<b>Total</b>	<b>5</b>

Once swallowed, the bolus of bread passes through the oesophagus, into the stomach and then the intestines where it is further broken down.

- (b) Describe the mechanical digestion which occurs in the stomach. (4 marks)

Description	Mark
(gastric) Peristalsis	1
Wave-like muscle contractions	1
Three muscle layers involved	1
Circular, oblique and longitudinal	1
<b>Total</b>	<b>4</b>

Jasmine had recently been sick due to food poisoning. The bacteria, E. coli, attaches to the columnar epithelia of the small intestine.

- (c) Describe why Jasmine's doctor is concerned about her nutrient absorption. (3 marks)

Description	Mark
Damaged microvilli	1
Decreases surface area	1
Reduces absorption of nutrients	1
<b>Total</b>	<b>3</b>

- (d) State two nutritional differences between a non-vegetarian and vegetarian diet and give an example of the effects these can have on the body. (4 marks)

Description	Mark
Any two of the following. 1 mark for identifying difference, 1 mark for the effect:	
<ul style="list-style-type: none"><li>• Less fibre in non-vegetarian</li><li>• irregular digestion (constipation) / elevated cholesterol / decreases immune function / leads to weight gain</li></ul>	1-2
<ul style="list-style-type: none"><li>• Higher (saturated) fats in non-vegetarian</li><li>• Increased cholesterol levels / greater risk of colon cancer / increased risk of cardiovascular disease (heart attack / stroke etc.)</li></ul>	1-2
<ul style="list-style-type: none"><li>• Less protein in vegetarian</li><li>• Affecting muscle strength and/or function / skin/hair/nail issues / increased risk of bone fractures</li></ul>	1-2
<ul style="list-style-type: none"><li>• Other suitable differences and appropriate effect, including calcium, iron, potassium, magnesium and folate being higher in vegetarians</li></ul>	1-2
<b>Total</b>	<b>4</b>

## Question 33

(13 marks)

A Blood Urea Nitrogen (BUN) test is a common diagnostic tool for investigations into kidney function.

(a) Explain how urea is formed.

(4 marks)

Description	Mark
Occurs in the liver	1
Deamination/removal of an amino group	1
Produces ammonia	1
Enzymes/urea cycle converts to urea	1
<b>Total</b>	<b>4</b>

Increased BUN levels can be due to prerenal, renal and postrenal factors.

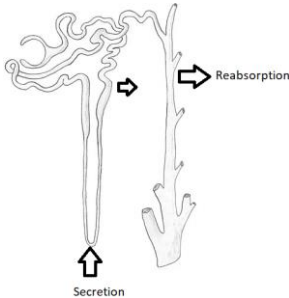
(b) Describe how decreased blood flow through the kidneys can result in excess urea in the blood.

(3 marks)

Description	Mark
Decreased blood flow into glomerulus	1
Glomerular filtration is reduced	1
Less urea is filtered into glomerular capsule/renal tubule	1
<b>Total</b>	<b>3</b>

(c) On the diagram below, label an arrow to identify **one** location where urea is reabsorbed and **one** location where it is secreted.

(3 marks)

Description	Mark
Correct identification of urea reabsorption site <ul style="list-style-type: none"> <li>PCT</li> <li>Collecting ducts</li> </ul>	1
Correct identification of urea secretion site <ul style="list-style-type: none"> <li>Loop of Henle</li> </ul>	1
Must identify that reabsorption is OUT OF and secretion INTO the tubules	1
Example:  <p>The diagram shows a nephron with a glomerulus at the top, a proximal convoluted tubule (PCT) on the left, a descending loop of Henle at the bottom, and an ascending collecting duct on the right. An arrow labeled 'Reabsorption' points from the PCT into the surrounding space. An arrow labeled 'Secretion' points from the collecting duct into the surrounding space.</p>	
<b>Total</b>	<b>3</b>

SEE NEXT PAGE



Patients with kidney failure can be treated with dialysis; however, kidney transplants are more efficient.

