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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: 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	All	40	30	30
Section Two: Short answers	7	All	90	100	50
Section Three: Extended answers	3	2	50	40	20
Total					100

Instructions to candidates

1. The rules for the conduct of the Western Australian Certificate of Education ATAR course examinations are detailed in the *Year 12 Information Handbook 2017*. 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. 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 three questions. You must answer two questions. Identify the question you are answering.

3. 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.
4. Additional working space pages at the end of this Question/Answer booklet are for planning or continuing an answer. If you use these pages, indicate at the original answer, the page number it is planned/continued on and write the question number being planned/continued on the additional working space 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. If you make a mistake, place a cross through that square, do not erase or use correction fluid, and shade your new answer. 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.

Use the following data, which shows the list of resting pulse rates of ten Year 11 Human Biology class members, to answer the next three questions.

76	84	89	71	69	73	97	82	23	88
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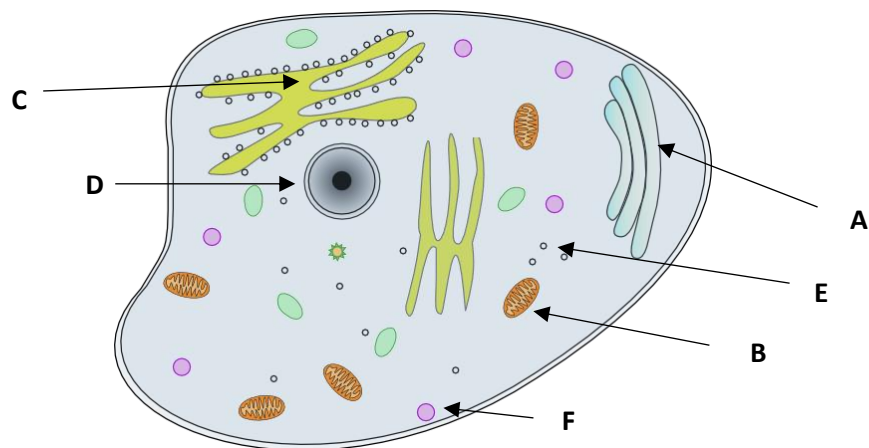
- The mean pulse rate for the class is calculated to be
 - 76
 - 75**
 - 23
 - 73
- The 9th student recorded a pulse rate of 23. What is the name given to such results that appear to be 'abnormal'?
 - Averages
 - Mistakes
 - Outliers**
 - Trials
- Which of the following is the best way of presenting the data of the resting pulse rates?
 - Line graph
 - Bar graph**
 - Histogram
 - Pie graph
- Cells are small because as the size of a cell increases, the
 - volume and surface area decrease.
 - surface area and volume increase at the same rate.
 - volume increases at a greater rate than the surface area.**
 - surface area increases at a greater rate than volume.

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5. Cells of similar structure and function form
- (a) specialised cells.
 - (b) **tissues.**
 - (c) organs.
 - (d) systems.
6. Osmosis is best described as
- (a) the movement of both water and solutes from an area of low solute concentration to high concentration.
 - (b) the movement of solutes from areas of high solute concentration to low solute concentration.
 - (c) diffusion of water along the concentration gradient.
 - (d) **movement of water from an area of low solute concentration to high solute concentration.**
7. A student made a wet mount of a letter that she observed under the microscope on low power as "d". What letter did she make the slide of?
- a) b
 - b) p**
 - c) q
 - d) d
8. A microscope with a 10x ocular lens and 10x objective lens has a field of view of 2mm. What will the field of view be with a 4x objective lens?
- (a) 0.5mm
 - (b) 2.5mm
 - (c) **5mm**
 - (d) 6mm

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Use the following diagram to answer the next three questions.



9. Which letter indicates the site where biosynthesis, processing and transport of proteins can occur?

- (a) A
- (b) B
- (c) **C**
- (d) D

10. What are the outputs of organelle B when oxygen is present?

- (a) Carbon dioxide and nutrients
- (b) Sugar and water
- (c) Nutrients and energy
- (d) **Water and carbon dioxide**

11. The process that occurs when organelle F fuses with the cell membrane and expels waste material is named

- (a) **exocytosis.**
- (b) pinocytosis.
- (c) endocytosis
- (d) phagocytosis.

