# HUMAN BIOLOGY

# Unit 1

# 2019

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 | 30 | 40 | 30 | 30 |
| Section Two Short answer | 8 | 8 | 90 | 106 | 50 |
| Section Three Extended answer | 3 | 2 | 50 | 40 | 20 |
| | | | | **Total** | 100 |

## Instructions to candidates

1. The rules for the conduct of the Western Australian examinations are detailed in the *Year 12 Information Handbook 2019*. 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 three questions. You must answer two questions. 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.

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**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. Erythrocytes (red blood cells) lack most of the membrane bound organelles found in other mature body cells. Which of the following processes are erythrocytes able to carry out?

   (a) Protein synthesis
   **(b) Glycolysis**
   (c) Electron Transport Chain
   (d) Cell division

2. In August 2016, Science in Australia Gender Equality released statistics stating that that out of 220 162 students studying STEM, 72 911 were women. Which of the following **best** represents the ratio between females and males studying STEM?

   (a) 1:2
   (b) 2:1
   **(c) 1:3**
   (d) 3:1

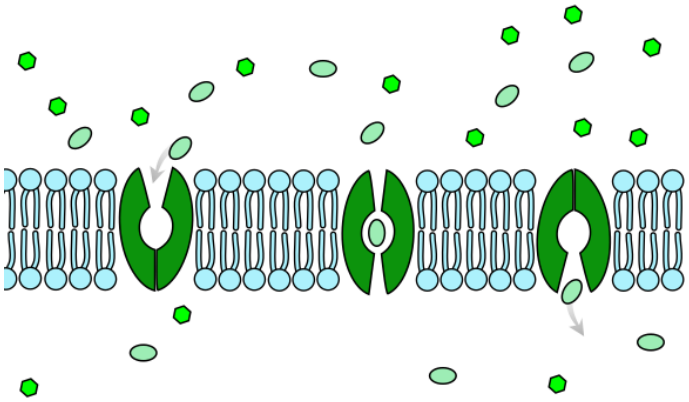
3. In which of the following parts of the body would you expect to find the **least** number of Golgi bodies?

   **(a) Muscles**
   (b) Salivary glands
   (c) Small Intestine
   (d) Stomach

4. The Fluid Mosaic Model of the cell membrane refers to the

   (a) variety of proteins that are found within the membrane.
   (b) ability of substances to pass through the membrane.
   (c) arrangement of the phospholipids into a bilayer.
   **(d) diverse number of components and their ability to move positions.**

Question 5 and 6 refer to the diagram below:



5. The diagram above shows the movement of a substance into a cell. Which description best describes the movement of this substance?

   (a) No energy (ATP) is required, as the substance is moving against the concentration gradient
   (b) Energy (ATP) is required, as the substance is moving against the concentration gradient
   **(c) No energy (ATP) is required, as the substance is moving with the concentration gradient**
   (d) Energy (ATP) is required, as the substance is moving with the concentration gradient

6. The type of transport best represented by the diagram above is referred to as

   (a) simple diffusion.
   **(b) facilitated diffusion.**
   (c) active transport.
   (d) vesicular transport.

**7.** Muscles work in pairs known as

   (a) agonistic pairs.
   **(b) antagonistic pairs.**
   (c) synergistic pairs.
   (d) stabilising pairs.

**8.** A patient with blood type A requires a transfusion. Which of the following lists the blood types that this patient can receive?

   **(a) Blood types A and O**
   (b) Blood types AB and A
   (c) Blood types AB and O
   (d) Blood types AB, A and O

9. Emphysema is a respiratory disease often associated with chronic smokers, where irritating particles damage the alveoli. Sufferers struggle to take in enough oxygen and often are fatigued. These symptoms are **best** attributed to

   (a) constriction of the alveoli and damage to the blood vessels surrounding the lungs.
   **(b) decreased surface area within the lungs and poor ventilation.**
   (c) vasoconstriction of the respiratory capillaries and reduced lung volume.
   (d) loss of fluid covering the lungs and increased thickness of the alveolar membranes.

10. The functions of the muscular system include all of the following **except**

   (a) produce movement.
   (b) maintain posture.
   (c) produce heat.
   **(d) protect internal organs.**

**11.** Blood clotting disorders, such as haemophilia, are often treated with blood transfusions containing

   (a) plasma only.
   (b) whole blood.
   **(c) platelet concentrates.**
   **(d)** red cell concentrates.

12. Which of the following correctly states the functional and structural classification of the following joints?

| | Joint | Functional | Structural |
|---|---|---|---|
| **(a)** | **Skull** | **Fixed joint** | **Fibrous** |
| (b) | Elbow | Slightly moveable | Synovial |
| (c) | Adjacent vertebrae | Cartilaginous | Slightly moveable |
| (d) | Wrist | Synovial | Freely moveable |

13. The shaft of the long bone is known as the

   (a) epiphysis.
   **(b) diaphysis.**
   (c) periosteum.
   (d) endosteum.

**SEE NEXT PAGE**

14. Which of the following sets of muscles are responsible for the action of inhalation in humans?

    **(a) External intercostal muscles and diaphragm**
    (b) Diaphragm only
    (c) Internal intercostal muscles and diaphragm
    (d) External and internal intercostal muscles

15. During aerobic respiration, the Krebs (or Citric Acid) cycle and Electron Transport Chain (ETC) occur. Which of the following states the correct location of these processes within the mitochondria?