- (d) Suggest **two** reasons against the use of kidney transplants. (2 marks)

Description	Mark
Any two of the following. Must give adequate reasoning for disadvantage.	
<ul style="list-style-type: none"> <li>Surgical risks such as infection/bleeding/damage to other organs</li> </ul>	1-2
<ul style="list-style-type: none"> <li>Immunosuppressants increasing risk of catching disease/acne/weight gain etc.</li> </ul>	
<ul style="list-style-type: none"> <li>Rejection of the organ due to patient's immune system</li> </ul>	
<ul style="list-style-type: none"> <li>Any other acceptable answer</li> </ul>	
<b>Total</b>	<b>2</b>

- (e) Outline why lungs are also considered to be an excretory organ. (1 mark)

Description	Mark
Removes metabolic wastes/water and carbon dioxide	1
<b>Total</b>	<b>1</b>

## Question 34

(19 marks)

The Health Department of WA runs several initiatives to help increase the community's physical activity levels. One type of exercise that is often undertaken is weightlifting.

- (a) State **one** benefit of weightlifting on the body. (1 mark)

Description	Mark
Any one of the following	
<ul style="list-style-type: none"> <li>Provide stability to joints</li> <li>Improve bone health/density</li> <li>Increase muscle mass</li> <li>Decrease body fat</li> <li>Any other acceptable answer</li> </ul>	1
<b>Total</b>	<b>1</b>

- (b) During weightlifting sessions, people often feel a burning sensation in the muscle group they are working. Explain why this occurs. (5 marks)

Description	Mark
Anaerobic metabolism	1
Occurs in lack/absence of oxygen	1
Glycolysis occurs	1
Occurs in cytoplasm only	1
Lactic acid produced	1
<b>Total</b>	<b>5</b>

- (c) Explain why endurance athletes load up on carbohydrates prior to running marathons. (4 marks)

Description	Mark
Glycogen is stored in muscles	1
Used as a quick energy reserve	1
For release of ATP	1
Through aerobic respiration	1
<b>Total</b>	<b>4</b>

- (d) Describe why there is an increase in blood flow to the lungs during exercise. (3 marks)

Description	Mark
Any three of the following	
Compensate for increased breathing rate	1-3
Maintain concentration gradient	
In capillaries around the alveoli	
Increased heart rate	
<b>Total</b>	<b>3</b>

Poor breathing technique during exercise can result in fatigue and dizziness.

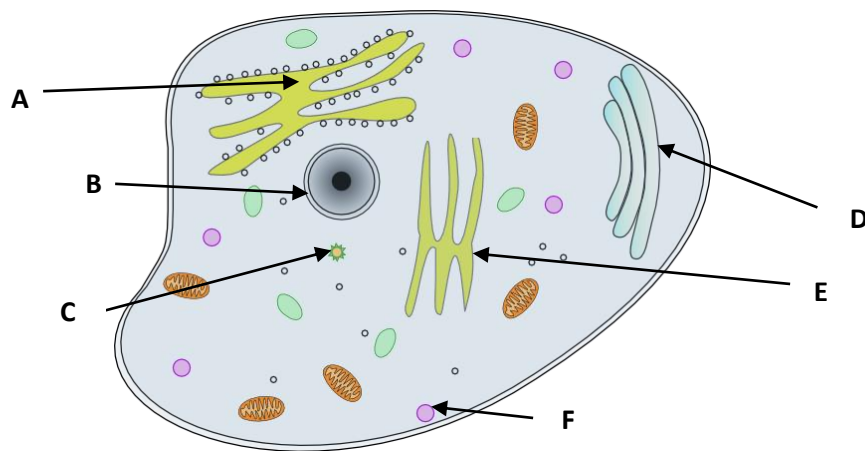
- (e) Explain why paradoxical breathing, when your stomach rises on exhale and sinks on inhale, is inefficient. (6 marks)