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Use the information in the table below to answer the next two questions.

A number of cells were obtained and placed in a nutrient medium to allow growth. The table below shows the composition and concentration of the cell's cytoplasm and nutrient solution.

Substance	Cytoplasm (g/L)	Nutrient Solution (g/L)
Chloride	32	15
Potassium	27	3
Sodium	42	44

12. The nutrient solution is

- (a) **hypotonic.**
- (b) isotonic.
- (c) exotonic.
- (d) hypertonic.

13. The movement of water (osmosis) would be

- (a) from the cell to the nutrient solution.
- (b) **from the nutrient solution to the cell.**
- (c) non-existent.
- (d) from the cell to the cytoplasm.

14. Which of the following is an example of a catabolic reaction?

- (a) Protein synthesis
- (b) **Digestion of sugars**
- (c) Glycogen formation
- (d) DNA replication

15. The correct pathway of air into the lungs is

- (a) **Nose, pharynx, larynx, trachea, bronchi, bronchioles, alveoli.**
- (b) Nose, larynx, pharynx, trachea, bronchi, bronchioles, alveoli.
- (c) Nose, pharynx, larynx, trachea, bronchioles, bronchi, alveoli.
- (d) Nose, larynx, pharynx, trachea, bronchioles, bronchi, alveoli.

16. What sign would a doctor find in a blood test if someone was suffering from an infection such as tetanus?

- (a) **Elevated white blood cell levels**
- (b) Pain and excessive drainage of fluid from the lungs
- (c) Increased heart and respiratory rate
- (d) Increased levels of erythrocytes

Use the table below that shows the stages and duration of an individual's cardiac cycle to answer the next two questions.

Stage	Duration (s)
Diastole	0.3
Atrial Systole	0.2
Ventricular Systole	0.3

17. The heart rate of the individual is

- (a) 52 beats per minute.
- (b) **75 beats per minute.**
- (c) 87 beats per minute.
- (d) 100 beats per minute.

18. If the individual's stroke volume is 70mL, what is their cardiac output?

- (a) 3640mL/min
- (b) **5250mL/min**
- (c) 6090mL/min
- (d) 7000mL/min

19. Early warning signs of anorexia nervosa include all of the following except

- (a) eating alone.
- (b) excessive interest in food and weight.
- (c) **rapid consumption of excessive quantities of food.**
- (d) weight loss.

20. Which of the following nutrients are not absorbed in the large intestine?

- (a) Water
- (b) Vitamin K
- (c) Vitamin B
- (d) **Protein**

21. The role of vitamins in the body includes all of the following except

- (a) co-enzymes.
- (b) **energy source.**
- (c) assist in absorption of calcium.
- (d) co-factors.

22. Each kidney is composed of around 1 million functional filtration units. What is the name given to these functional units?
- (a) Glomerulus
 - (b) Bowman's Capsule
 - (c) Renal Corpuscle
 - (d) **Nephrons**
23. The effect of a high-protein diet on the production of urine will:
- (a) **increasing the volume of urine.**
 - (b) decreasing the volume of urine.
 - (c) not changing the volume of urine.
 - (d) increasing the concentration of urine.
24. Which of the following is not included as part of the excretory system?
- (a) Lungs
 - (b) Kidney
 - (c) Liver
 - (d) **Rectum**
25. Ammonia is converted to urea for excretion in the urine because
- (a) ammonia is too large to enter the kidneys.
 - (b) urea is too large to remain in the body.
 - (c) **ammonia is more toxic than urea.**
 - (d) urea is more toxic than ammonia.

End of Section One

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Section Two: Short answer**50% (100 Marks)**

This section has **seven (7)** questions. Answer **all** questions. Write your answers in the spaces provided.