    (a) Both the Krebs Cycle and ETC occur in the matrix
    (b) The Krebs Cycle occurs on the inner membrane whilst the ETC occurs in the matrix
    (c) Both the Krebs Cycle and ETC occur on the inner membrane
    **(d) The Krebs Cycle occurs in the matrix whilst the ETC occurs on the inner membrane**

16. Which of the following correctly states the nutrient, its basic structural unit and main function?

| | Nutrient | Structural Unit | Function |
|---|---|---|---|
| (a) | Protein | Nucleotides | Enzymes |
| **(b)** | **Lipid** | **Fatty Acids and Glycerol** | **Energy source** |
| (c) | Carbohydrate | Monosaccharides | Co-enzymes |
| (d) | Vitamin | Amino acids | Solvent |

17. Muscle tissue which shows a lack of striations is known as

    **(a) smooth muscle.**
    (b) skeletal muscle.
    (c) cardiac muscle.
    (d) voluntary muscle.

18. Athletes competing in a race are often given a glucose drink rather than sucrose to keep their energy levels up. The **best** reason for this is that glucose is

    (a) a complex carbohydrate and therefore contains more energy per molecule than sucrose.
    (b) the only nutrient that can be converted to energy during cellular respiration.
    (c) lipid-soluble, therefore easily digested and absorbed by the digestive tract.

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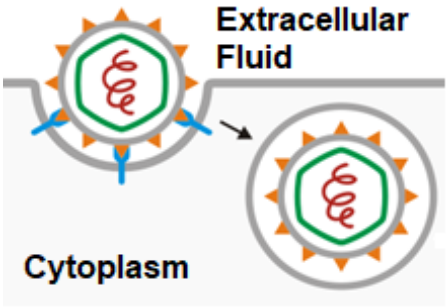
**(d) the simplest form of carbohydrate and therefore does not require any further digestion.**

Question 19 refers to the diagram below:




19. The cellular process depicted above is **best** explained as

(a) endocytosis; material is surrounded by the plasma membrane and buds off outside the cell forming a vesicle.
**(b) endocytosis; material is surrounded by the plasma membrane and buds off inside the cell forming a vesicle.**
(c) exocytosis; material is surrounded by the plasma membrane and buds off outside the cell forming a vesicle.
(d) exocytosis; material is surrounded by the plasma membrane and buds off inside the cell forming a vesicle.

20. The inner lining of the trachea and kidney tubules is made up of

**(a) epithelial tissue.**
(b) nervous tissue.
(c) muscle tissue.
(d) connective tissue.

21. The major difference between vitamins and minerals is

(a) minerals can be broken down by heat, whilst vitamins cannot.
**(b) minerals are inorganic, whilst vitamins are organic.**
(c) minerals can be water-soluble or fat-soluble, whilst vitamins are only fat-soluble.
(d) minerals are classified as macronutrients, whilst vitamins are classified as micronutrients.

22. A molecule can only be moved against its concentration gradient by

(a) passage through a carrier protein.
(b) facilitated diffusion.
**(c) active transport.**

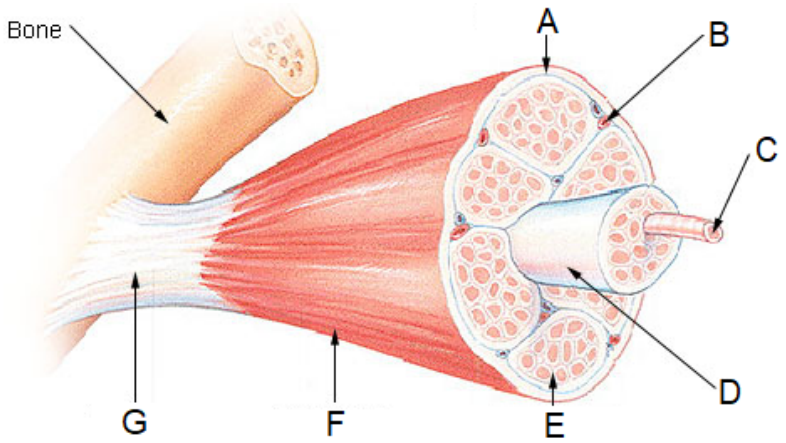
**SEE NEXT PAGE**

(d) vesicular transport.

23. Asthma narrows the breathing airways. This can affect the actions of breathing as

**(a) air is caught in the lungs causing a decrease in the volume of air entering and exiting the lungs.**
(b) the epithelial lining of the airways becomes thinner, decreasing the ability of the lungs to contract.
(c) it decreases the moisture entering the lungs, causing them to dry out and making it harder to breathe.
(d) alveoli are damaged, decreasing the efficiency of gas exchange in the lung tissue.

Question 24 refers to the diagram below, illustrating the structure of skeletal muscle:




24. The structure shown at location G best represents

**(a) a tendon.**
(b) a ligament.
(c) a muscle fibre.
(d) a myofilament.

25. The semi-lunar valves found in the heart prevent backflow of blood into the

(a) atria.
**(b) ventricles.**
(c) pulmonary veins and arteries.
(d) aorta and vena cava.