Description	Mark
Diaphragm moves up rather than down during inspiration	1
Lungs do not expand enough	1
Less oxygen can be inhaled	1
Diaphragm moves down rather than up during expiration	1
Lungs are not compressed	1
Less carbon dioxide can be exhaled	1
<b>Total</b>	<b>6</b>

## Question 35

(15 marks)

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



- (a) Identify the following organelles from the diagram above: (2 marks)

Description	Mark
C: Centriole	1
D: Golgi body/apparatus/network	1
<b>Total</b>	<b>2</b>

- (b) Describe how Organelles A and E differ in structure and function. (2 marks)

Description	Mark
Organelle A has ribosomes, whilst organelle E does not	1
Protein synthesis can occur on organelle A, but not on organelle E / Organelle is involved in lipid synthesis	1
<b>Total</b>	<b>2</b>

- (c) Organelle F entered the cell via a process known as endocytosis. Describe this process. (5 marks)

Description	Mark
Any five of the following	
Vesicular transport	1-5
Active process / requires energy/ATP	
Cell membrane folds around material until enclosed	
Vesicle is formed and is pinched off	
Pinocytosis takes liquids in	
Phagocytosis takes solids in	
<b>Total</b>	<b>5</b>

- (d) Describe how the structure of the cell membrane allows for transport of materials via exocytosis. (2 marks)

Description	Mark
Vesicles are made of the same phospholipid bilayer as cell membrane allowing for attachment	1
Membrane is fluid / contain cholesterol, so can change shape	1
<b>Total</b>	<b>2</b>

Erythrocytes (red blood cells) are of equal size in both humans and mice, although their body size differs considerably.

- (e) Explain why the size of an erythrocyte is the same in these two species. (4 marks)

Description	Mark
large surface area to volume ratio	1
allows for faster diffusion / if ratio was smaller, diffusion would occur slower	1
cells require efficient removal of waste AND nutrients to function	1
also affects movement of materials within the cell	1
<b>Total</b>	<b>4</b>

## Question 36

(17 marks)

Rigor mortis is the rigidity of the body after death, characterised by stiffening of the limbs. Chemical changes in the muscles cause a continual flood of calcium ions into the contractile units of the muscle fibres.

- (a) State the name given to the contractile unit of a muscle fibre. (1 mark)

Description	Mark
Sarcomere	1
<b>Total</b>	<b>1</b>

- (b) Explain why the influx of calcium ions causes rigor mortis to occur. (6 marks)

Description	Mark
Calcium binds to troponin	1
myosin head to bind to actin / crossbridge forms between myosin and actin	1
Myosin pulls (power stroke) actin towards centre of sarcomere	1
Sarcomere shortens/contracts	1
No ATP (due to no biochemical processes) means crossbridge doesn't detach	1
Myosin remains bound to actin / muscle remains contracted/stiff /rigid	1
<b>Total</b>	<b>6</b>

The contraction of skeletal muscles on joints results in movement of the body, such as arms and legs.

- (c) Describe how the actions of muscles result in movement and provide a specific example to demonstrate your answer. (5 marks)

Description	Mark
Antagonistic muscle action	1
Working muscle is prime mover and/or agonist	1
Relaxing muscle is antagonist	1
Stabiliser/fixator stabilises the origin of the agonist and joint	1
Appropriate example given, i.e. bicep (agonist), tricep (antagonist) and rotator cuff (stabiliser)	1
<b>Total</b>	<b>5</b>

During physical activity, heart rate increases. Although a single organ, the heart functions as a double pump.

(d) Describe how the circulatory system distributes blood around the body.

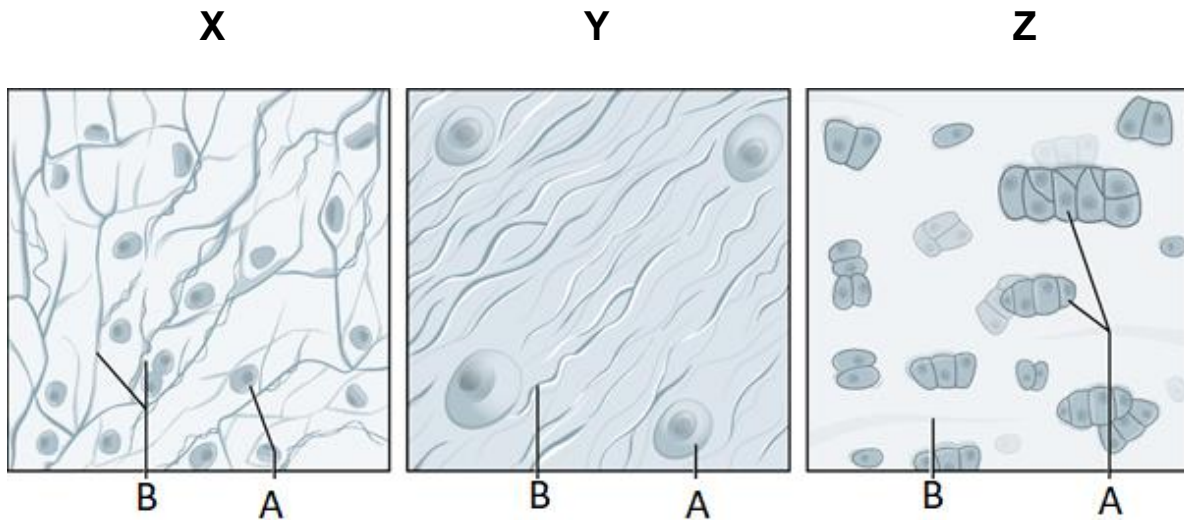
(5 marks)

Description	Mark
Pulmonary circuit	1-5
Pumps blood to lungs to be oxygenated	
Systemic circuit	
Pumps oxygenated blood to body	
Blood moves through arteries to capillaries and then veins	
Valves within veins ensure unidirectional flow	
High pressure in arteries ensure unidirectional flow	5
Total	

## Question 37

(12 marks)

The figures below show the histological picture of the three different types of cartilage and their components.



(a) Identify the type of cartilage represented by figure X and justify your reason.

(2 marks)

Description	Mark
Elastic cartilage	1
Cells (A) are closer together / less intracellular space	1
Some elastic / collagen fibres (B) present	
<b>Total</b>	<b>2</b>

(b) State **one** location where the cartilage represented by figure Z would be found.

(1 mark)

Description	Mark
Spine / Menisci / Pubic symphysis / TMJ etc.	1
<b>Total</b>	<b>1</b>

Ossification is the conversion of cartilage to bone.

(c) Identify **two** aspects of bone that are not found in cartilage.

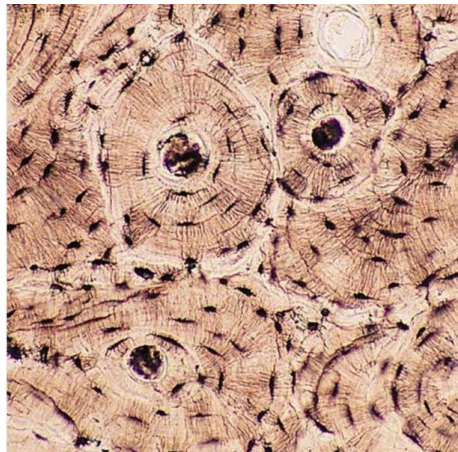
(2 marks)

Description	Mark
<b>Any two of the following for 1 mark each:</b>	
<ul style="list-style-type: none"> <li>Calcium</li> <li>Blood vessels</li> <li>Nerves</li> </ul>	1-2
<b>Total</b>	
<b>Total</b>	<b>2</b>

SEE NEXT PAGE



The diagram below is a cross section of bone.



- (d) (i) Identify the type of bone that this sample would have been taken from. (1 mark)

Description	Mark
Compact / cortical bone	1
<b>Total</b>	<b>1</b>

- (ii) State the name given to the functional unit of this bone. (1 mark)

Description	Mark
Osteon / haversian system	1
<b>Total</b>	<b>1</b>

Joints are found where two or more bones meet and are often associated with movement.

- (e) Describe how age and ongoing damage to a joint can result in restricted movement. (5 marks)

Description	Mark
Any five of the following	
Osteoarthritis	1-5
Cartilage is degraded	
Exposed bone rubs on bone	
Bony spurs/growths develop	
Joint cavity space is reduced	
Pain limits movement	
<b>Total</b>	<b>5</b>

**End of Section Two**

**SEE NEXT PAGE**

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

Section Three consists of **four** 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.

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: 50 minutes.

**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 27 - 31. When you have answered your first question, turn to page 32 and indicate on that page the second question you will answer.

☐
**Question 38****(20 marks)**

The requirements of cells differ both between cell types and over time. Biochemical processes occurring in the cell during these times are controlled by the presence of enzymes.

- (a) Briefly describe the role of an enzyme and explain how an enzyme's function can be altered due to the presence of other molecules. (12 marks)

Description	Mark
<b>Role of enzyme</b>	
Biological catalyst	1-4
Lowers the activation energies of chemical reactions	
Not consumed in the reaction / reusable	
Increases the rate of reaction / speed of the biochemical process	
Enzymes are specific for a substrate/active site of the enzyme only matches the substrate	
Lock and key model / Induced fit model	
<b>Factors affecting function</b>	
Inhibitors	
Molecule binds to the enzyme's active site to stop it from binding to the substrate	
Molecule binds to the enzyme at an allosteric site (location other than the active site) changing the enzyme's shape	

**SEE NEXT PAGE**

Co-enzymes	1-8
Organic molecules	
Co-factors	
Inorganic ions/molecules	
Both bind to enzyme to change its shape to allow function	
Concentration of substrates	
Increases reaction rate due to increased collisions	
until all enzyme active sites are used up	12
<b>Total</b>	

The nutritional requirements for cells are obtained through the digestive system. The supply of these nutrients is facilitated by enzymes produced in specialised cells and released into the digestive organs.

- (b) State the specialised cell which produces gastric enzymes and describe the role of the gastric enzymes to supply soluble nutrients. (8 marks)

Description	Mark
Chief cells	1
Pepsinogen (inactive)	1-7
Activated by acidic pH / hydrochloric acid	
Becomes pepsin	
Breaks down proteins into amino acids	
Gastric lipase	
Not dependent on acid / optimum pH is 3-6	
Digests fats	
Removes fatty acid from triglyceride	8
Both absorbed in the small intestine	
<b>Total</b>	<b>8</b>



## Question 39

(20 marks)

The human body is composed of tissues, which are groups of cells that perform specific functions.

(a) Identify and compare the types of tissues that make up the muscular system.

(8 marks)

Description				Mark
Skeletal, Cardiac and Smooth muscle tissue identified				1
Any 7 of the following rows for 1 mark each:				
Type	Skeletal	Cardiac	Smooth	1-7
Function	Movement of bone	Heart beating	Movement of internal organs	
Striation	Striated	Striated	Non-striated	
Nucleated	Multinucleated	Uninucleated	Uninucleated	
Shape	Long cylindrical	Spindle	Short cylindrical	
Fibres	Bundled/ unbranched	Sheets	Networks/ branched	
Location	Limbs	Heart	Iris/ureters/ bronchi	
Control	Voluntary	Involuntary	Involuntary	
Fatigue	Yes	No	No	
Contraction	Quick	Quick	Slow	
Intercalated discs	Not present	Present	Not present	
*Other appropriate comparisons accepted.				
Total				8

- (b) Describe the lymphatic system and explain how it works in conjunction with the circulatory system, describing what would occur if the lymphatic system became blocked in the lower leg of a patient. (12 marks)

Description	Mark
Open system	1-10
One-way valves	
Consists of vessels, tissues and organs	
Fluid leaks out of blood vessels	
Pools in between cells and tissues	
Collected by lymph vessels	
Passes through lymph nodes	
Pathogens are filtered from blood	
Returns tissue fluid to circulatory system	
Lymph moved by muscle contraction	
Lymphatic system produces WBC/leukocytes	
Circulatory system moves immune cells around body	
Interstitial fluid would not be removed leading to	1
Swelling / oedema / lymphedema in the lower leg	1
<b>Total</b>	<b>12</b>

## 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)**

Active processes are involved in the formation of urine as it passes through the nephron allowing the body to regulate chemical composition of body fluids.

- (a) State what substances are actively removed and added to the filtrate, giving reason for their movement. (8 marks)

Description	Mark
<b>Two of the following for 1 mark each (selective reabsorption):</b>	<b>1-4</b>
<ul style="list-style-type: none"> <li>• Glucose</li> <li>• Amino acids</li> <li>• Vit C</li> <li>• Potassium ions</li> <li>• Salts (<math>\text{Na}^+</math>, <math>\text{Cl}^-</math>)</li> </ul>	
<b>Two of the following for 1 mark each (tubular secretion):</b>	
<ul style="list-style-type: none"> <li>• <math>\text{H}^+</math> ions</li> <li>• Electrolytes i.e. <math>\text{K}^+</math>, <math>\text{HPO}_4^{2-}</math>, <math>\text{SO}_4^-</math></li> <li>• <math>\text{NH}_3</math> / <math>\text{NH}_4^+</math></li> <li>• Penicillin</li> <li>• Histamine</li> </ul>	
Glucose / Amino acids / Vit C are reabsorbed for their nutritional properties.	<b>1</b>
Ions reabsorbed to increase blood osmolarity / assist in osmosis / move water back into blood from filtrate	<b>1</b>
$\text{H}^+$ ions for blood pH levels	<b>1-2</b>
$\text{NH}_3/\text{NH}_4^+$ / Penicillin / Histamine due to toxicity	
Potassium ions due to excess in body	
<b>Total</b>	<b>8</b>

Joints are constructed to allow for differing types and degrees of movement.

- (b) Discuss the similarities between the knee and hip joints and identify how the structure of these two joints allows for the variation in movement seen at the joints.  
(12 marks)

Description	Mark
<b>Similarities:</b>	
both freely moveable	1-4
both synovial joints	
rely on muscles, ligaments and tendons for stability	
both involve movement of the leg / required for walking	
largest joints in the body	
<b>Hip:</b>	
located between femur and pelvis	1-4
ball and socket joint	
ball-like structure in cup-like depression	
range of movement / multiaxial	
flexion, extension, abduction, adduction and rotation	
<b>Knee:</b>	
located between femur and tibia	1-4
hinge joint	
convex surface into concave surface	
movement in one direction / uniaxial	
flexion and extension	
<b>Total</b>	<b>12</b>



## Question 41

(20 marks)

(a) Explain how oxygen is exchanged in the lungs and transported throughout the body.

(10 marks)

Description	Mark
<b>Oxygen exchange:</b>	
Diffusion	1
Occurs within alveoli	1-6
1 cell thick / simple squamous epithelium	
short distance for oxygen to travel/diffuse	
goes with concentration (diffusion) gradient / moves from higher to lower concentrations	
Doesn't require ATP / energy	
Become evenly spread over the space available	
Dependent on air flow into the lungs / ventilation	
And blood flow in the capillaries / perfusion	
Requires moist environment for gases to dissolve	
<b>Transportation:</b>	
small amount of oxygen dissolved in plasma	1-3
majority of oxygen attached to haemoglobin / oxyhaemoglobin	
carried within RBCs/erythrocytes	
heart pumps blood around the body	
<b>Total</b>	<b>10</b>



ABO blood groups were discovered over 100 years ago. Prior to this, all blood was thought to be the same and the outcomes of blood transfusions were often tragic. ABO typing is now used to determine a person's blood group prior to surgeries that may require blood transfusions.

- (b) Describe how blood groups are determined and explain the importance of having this completed prior to a blood transfusion. (10 marks)

Description	Mark
(four) blood groups are A, B, AB and O	1-8
Determined by antigens on the RBC/erythrocyte	
Opposite antibodies are found in the plasma	
Group A has A antigens and B antibodies	
Group B has B antigens and A antibodies	
Group AB has A & B antigens and no antibodies	
Group O has no antigens and A & B antibodies	
ABO testing determines blood group	
Blood samples are mixed with antibodies A and B	
Blood groups are determined by genes	1-2
If wrong blood is transfused, immune system reacts to new RBCs	
New RBCs agglutinate/coagulate/clump together	
Can result in organ failure/death	10
<b>Total</b>	

**End of Questions**

## ACKNOWLEDGEMENTS

- Question 5** BC Campus: Rice University. (N.D.). Anatomy and Physiology. Fluid Compartments in the Human Body [Image]. Retrieved 27<sup>th</sup> November, 2019, from:  
<https://opentextbc.ca/anatomyandphysiology/chapter/26-1-body-fluids-and-fluid-compartments/>
- Question 22** Patrick J. Lynch. (2006). Heart normal short axis [Image]. Retrieved 28<sup>th</sup> October, 2019, from:  
[https://commons.wikimedia.org/wiki/File:Heart\\_normal\\_short\\_axis\\_section.jpg](https://commons.wikimedia.org/wiki/File:Heart_normal_short_axis_section.jpg)
- Question 23** OpenStax College. (2013). Anatomy and Physiology, Connexions Website. *Age and Bone Mass* [Graph]. Retrieved 15<sup>th</sup> December, 2019, from:  
[https://commons.wikimedia.org/wiki/File:615\\_Age\\_and\\_Bone\\_Mass.jpg](https://commons.wikimedia.org/wiki/File:615_Age_and_Bone_Mass.jpg)
- Question 24** Fran Rogers. (2007). Skeletal Muscle [Image]. Retrieved 28<sup>th</sup> October, 2019, from:  
[https://commons.wikimedia.org/wiki/File:Skeletal\\_muscle.png](https://commons.wikimedia.org/wiki/File:Skeletal_muscle.png)
- Question 25** Fran Rogers. (2007). Skeletal Muscle [Image]. Retrieved 28<sup>th</sup> October, 2019, from:  
[https://commons.wikimedia.org/wiki/File:Skeletal\\_muscle.png](https://commons.wikimedia.org/wiki/File:Skeletal_muscle.png)
- Question 33** CKRobinson. (2007). Unlabelled diagram of a mammalian nephron [Image]. Retrieved 2<sup>nd</sup> October, 2019, from:  
<https://commons.wikimedia.org/w/index.php?curid=45678885>
- Question 35** Shared by OCAL. (2010). Animal Cell Clip Art [Image]. Retrieved 16<sup>th</sup> October, 2019, from: <http://www.clker.com/clipart-animal-cell.html>
- Question 37** OpenStax College. (2013). Anatomy and Physiology, Connexions Website. *Types of Cartilage*. Retrieved 18<sup>th</sup> December, 2019, from:  
[https://commons.wikimedia.org/wiki/File:412\\_Types\\_of\\_Cartilage-new.jpg](https://commons.wikimedia.org/wiki/File:412_Types_of_Cartilage-new.jpg)
- Question 37** Darshani Kansara. (2014). Bone Connective Tissue [Image]. Retrieved 29<sup>th</sup> October, 2019, from:  
[https://commons.wikimedia.org/wiki/File:Bone\\_connective\\_tissue.jpg](https://commons.wikimedia.org/wiki/File:Bone_connective_tissue.jpg)