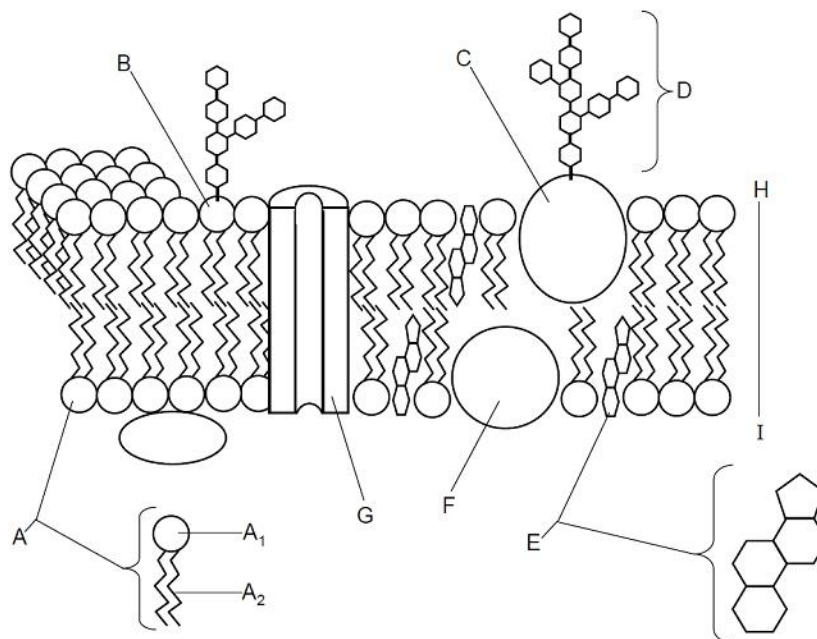
Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

Suggested working time: 90 minutes.

Question 31**(11 marks)**

Each cell is surrounded by a cell membrane that separates the cell contents from the external environment. Refer to the diagram below to answer the following question.



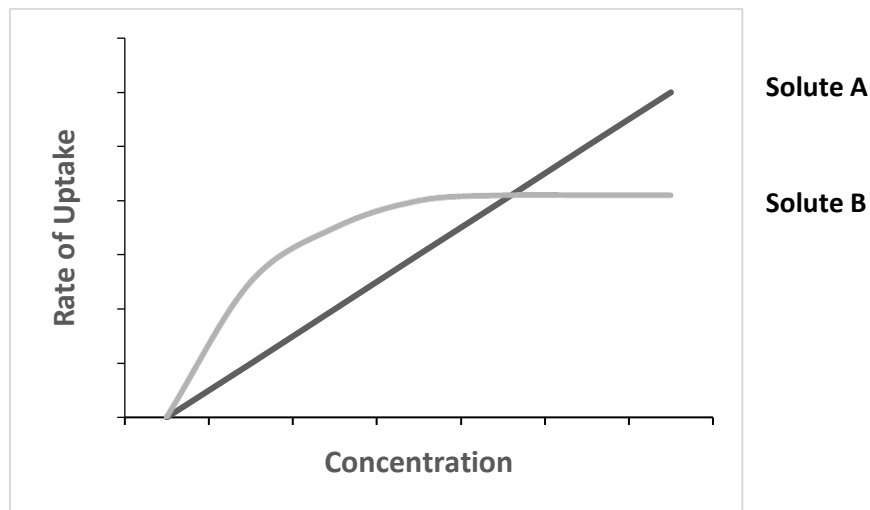
(a) Name the molecules represented by the following structures.

(3 marks)

- A₁ **Hydrophilic Head / Phosphate Head**
 A₂ **Hydrophobic / Fatty Acid Tail**
 G **Protein Channel**

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The graph below shows the rate of uptake of two solutes.



(b) State which type of transport is represented by each solute and give an example of a material that moves by this method. (4 marks)

i. Solute A

Diffusion - Water / oxygen / carbon dioxide / alcohol / fatty acids / steroids / ions including sodium, potassium, calcium / lipids / soluble drugs

ii. Solute B

Facilitated Diffusion / Carrier Mediated – glucose / amino acids

(c) Explain the difference in the rate of uptake between the two solutes. Be sure to consider in your answer the physical and/or chemical nature of Solute A and Solute B in relation to their movement across the cell membrane. (4 marks)

Any four of the following for 1 mark each:

- **Smaller sized particles undergo diffusion quicker**
- **Larger sized particles require facilitation / diffuse slower**
- **Polar / hydrophilic particles require facilitation / diffuse slower**
- **Nonpolar / hydrophobic particles undergo diffusion quicker**
- **Lipid soluble particles undergo diffusion quicker**
- **Water soluble require facilitation / diffuse slower**

Question 32**(15 marks)**

The respiratory system allows for the exchange of gases between the internal and external environments.

- (a) Alveoli increase the surface area of the lungs to allow for diffusion. Name two other structural features of the lungs that assist in diffusion. (2 marks)

Any two of the following for 1 mark each:

- **Well supplied with blood / blood vessels (accept continuous blood flow)**
- **Thin membranes of capillary / alveolus (accept short diffusion pathway)**
- **Layer of moisture / positioned deep within the body to prevent evaporation**

Whilst exercising it is important the body receives adequate amounts of oxygen, otherwise fatigue may occur.

- (b) Explain the mechanics of breathing that allow the lungs to fill with air. (3 marks)

Any 3 of the following for 1 mark each:

- **Diaphragm / Intercostal muscles contract / flatten**
- **Lungs / Ribs are pulled upwards and outwards**
- **Volume of lungs / size of chest / thoracic cavity increases**
- **Pressure within lungs are reduced**
- **Air moves in to lungs**

- (c) Explain the process of oxygen and carbon dioxide diffusion between the alveolus and capillaries in the lung of a person at rest. (4 marks)

Any four of the following:

- **Diffusion requires differences in concentration gradient (1)**
- **Oxygen concentration is higher in alveolus (1)**
- **and therefore will move from alveolus to capillary (1)**
- **Carbon dioxide concentration is higher in capillary (1)**
- **and therefore will move from capillary to alveolus (1)**

Aerobic respiration is a metabolic process that occurs in many small steps controlled by specific enzymes.

- (d) In aerobic respiration, how many ATP molecules are produced from one molecule of glucose. (1 mark)

36-38 ATP

- (e) State the location/s in the cell where aerobic respiration occurs. (2 marks)

Cytoplasm and Mitochondria

- (f) Many enzymes are involved in the different steps of aerobic respiration. Explain the specificity of enzymes to their substrates. (3 marks)

Lock and key theory (1)

Enzyme has a specific active site (1) that is complementary to a specific substrate (1)

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Question 33**(10 marks)**

An accident occurred in which a man severed a main artery in his leg and was taken to hospital.

- (a) In the ambulance, the man's blood pressure was monitored. Paramedics observed that it was falling. Give two ways that the body can deliberately lower blood pressure under both normal and trauma conditions. (2 marks)

Any two of the following:

- **Vasodilation (1)**
- **Lowering heart rate (1)**
- **Reducing stroke volume (1)**

Once cut, the body's external defence systems are open to micro-organisms. As micro-organisms may cause disease, these must be destroyed and removed.

- (b) State the name of the cells specifically responsible for the destruction and removal of microorganisms. (1 mark)

Phagocytes / Macrophages

- (c) Explain why lymph nodes of the immediate areas surrounding the cut may swell and feel tender and sore. (2 marks)

Lymph tissue contains lymphocytes/macrophages/phagocytes (1)
Increased number of these cells causes swelling/tenderness (1)

The man has blood type O and required a blood transfusion.

- (d) Explain why the man can only receive blood from an O-type donor. (3 marks)

RBC's of O-type do not have antigens present on cell (1)
Plasma of O-type has antibodies for both A and B antigens (1)
If RBC/blood with A / B / AB antigens is present, O-type plasma antibodies will destroy the donated blood (1)

Often accidents, and other scary incidents, can result in increased blood pressure. Long term high blood pressure, or hypertension, is often associated with swollen ankles due to tissue fluid build-up.

- (e) Explain how high blood pressure can cause swelling in a localised area. (2 marks)

High blood pressure / hypertension forces more fluid out of the capillaries and into the tissue (1). The lymph vessels / lymphatic system cannot reabsorb the excess fluid, and the tissue swells (1)

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Question 34**(13 marks)**

Once ingested, food passes through the alimentary canal and is digested.

- (a) Explain how the structure of the ileum, the third section of the small intestine, is well adapted to absorb nutrients. (4 marks)

**Long / 6m / large surface area / inner lining is folded
Villi / finger-like projections are present (1)
Microvilli on cells are present (1)
Thin membrane for easier diffusion (1)**

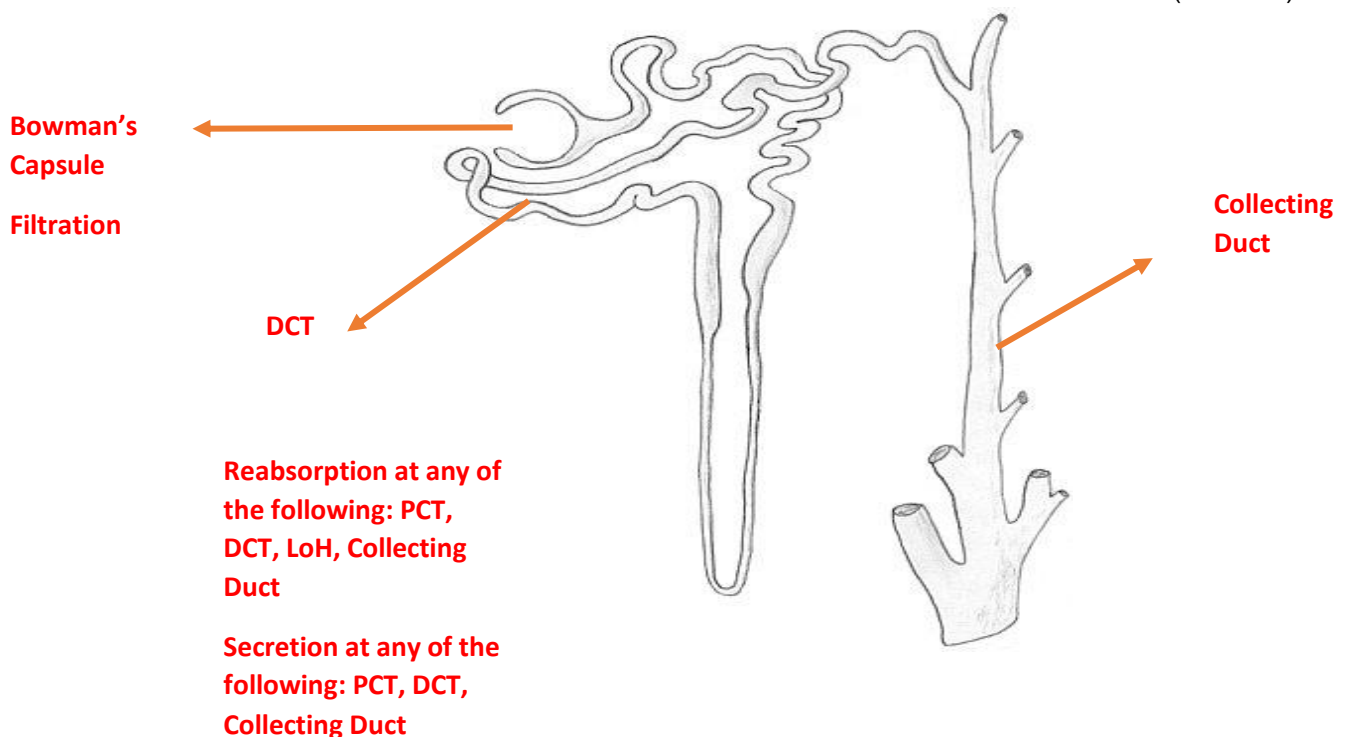
Once absorbed, these nutrients are further broken down within the body.

- (b) State the name given to the breakdown of proteins. (1 mark)

Deamination

Proteins, and their substrates, can be removed from the body via the kidney.

- (c) On the diagram below:
i. Label the Bowman's capsule, distal convoluted tubule and collecting duct
ii. Identify 1 area of filtration, 1 area of secretion and 1 area of reabsorption. (6 marks)



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Not all wastes are removed from the body in this way.

- d) Describe the difference between elimination and excretion of wastes. (2 marks)

Excretion is the removal of metabolic wastes from the body (1)

Elimination is the removal of indigestible foods / defecation (1)

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Question 36**(20 marks)**

Hydrogen peroxide (H_2O_2) is an unstable compound, decomposing to water and oxygen. Under normal conditions, the decomposition occurs very slowly. When yeast, which contains the enzyme catalase, is added, the reaction occurs faster. The table below shows the data collected during the experiment.

Temperature ($^{\circ}\text{C}$)	Volume of Gas Collected (cm^3)			
	Trial 1	Trial 2	Trial 3	Average
20	8	8	8	8
30	38	41	37	39
40	49	54	57	53
50	35	31	34	33
60	12	11	12	12

(a) Calculate the average volume of gas collected for each temperature. (5 marks)

(b) State why multiple trials of the experiment are undertaken. (1 mark)

Improves the reliability of the experiment

(c) Identify the following variables:

i. Independent variable (1 mark)

Temperature in $^{\circ}\text{C}$ (unit must be included)

ii. Dependent variable (1 mark)

Volume of Gas Produced in cm^3 (unit must be included)

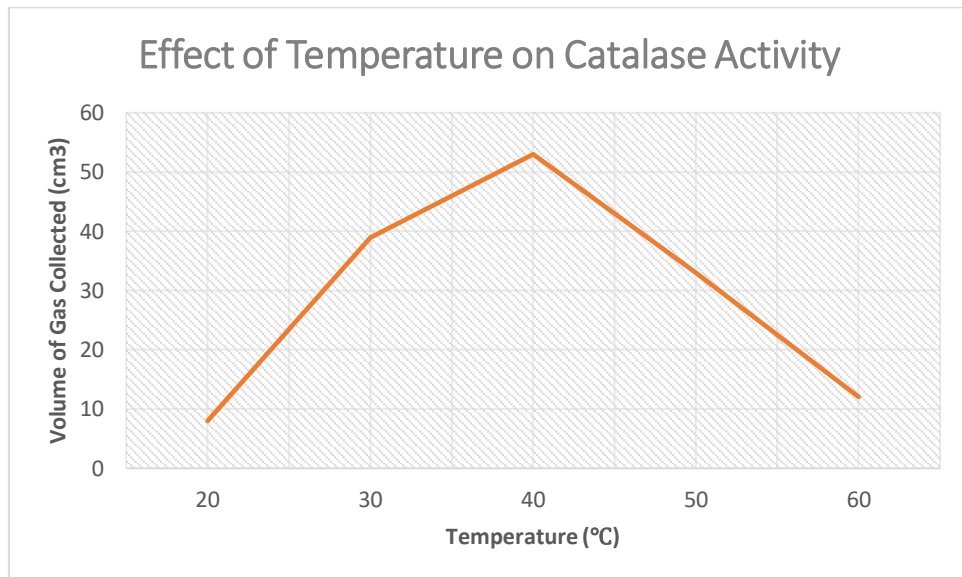
iii. Two controlled variables (2 marks)

Any two of the following or other appropriate variables:

- **Concentration of hydrogen peroxide**
- **Time allowed for reaction to occur**
- **Mass of yeast added**
- **Volume of hydrogen peroxide**

- (d) On the grid paper provided, construct a graph that can be used to represent the data. (5 marks)

If you wish to make a second attempt at this graph, extra grid paper can be found at the end of the examination booklet. Ensure you indicate this clearly.



One mark for the following:

- **Appropriate title stating independent and dependent variables**
- **Correctly labels axes with names**
- **Labels axes with units**
- **Uses correct type of graph**
- **Plots data correctly**

(e) State the optimal temperature for catalase activity.

(1 mark)

40°C

(f) Describe the evidence that suggests that (e) is the optimum temperature for catalase activity.

(2 marks)

Most product is being formed at 40°C (1)
Less product is being formed after 40°C (1)

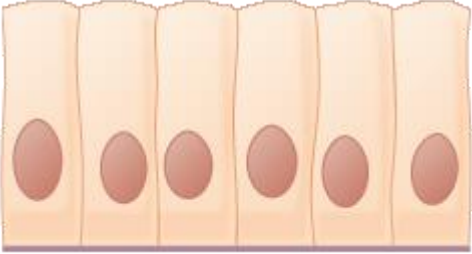
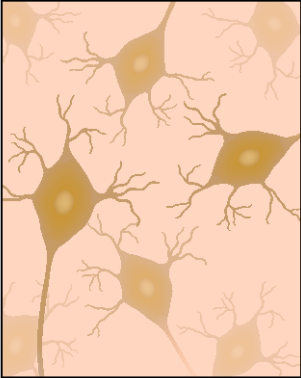
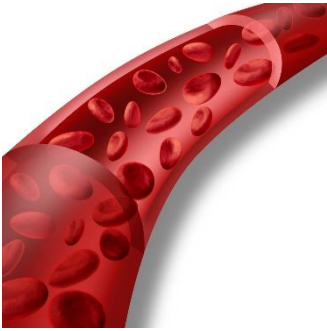
(g) Describe what occurs to catalase after the optimum temperature is reached.

(2 marks)

Denatured (1)
Alters the active site (1)

Question 37**(6 marks)**

The various tissues of the human body can be categorised into four basic tissue types. In the table below, identify the tissue type and state the function of the tissue.

	Tissue Type	Function
	Epithelial	Covers / lines internal and external surfaces of the body
	Nervous Tissue	Receives and transmits messages/impulses around the body
	Connective Tissue	Binds and supports other tissues

End of Section Two**SEE NEXT PAGE**

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

This section contains **three (3)** questions. You must answer **two (2)** questions. Make sure you clearly indicate which question you are answering and write your answers in the space provided.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- **Planning:** If you use the spare pages for planning, indicate this clearly at the top of the page.
- **Continuing an answer:** If you need to use more space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Write the number of the question(s) that you are continuing to answer at the top of the additional space page.

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.

Question 38**(20 marks)**

- (a) Describe how the mouth, stomach and small intestine allows for the processes of mechanical and chemical digestion to occur. (15 marks)

Any 15 of the following worth 1 mark each:

- **Action of the teeth / jaw break food into smaller pieces (1)**
- **Mixes with saliva / amylase that breaks down starch molecules (1)**
- **stomach lining produces gastric juice which contain enzymes (1)**
- **stomach has three muscle layers / have circular, longitudinal and oblique muscles (1)**
- **muscle constricts behind food and relaxes ahead (1)**
- **occurs in waves / peristalsis (1)**
- **stomach and intestine churns food in a variety of ways (1)**
- **pepsin / gastric protease breaks down proteins / amino acids (1)**
- **pepsin requires HCl acid to act (1)**
- **bile salts as chemical digestion to break up fats / emulsify fats (1)**
- **intestine releases intestinal juices (1)**
- **pancreas produces pancreatic juices (1)**
- **enzymes include:**
 1. **lipase that break down lipids/fats (1) → fatty acids + glycerol (1)**
 2. **amylase that break down starch (1) to glucose (1)**
 3. **protease that break down proteins (1) to peptides (1)**
 4. **peptidases that break down peptides (1) to amino acids (1)**
 5. **nucleases that break down RNA/DNA (1)**

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Once broken down, the nutrient materials are absorbed through the membranes of the cells lining the intestine.

- (b) Compare and contrast facilitated diffusion and active transport. (5 marks)

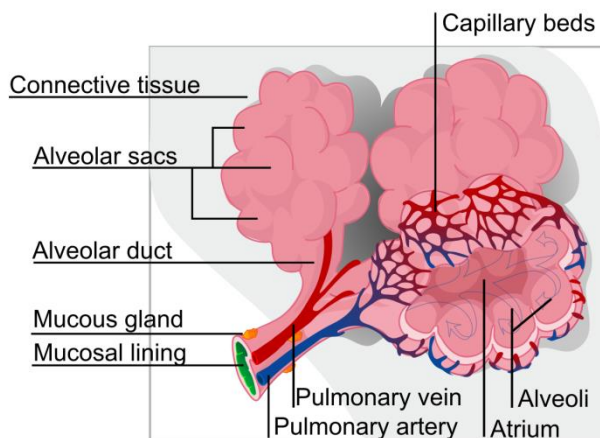
Both involve binding of a substrate to a carrier protein (1)
Facilitated diffusion is passive (1), with solutes moving down their concentration gradients (1).
Active transport requires ATP / energy (1), and moves solutes against their concentration gradient (1).

Question 39

(20 marks)

The excretory system is comprised of the skin, the respiratory system and the urinary system. It is linked by the circulatory system.

- (a) Use a labelled diagram to explain the features of the alveolus that make them suited to their gas exchange function. (10 marks)



1 mark for a matching structure drawn and 1 mark for the label of:

- **Many alveoli**
- **One cell thick walls**
- **Surrounding capillary bed**
- **Moist lining**
- **Large surface area**

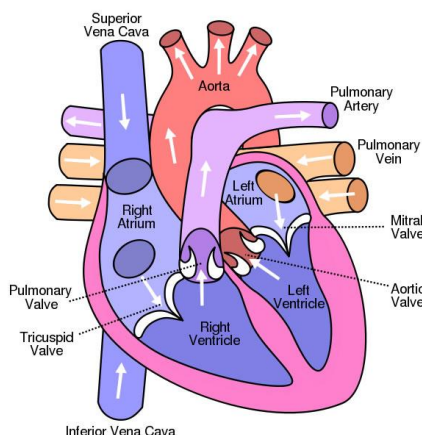
- (b) Compare and contrast the structure and function of veins and arteries. (10 marks)

Any 5 PAIRS of the following for 2 marks per pair

	Arteries	Veins
Blood carried	Away from heart	To heart
Valves	Absent	Present
Thickness of tunica media	Thick	Thin
Size of lumen	Small	Large
Ability to contract	Yes	No

Question 40**(20 marks)**

- (a) Draw and label the major structures of the heart, identifying the pathway of blood flow. (8 marks)



7 of the following structures MUST be included

- Right atrium (1)
- Left atrium (1)
- Aorta (1)
- Pulmonary artery (1)
- Right ventricle (1)
- Left ventricle (1)
- Vena Cava (1)
- Pulmonary vein (1)

AND the correct pathway of blood (1)

- (b) For efficient metabolism, cells require nutrients such as carbohydrates, proteins and lipids. Describe the structure and function of these three nutrients.

(12 marks)

2 marks for structure, 2 marks for function from each nutrient. Total 4 marks per nutrient.

	Structure	Function
Carbohydrate	Contain CHO (1) Structural units are monosaccharides, disaccharides and polysaccharides (1)	Main energy source (1) Excess stored as glycogen or converted to fat (1)
Proteins	Contain CHON (1) and sometimes S and P. Amino acids are the basic structural unit (1)	Functions include catalytic / regulatory / movement / immunological / recognition / structural / transport (1)
Lipids	Contain CH and small amount of O (1) Made up of glycerol and fatty acids (1) Can be saturated, unsaturated and trans fats (1) Can be high or low density (1)	Energy reserve (1) Cell membrane / phospholipid (1) Cholesterol (1) Steroid hormone (1)

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