26. Which of the following is **not** considered to be part of the excretory system?

(a) Lungs

(b) Liver
(c) Skin
**(d) Stomach**

**27.** Which of the following describes the importance of a synergist in muscle movement?

(a) Allows for more than one movement to occur at a time
**(b) Ensures that only one movement can occur at a time**
(c) Is the antagonist which opposes the movement of the agonist muscle
(d) Acts as the prime mover in creating movement

28. Which of the following substances is directly absorbed into the lymphatic system during digestion?

(a) Glucose
(b) Water
(c) Amino acids
**(d) Fatty acids and glycerol**

29. A laboratory technician forgot to label a cross section of a blood vessel. Which of the following descriptions would help the technician to classify the vessel?

(a) Veins have small lumens, which keep blood pressure high throughout the circulatory system.
(b) Capillary walls are thick, which help resist the high pressure in capillary beds.
**(c) Veins contain the same three layers as arteries, but have less smooth muscle and elastic tissue.**
(d) Arteries contain valves to help push the blood away from the heart.

**30.** A microscope with an objective lens of 10X and an eyepiece lens of 4X, has a field of view of 3500 µm. If the eyepiece lens is changed to 10X, what is the new field of view?

(a) 8750 µm
(b) 14 000 µm
(c) 35 000 µm
**(d) 1400 µm**

**End of Section One**

**Section Two: Short answer** **50% (106 Marks)**

This section has **8** 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** **(15 marks)**

Adenosine triphosphate (ATP) provides the energy for the basic functions and cellular processes that occur within the human body.

(a) Describe the structure of ATP and explain how it can both store and release energy.
(5 marks)

| Description | Mark |
|---|---|
| adenosine bonded to three phosphates | 1 |
| energy is stored in the bond between the second and third phosphates | 1 |
| when required, the third phosphate is lost/ADP is formed | 1 |
| stored energy is released | 1 |
| ATP-ADP can be recycled/can be reused | 1 |
| **Total** | **5** |

Basal metabolic rate (BMR) is the measurement of energy required to perform basic functions such as movement and digestion.

(b) State the basic structure of the mammalian heart and explain how this structure relates to the high BMR seen in humans.
(4 marks)

| Description | Mark |
|---|---|
| two atria and two ventricles/four chambers | 1 |

| | |
|---|---|
| no mixing of deoxygenated blood / oxygen delivery is more efficient | 1 |
| more aerobic respiration can take place | 1 |
| more ATP produced for metabolic activity/biochemical processes | 1 |
| **Total** | **4** |

(c) Crohn's disease is a gastrointestinal disorder in which the villi of the small intestine become atrophied and waste away.

Explain why a person with Crohn's disease would suffer from malabsorption and state **three** nutrients they would most likely be deficient in.

(5 marks)

| **Description** | **Mark** |
|---|---|
| Villi is the site/structure associated with nutrient absorption | 1 |
| Absorption is enhanced by (continual) movement of villi/large surface area of villi, which wouldn't occur if damaged | 1 |
| Deficient in any three of the following for 1 mark each: | |
| • Amino acids<br>• Fatty acids and glycerol<br>• Simple sugars/glucose<br>• Water-soluble vitamins (e.g. Vitamin B12)<br>• Water<br>• Mineral nutrients (e.g. calcium, potassium etc.) | 1-3 |
| **Total** | **5** |

(d) State the name given to the lymph capillary that is found within the villi.

(1 mark)

| **Description** | **Mark** |
|---|---|
| lacteal | 1 |
| **Total** | **1** |

**Question 32** **(13 marks)**

A group of Year 11 Human Biology students decided to investigate the relationship between the height of an individual and their lung capacity in both males and females. 100 subjects (50 males and 50 females) of the same age group were selected, and divided into height ranges. The Expiratory Reserve Volume (ERV), which is the amount of air that can be forcefully exhaled after a normal breath out, was obtained by breathing into a balloon, measuring the circumference and converting that measurement to millilitres. This was undertaken three times per participant and the average ERV for each age range was calculated.

The results of the experiment are shown in the table below.

| **Height (cm)** | | **156 - 160** | **161 – 165** | **166 - 170** |
|---|---|---|---|---|
| **ERV (mL)** | **Male** | 1213 | 1387 | 1393 |
| | **Female** | 832 | 916 | 948 |

(a) Identify the following variables for the students' investigation:

(2 marks)

(i) Independent.

| Description | Mark |
|---|---|
| height in centimetres (cm)<br>*must include units of measurement | 1 |
| **Total** | **1** |

(ii) Dependent.

| Description | Mark |
|---|---|
| ERV/Expiratory Reserve Volume in millilitres (mL)<br>*must include units of measurement | 1 |
| **Total** | **1** |

(b) Propose a hypothesis for which gender has the largest ERV.

(1 mark)

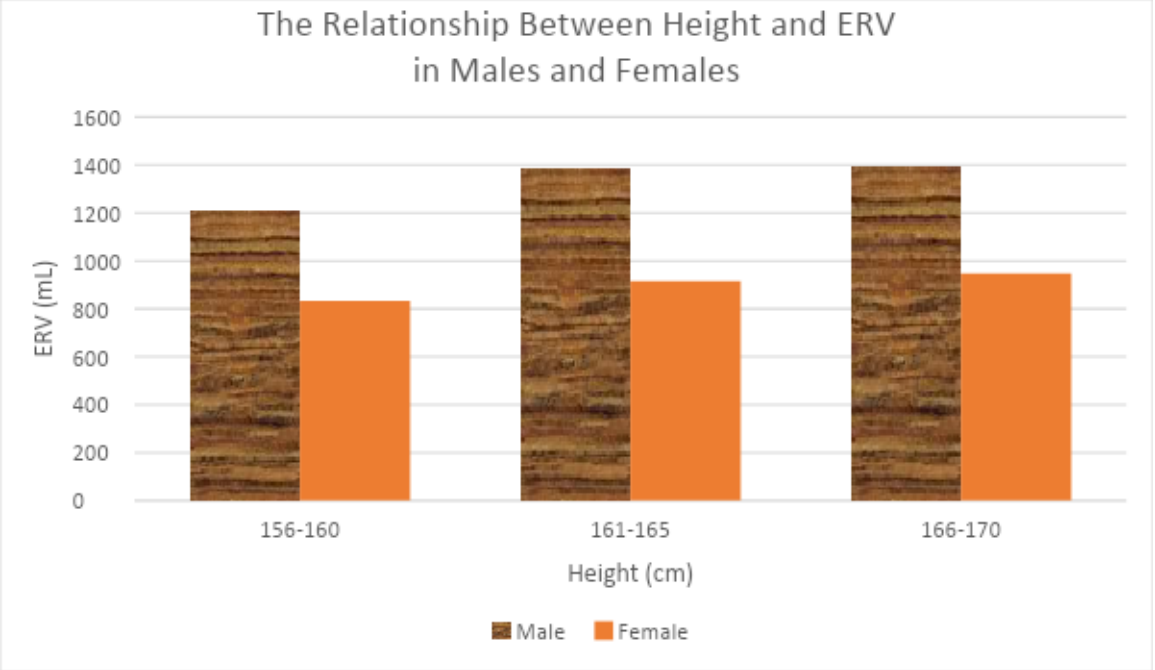
| Description | Mark |
|---|---|
| Any appropriate answer, for example:<br>- males will have a higher ERV than females<br>*gender must be related to dependent variable | 1 |
| **Total** | **1** |

**(c)** Graph the results from the table on page 12 onto the grid provided below.

(5 marks)

A spare grid can be found on page 39.

| Description | Mark |
|---|---|
| Correctly plotted points using a column graph with gaps between conditions (i.e. not continuous data) | 1 |
| Labelling of axes with correct name | 1 |
| Labelling of axes with correct unit of measurement | 1 |
| Uses keys/labels correctly | 1 |
| Title appropriate with both independent and dependent variables | 1 |
| **Total** | **5** |




(d) Describe **one** reason why increasing the height of an individual increases their ERV.

(2 marks)

| Description | Mark |
|---|---|
| Any one of the following for 2 marks: | |
| • Taller people have larger muscles<br>• allowing for a greater force of expiration | 1-2 |
| • Taller people have larger lungs<br>• therefore increasing lung capacity/volume/more air can be held | 1-2 |
| **Total** | **2** |

(e) As this investigation was conducted on humans, describe **one** ethical requirement that would need to be considered.

(2 marks)

| Description | Mark |
|---|---|
| Any one of the following for 2 marks: | |
| • Voluntary participation<br>• Subject should not be coerced/forced | |

| | |
|---|---|
| • Informed consent<br>• All information about the investigation should be provided | 1-2 |
| • Risk of harm<br>• Physical (or psychological) harm should be minimised/absent | |
| • Confidentiality<br>• Subjects data/identity should not be released | |
| **Total** | **2** |

(f) State **one** change to this investigation that would increase the validity of the results.

(1 mark)

| **Description** | **Mark** |
|---|---|
| Any one of the following for 1 mark: | |
| • controlling more variables/controlling named variable e.g. same age, no underlying respiratory conditions etc.<br>• improving measurement techniques/describes specific example e.g. use of a spirometer | 1 |
| **Total** | **1** |

**Question 33** **(13 marks)**

(a) Multicellular organisms, such as humans, involve a hierarchical organisation working together to maintain life.

Using an example, describe how cells, tissues and organs are related.

(3 marks)

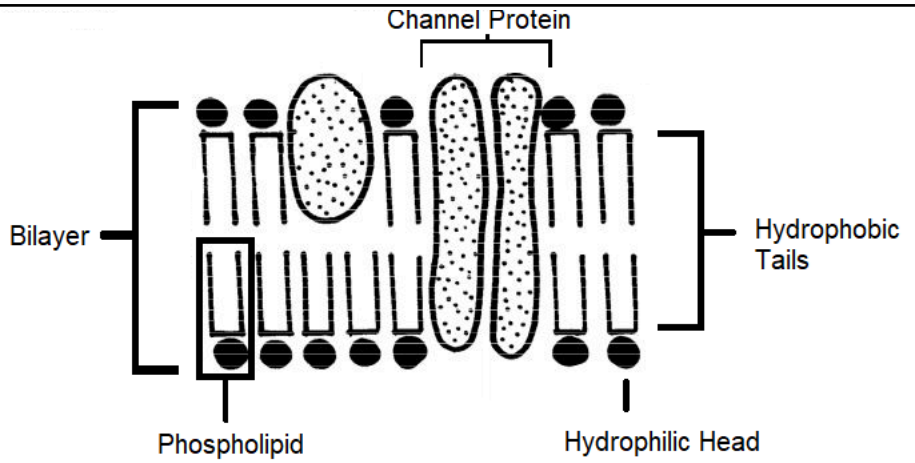
| Description | Mark |
|---|---|
| Cells are specialised to carry out specific functions/basic building block/smallest structural and functional unit AND example (i.e. epithelial cell) | 1 |
| Groups of specialised cells/cells that have a common function make up a tissue AND example (i.e. epithelial tissue) | 1 |
| Different tissues work together to function as an organ AND example (i.e. trachea) | 1 |
| **Total** | **3** |

**(b)** The internal environment of a cell is separated from the external environment by a thin membrane that regulates the movement of substances into and out of the cell.

In the space below, create a fully labelled diagram that identifies the main structures of the plasma membrane that are involved in the transport of substances.

(5 marks)

| Description | Mark |
|---|---|
| Labelled diagram must include the following for 1 mark each: | |
| - Bilayer | 1 |
| - Phospholipid | 1 |
| - Hydrophilic head (facing outwards) | 1 |
| - Hydrophobic tails (facing inwards) | 1 |
| - Channel/Carrier protein (span membrane with central pore) | 1 |
| Example: | |




| | |
|---|---|
| **Total** | **5** |

(c) Explain, making reference to the importance of concentration gradients, how oxygen and carbon dioxide levels are maintained in the lungs.

(4 marks)

| Description | Mark |
|---|---|
| Importance: | |
| - the greater the difference in gas concentrations/levels between air and blood | 1 |
| - the more efficient/faster gas exchange/diffusion | 1 |
| Maintained by: | |
| - constant flow of blood through the capillaries | 1 |
| - movement of air into and out of the alveoli | 1 |
| **Total** | **4** |

(d) State the reason that carbon dioxide moves across the alveolar membrane much faster than oxygen.

(1 mark)

| Description | Mark |
|---|---|
| Carbon dioxide is more soluble/polarised bonds between C=O/ability to react with water/form carbonic acid | 1 |
| **Total** | **1** |

**Question 34** **(14 marks)**

Gallbladder removal is often the only choice for patients suffering significant pain and other complications associated with the organ.

(a) Besides a reduction in fat intake, identify **two** suggestions a doctor may make about a patient's diet after having their gallbladder removed.

(2 marks)

| Description | Mark |
|---|---|
| • eat smaller, more-frequent meals | 1 |
| • increase fibre | 1 |
| **Total** | **2** |

(b) Suggest why someone would reduce their fat intake after having their gallbladder removed.

(2 marks)

| Description | Mark |
|---|---|
| gallbladder stores bile/bile salts | 1 |
| less bile available to emulsify fat/break fat into smaller pieces/mechanical digestion of fat | 1 |

| | |
|---|---|
| **Total** | **2** |

**(c)** Besides the gallbladder, describe how **one** other accessory organ aids in the process of digestion.

(3 marks)

| Description | Mark |
|---|---|
| Any one of the following for three marks: | |
| • salivary glands<br>• saliva containing amylase/mucus that lubricates/dissolves food/holds food in lump<br>• deposited into the mouth | 1-3 |
| • pancreas<br>• pancreatic juices containing enzymes/neutralise acids from the stomach<br>• deposited into small intestine/duodenum | 1-3 |
| • liver<br>• produces bile/bile salts/bile emulsifies lipids<br>• deposited into the small intestine/duodenum | 1-3 |
| **Total** | **3** |

Peristaltic muscular waves occur in many hollow tubes of the body, such as the oesophagus, stomach and intestines.

(d) State the three layers of muscle found in the stomach.

(1 mark)

| Description | Mark |
|---|---|
| circular, oblique and longitudinal | 1 |
| **Total** | **1** |

(e) Explain how the muscle fibres of the stomach contract.

(6 marks)

| Description | Mark |
|---|---|
| sliding filament theory | 1 |

| | |
|---|---|
| influx of $Ca^{2+}$ into cell | 1-5 |
| myosin attaches to actin / (myosin) cross bridges form | |
| power stroke occurs | |
| actin slides/pulled over myosin | |
| Z-lines/I-bands/sarcomere shorten | |
| **Total** | **6** |

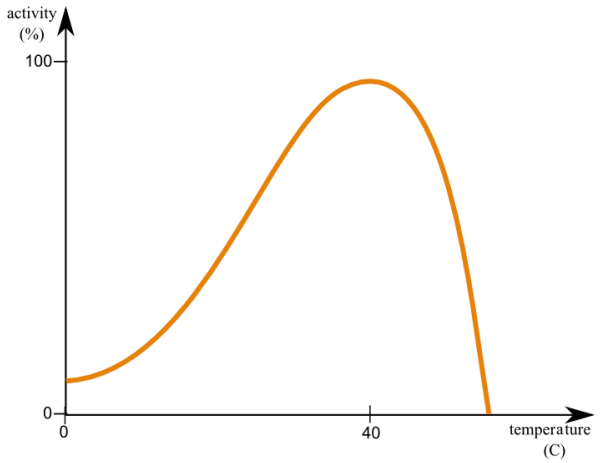
**Question 35** **(12 marks)**

**(a)** For each of the following factors, draw a line graph which depicts its effect on the activity of enzymes.

**(i)** Temperature, with an optimal activity at 40 °C.

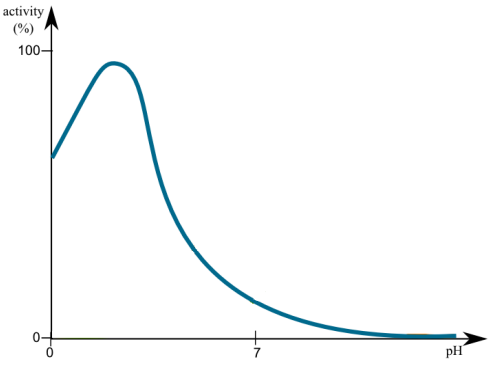
(1 mark)

| Description | Mark |
|---|---|
| Line graph shows an even rate of increase up to optimal, then rapid decrease after. | 1 |
| Example: | |

| | |
|---|---|
|  | |
| **Total** | **1** |

**(ii)** pH, with an optimal activity of pH 3.

(1 mark)

| Description | Mark |
|---|---|
| Line graph shows an even rate of increase up to optimal, then gradual decrease after. | 1 |
| Example:<br>  | |
| **Total** | **1** |

**(b)** Describe and explain how the concentrations of reactants and products can affect an enzyme's rate of reaction.

(5 marks)

| Description | Mark |
|---|---|
| increasing substrate/reactant concentration, increases reaction rate | 1 |
| due to more substrate/reactant coming into contact with the enzyme | 1 |

**SEE NEXT PAGE**

| | |
|---|---|
| once all enzyme molecules are utilised, there will be no effect | 1 |
| increased concentration of products, decreases reaction rate | 1 |
| due to lowered chance that substrate comes into contact with enzymes/more chance that enzyme will run into the product | 1 |
| **Total** | **5** |

**(c)** Enzymes are found all over the body. Explain how enzymes normally found in the blood could also be located in the lymphatic system.

(3 marks)

| Description | Mark |
|---|---|
| high pressure of the circulatory system | 1 |
| forces fluid across capillary membranes/thin membranes of vessels | 1 |
| collected in the lymph capillaries | 1 |
| **Total** | **3** |

(d) Lymph contains a high number of macrophages. Describe the role of these cells within the lymphatic system.

(2 marks)

| Description | Mark |
|---|---|
| defence against disease/immunity | 1 |
| phagocytosis/macrophages engulf bacteria/pathogens/foreign particles/micro-organisms | 1 |
| **Total** | **2** |

**Question 36** **(14 marks)**

Hip dysplasia occurs due to the incorrect development of the hip joint. It is often detected in babies, but can go unnoticed until adolescence and adulthood.

(a) Identify which classification the hip joint belongs to.

(2 marks)

| Description | Mark |
|---|---|
| Synovial/freely moveable joint | 1 |
| ball and socket | 1 |
| **Total** | **2** |

(b) Describe a surgical treatment that a patient suffering hip dysplasia could undertake to help lessen the symptoms.

(2 marks)

| Description | Mark |
|---|---|
| (total) hip replacement | 1 |
| replace affected joint with prosthesis/artificial joint | 1 |
| **Total** | **2** |

**(c)** The types of movement occurring at a joint can be described by a number of terms. Complete the following table.

(5 marks)

| Term | Movement | Example |
|---|---|---|
| Flexion | Decreases the angle between articulating bones | Bending the knee/elbow |
| Rotation | Movement of bone around its long axis | Moving the head to the left and the right |
| Abduction | Movement away from the midline of the body | Lifting arm/leg out to the side |

**SEE NEXT PAGE**

| | | |
|---|---|---|
| | | |

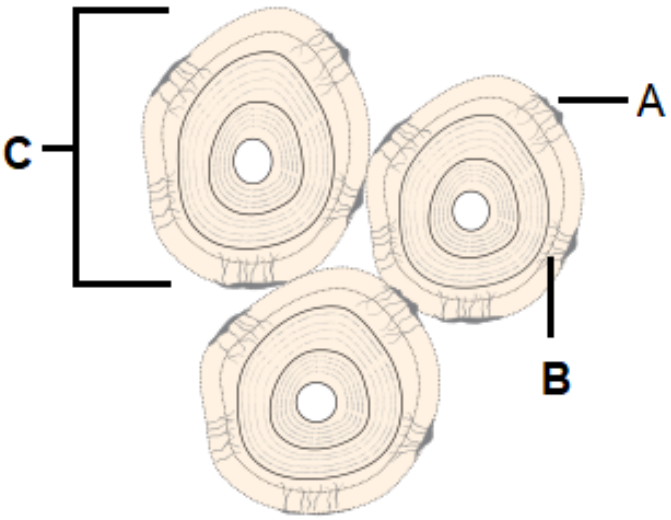
The skeletal framework aids in the production of movement and can be divided into two sections.

(d) Differentiate between the bones of the axial and appendicular skeleton.

(2 marks)

| Description | Mark |
|---|---|
| axial – bones lie around the central axis of the body | 1 |
| appendicular – bones of the limbs and pelvis | 1 |
| **Total** | **2** |

(e) The diagram below shows the structure of a section of compact bone.




**(i)** State the name given to the individual units, labelled C, which make up compact bone.

(1 mark)

| Description | Mark |
|---|---|
| | |

| | |
|---|---|
| Haversian system/osteon | 1 |
| **Total** | **1** |

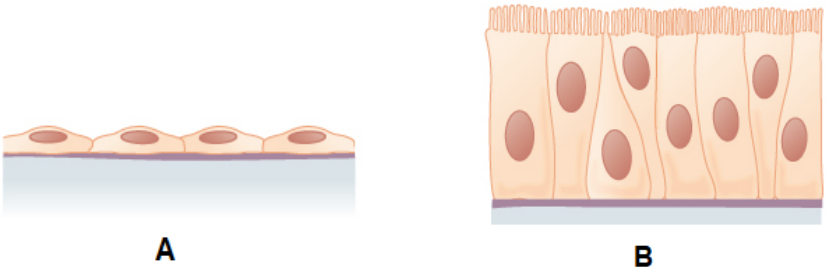
(ii) Identify and state the function of the tiny canals, labelled B.

(2 marks)

| Description | Mark |
|---|---|
| canaliculi | 1 |
| transport nutrients between cells/osteocytes | 1 |
| **Total** | **2** |

**Question 37** **(13 marks)**

The cells of a tissue found in the respiratory system are show below.




(a) Explain how the structure of the cells labelled B is suited to its function and state where they can be found in the respiratory system.

(3 marks)

| Description | Mark |
|---|---|
| lined with cilia | 1 |
| move mucus and/or particles upwards/towards the mouth | 1 |
| Inner lining of the trachea/bronchial tubes/nasal passage | 1 |
| **Total** | **3** |

(b) State the structure of the respiratory system that the cells labelled A would make up.

(1 mark)

| Description | Mark |
|---|---|
| | |

| | |
|---|---|
| alveoli | 1 |
| **Total** | **1** |

(c) Explain how the structure identified in part (b) is well suited to its function.

(3 marks)

| Description | Mark |
|---|---|
| large (internal) surface area to speed up gas exchange | 1 |
| well supplied with blood vessels to maintain diffusion gradients | 1 |
| thin/1 cell thick membrane to increase diffusion rate | 1 |
| **Total** | **3** |

(d) Identify the two types of cellular respiration which occur in humans and differentiate between these processes.

(4 marks)

<table>
<tr><th colspan="2">Description</th><th>Mark</th></tr>
<tr><td colspan="2">identifies the two types of respiration as anaerobic and aerobic</td><td>1</td></tr>
<tr><td colspan="2">Any 3 of the following lines for 1 mark each:</td><td rowspan="6">1-3</td></tr>
<tr><th>Aerobic</th><th>Anaerobic</th></tr>
<tr><td>requires/uses/in presence of oxygen</td><td>absence of oxygen</td></tr>
<tr><td>36 – 38 ATP created</td><td>2 ATP created</td></tr>
<tr><td>products are $CO_2$ and $H_2O$</td><td>product is Lactic Acid</td></tr>
<tr><td>occurs in cytoplasm and mitochondria</td><td>occurs in cytoplasm only</td></tr>
<tr><td>glucose is completely broken down/oxidised</td><td>glucose is incompletely broken down/oxidised</td></tr>
<tr><td colspan="2">Total</td><td>4</td></tr>
</table>

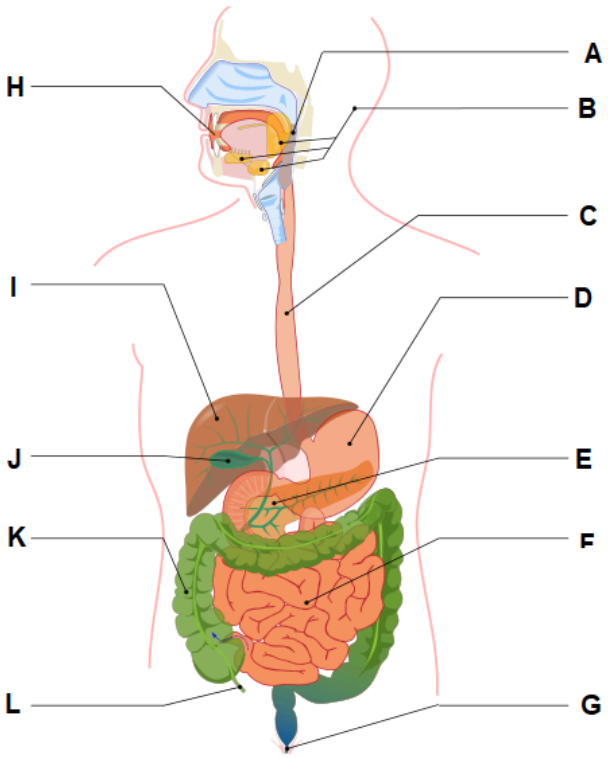
(e) Describe how the physical nature of the product/s of anaerobic respiration affect their movement across the cell membrane.

(2 marks)

| Description | Mark |
|---|---|
| Lactic acid is a large molecule | 1 |
| Occurs through facilitated diffusion/requires a carrier protein | 1 |
| **Total** | **2** |

**Question 38** **(12 marks)**

The diagram below shows different organs associated with the digestive system.




(a) State the name of the organs labelled:

(2 marks)

| Description | Mark |
|---|---|
| C – Oesophagus | 1 |
| D – Stomach | 1 |
| **Total** | **2** |

(b) Describe the functions of the organ labelled K.

(2 marks)

| Description | Mark |
|---|---|
| absorption of water/vitamins from bacteria/mineral nutrients | 1-2 |
| formation/temporary storage of faeces | |
| bacterial fermentation/breakdown of organic/indigestible material | |
| **Total** | **2** |

(c) Identify the enzyme produced in the organ labelled E that breaks down fats and state **one** issue that shortage of this enzyme may cause.

(2 marks)

| Description | Mark |
|---|---|
| lipase | 1 |
| diarrhoea/lack of required fats/fat-soluble vitamins | 1 |
| **Total** | **2** |

The autonomic nervous system controls the muscular actions of the digestive system.

(d) State the name of the specialised cells found within nervous tissue and describe why these cells are microscopic.

(3 marks)

| Description | Mark |
|---|---|
| neuron | 1 |
| large surface area to volume ratio | 1 |
| efficient exchange of materials/diffusion rate | 1 |
| **Total** | **3** |

(e) Cell death, otherwise known as apoptosis, is associated with the release of digestive enzymes into the cytoplasm.

Outline how cell organelles are involved in apoptosis.

(3 marks)

| Description | Mark |
|---|---|
| RER creates digestive enzymes which are | 1 |
| modified and packaged by the Golgi body | 1 |
| and stored in the lysosome | 1 |
| **Total** | **3** |

**End of Section Two**

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SEE NEXT PAGE

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

This section contains **three** questions. You must answer **two** questions. Write your answers on the pages following Question 41.

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.

Answer any **two** questions from Questions 39 to 41.

Indicate the questions you will answer by ticking the box next to the question. Write your answers on the pages that follow.

☐ **Question 39** **(20 marks)**

(a) By the year 2050, it is expected that approximately 25% of Australia's population will be over 65 years of age.

Osteoporosis and osteoarthritis are chronic diseases associated with ageing that result in disability. For each of these diseases, describe the effect on the musculoskeletal system, the main symptoms experienced by an affected individual, and outline a practice that aids in its prevention.

(10 marks)

| Description | Mark |
|---|---|
| Osteoporosis effect:<br>- imbalance between bone formation and reabsorption / body doesn't form enough new bone / body reabsorbs too much old bone<br>- loss of calcium/bone density<br>- bones become porous and fragile | 1-2 |
| Osteoporosis symptoms:<br>- loss of height<br>- stooped posture<br>- more frequent/easier bone fractures | 1-2 |

**SEE NEXT PAGE**

| | |
|---|---|
| - back pain | |
| Practice for prevention:<br>- increased calcium/increased protein/increased vitamin D<br>- regular exercise/weight-bearing/strength training<br>- maintaining healthy weight range | 1 |
| Osteoarthritis effect:<br>- exposed ends of bone within joint<br>- bony spur growth<br>- narrowed joint space<br>- cartilage is damaged/deteriorates | 1-2 |
| Osteoarthritis symptoms:<br>- pain / tenderness<br>- grating / crackling sensation/noise<br>- limited range of movement<br>- stiffness<br>- inflammation / swelling<br>- muscle weakness | 1-2 |
| Practice for prevention:<br>- regular exercise<br>- improved posture<br>- maintain healthy weight range | 1 |
| **Total** | **10** |

(b) As you age, your kidneys and bladder undergo changes. A decrease in the number of nephrons in the kidney is common and can lead to chronic kidney disease.

Explain the processes involved in the formation of urine, and state how chronic kidney disease would affect the volume of urine produced.

(10 marks)

| Description | Mark |
|---|---|
| Must state: | |
| amount of urine would decrease | 1 |
| Any nine of the following for 1 mark each: | |
| (glomerular) filtration | |

| | |
|---|---|
| takes place in renal corpuscle/fluid forced out of glomerulus and into glomerular capsule | 1-9 |
| filtrate is formed | |
| (selective) reabsorption | |
| substances/material are returned to the blood | |
| can be passive or active | |
| facultative reabsorption is an active process/under hormonal control | |
| occur in the distal convoluted tubule and collecting duct | |
| (tubular) secretion | |
| can be passive or active | |
| hydrogen/ammonium is added to the filtrate | |
| **Total** | **10** |

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

The digestive system functions to breakdown and absorb required nutrients that are used by cells for biochemical processes.

(a) Explain why mechanical digestion must occur before chemical digestion.

(4 marks)

| Description | Mark |
|---|---|
| breaks food into smaller pieces | 1 |
| increases effectiveness of chemical digestion | 1 |
| where enzymes act on molecules | 1 |
| due to increased surface area/more enzymes can surround the food | 1 |
| **Total** | **4** |

(b) