



# HUMAN BIOLOGY

## Unit 1

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

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

### Time allowed for this paper

Reading time before commencing work: ten minutes  
Working time for the paper: two and a half 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.



**Question 40****(20 marks)**

- (a) Draw and label the major structures of the heart, identifying the pathway of blood flow. (8 marks)
- (b) For efficient metabolism, cells require nutrients such as carbohydrates, proteins and lipids. Describe the structure and function of these three nutrients. (12 marks)

**End of questions.****Section One: Multiple-choice****(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.

- Objectivity is a very important quality for a scientist. Which of the following best describes the difference between reliability and validity?
  - An experiment is valid if it tests what it is supposed to, whilst reliability is the extent to which an experiment produces the same result each time.
  - An experiment is reliable if it tests what it is supposed to, whilst validity is the extent to which an experiment produces the same result each time.
  - Validity can be improved by performing the experiment on a large number of subjects at the same time, whilst reliability can be improved by repeating the experiment with a new set of equipment.
  - Reliability is dependent on the number of uncontrolled variables, whilst validity is only dependent on the experimental variables.
- 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.
- Cells with similar structure and function form
  - specialised cells.
  - tissues.
  - organs.
  - systems.

4. 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.

5. 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

Use the following data, which shows the list of resting pulse rates of ten Year 11 Human Biology class members, to answer Questions 6 to 8.

|    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|
| 76 | 84 | 89 | 71 | 69 | 73 | 97 | 82 | 23 | 88 |
|----|----|----|----|----|----|----|----|----|----|

6. The mean pulse rate for the class is calculated to be
- (a) 76
  - (b) 75
  - (c) 23
  - (d) 73
7. The 9<sup>th</sup> student recorded a pulse rate of 23. What is the name given to such results that appear to be 'abnormal'?
- (a) Averages
  - (b) Mistakes
  - (c) Outliers
  - (d) Trials
8. Which of the following is the best way of presenting the data of the resting pulse rates?
- (a) Line graph
  - (b) Bar graph
  - (c) Histogram
  - (d) Pie graph

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### Section Three: Extended answer (20 Marks)

This section contains **three (3)** questions. You must answer **one (1)** question. 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.

Suggested working time: 25 minutes.

#### Question 38

(20 marks)

Every day we eat food and our bodies chemically breakdown these large molecules into smaller ones with the help of enzymes located in the alimentary canal.

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

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)

#### Question 39

(20 marks)

The muscular system is organised to produce movement, such as when breathing.

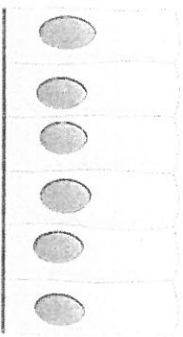

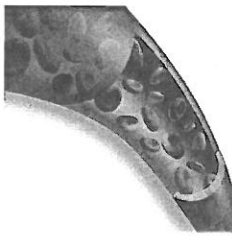
- (a) Explain the sliding filament theory in relation to the microscopic structure of skeletal muscle. (12 marks)
- (b) Lifestyle choices can compromise our body's function, such as breathing. Explain the effects that long-term smoking has on the respiratory system. (8 marks)

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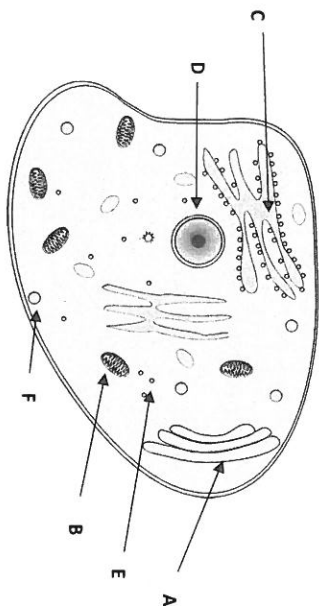
**Question 37**

(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 |
|---|-------------|----------|
|  |             |          |
|    |             |          |
|    |             |          |

Use the following diagram to answer Questions 9 to 11



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.

12. Osteoporosis is usually a disease associated with ageing. Which of the following would be the best treatment for this disease?

- (a) Running and drinking at least 3 litres of water a day
- (b) Walking and increasing the intake of calcium in the diet
- (c) Increased sun exposure and testosterone therapy
- (d) Limited exercise and increased phosphorous in the diet

**End of Section Two**

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13. Which of the following is an INCORRECT pairing of "structure" and "function"?

- (a) Large intestines - remove water from undigested food
- (b) Liver receives - nutrients from the small intestine via the blood
- (c) Small intestine - absorbs small food molecules
- (d) Gall bladder - produces digestive enzymes

Use the table below that shows the stages and duration of an individual's cardiac cycle to answer Question 14 and 15.

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

14. 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.

15. 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

16. 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

17. A high-protein diet will affect the production of urine by

- (a) increasing the volume of urine.
- (b) decreasing the volume of urine.
- (c) no change in the volume of urine.
- (d) increasing the concentration of urine.

(e) State the optimal temperature for the activity of catalase. (1 mark)

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(f) Describe the evidence that suggests that (e) is the optimum temperature for catalase activity. (2 marks)

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(g) Describe what occurs to catalase after the optimum temperature is reached. (2 marks)

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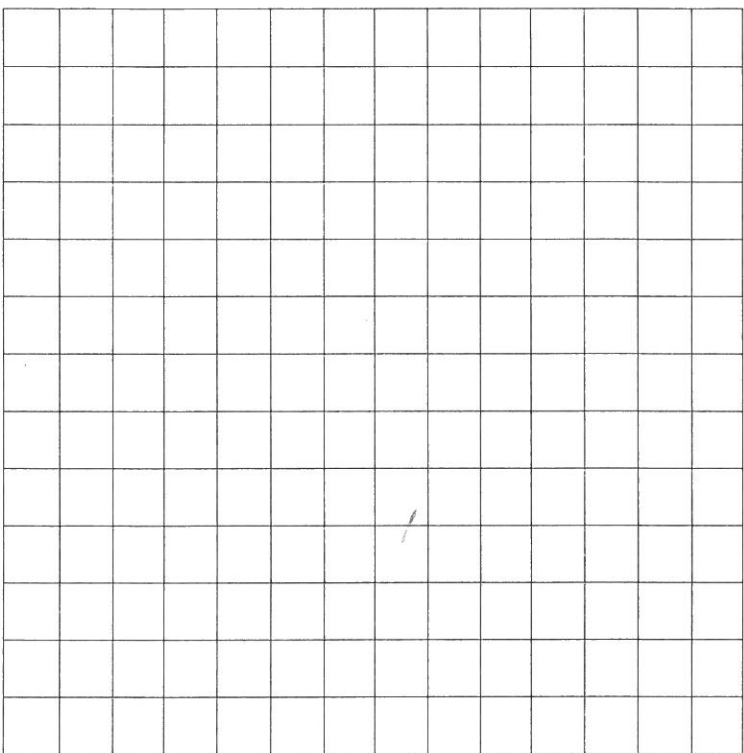
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(d) On the grid paper provided, construct a graph that can be used to represent the data. (5 marks)

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.



18. What sign would a doctor find in a blood test if someone was suffering an allergic reaction such as hay fever?

- (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

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

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

20. 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.

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

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

22. Which of the following muscle types are striated and voluntary?

- (a) Cardiac muscle
- (b) Skeletal muscle
- (c) Smooth muscle
- (d) Skeletal and smooth muscle

23. Bone and cartilage share many functions. Which of the following is a function of bone but not of cartilage?

- (a) Movement
- (b) Protection
- (c) Support
- (d) Mineral storage

24. 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.

25. Which of the following is not included as part of the excretory system?

- (a) Lungs
- (b) Kidney
- (c) Liver
- (d) Rectum

26. Which of the following bones is associated with the axial skeleton?

- (a) Skull
- (b) Pelvic Girdle
- (c) Phalanges
- (d) Fibula

27. 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.

Use the information in the table below to answer Question 28.

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                      |

28. 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.

**Question 36**

(20 marks)

Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) 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 (°C) | Volume of Gas Collected (cm <sup>3</sup> ) |         |         | Average |
|------------------|--|---------|---------|---------|
|                  | Trial 1                                    | Trial 2 | Trial 3 |         |
| 20               | 8  | 8       | 8       |         |
| 30               | 38   | 41      | 37      |         |
| 40               | 49   | 54      | 57      |         |
| 50               | 35   | 31      | 34      |         |
| 60               | 12   | 11      | 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)

(c) Identify the following variables:

i. Independent variable (1 mark)

ii. Dependent variable (1 mark)

iii. Two controlled variables (2 marks)



(c) Deterioration of the joints due to age and injury can lead to pain and stiffness of the joints.

i. State the name given of the disease that is characterised by these symptoms. (1 mark)

\_\_\_\_\_

ii. Explain the reasons for symptoms of pain and stiffness. (3 marks)

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\_\_\_\_\_  
\_\_\_\_\_  
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iii. List three treatments currently available to alleviate the symptoms of this joint disease. (3 marks)

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\_\_\_\_\_  
\_\_\_\_\_

The movement of limbs around synovial joints are limited due to ligaments and attachments to the local muscles.

(d) Describe two ranges of motion that can occur at the hip joint. (4 marks)

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\_\_\_\_\_

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29. Which of the following statements is CORRECT?

- (a) The larger the cell, the greater its ability to take up nutrients from its surroundings.
- (b) The increased surface area to volume ratio of a small cell means that it can remove its waste more efficiently.
- (c) Smaller cells have a larger volume to surface area ratio to enable them to gain glucose by diffusion more readily.
- (d) The size of the cell is irrelevant to diffusion because particles will always move randomly from areas of high to low concentration.

30. Osteocytes are located within the

- (a) lacuna.
- (b) central canal.
- (c) lamellae.
- (d) canaliculi.

**End of Section One**

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**Section Two: Short answer**

**(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: 85 minutes.

**Question 31**

**(19 marks)**

The human body consists of complex systems that work together to maintain life.

- (a) List two body systems that bone marrow is associated with. (2 marks)

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- (b) Name the two different types of bone marrow and describe the location and function of them in relation to the body systems answered in question (b) above. (6 marks)

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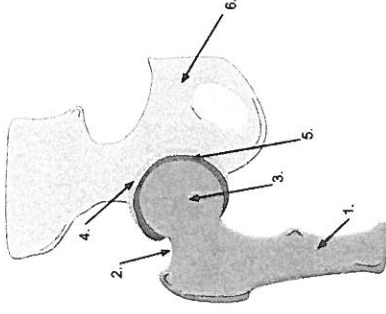


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**Question 35**

**(17 marks)**

The diagram below shows the hip joint, with the head of the femur (3) connecting to the pelvis (6).



- (a) State the name and function of the cartilage found in locations 4 and 5. (2 marks)

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- (b) Fill in the table below stating the structure and movement of a fibrous and cartilaginous joint. (4 marks)

| Type of Joint | Structure | Movement |
|---------------|-----------|----------|
| Fibrous       |           |          |
| Cartilaginous |           |          |

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

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

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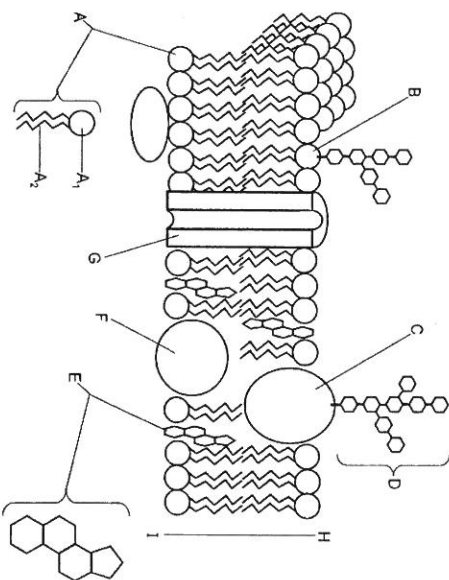
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Each cell is surrounded by a cell membrane that separates the cell contents from the external environment. Refer to the diagram below to answer the following question.



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

(3 marks)

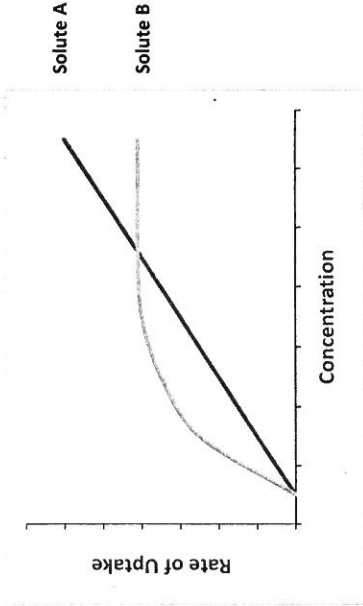
A<sub>1</sub> \_\_\_\_\_

A<sub>2</sub> \_\_\_\_\_

G \_\_\_\_\_

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



(d) 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  
\_\_\_\_\_
- ii. Solute B  
\_\_\_\_\_

(e) Describe the possible differences in the physical and/or chemical nature of Solute A and Solute B in relation to their movement across the cell membrane. (4 marks)

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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)

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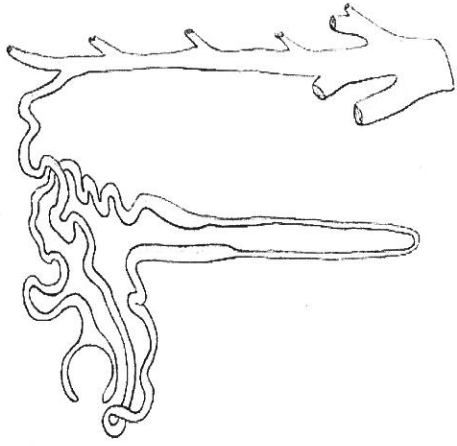
Once absorbed, these nutrients are further broken down within the body.

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

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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 an area of filtration, an area of secretion and an area of reabsorption. (6 marks)



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) Describe the connection between high blood pressure and swollen ankles. (2 marks)

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**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)

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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

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

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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

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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)

\_\_\_\_\_

(e) State the location/s that aerobic respiration occurs in. (2 marks)

\_\_\_\_\_  
\_\_\_\_\_

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

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Question 33**

(10 marks)

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

(a) Describe two structural differences between a vein and an artery. (2 marks)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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)

\_\_\_\_\_

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

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\_\_\_\_\_  
\_\_\_\_\_

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)

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\_\_\_\_\_  
\_\_\_\_\_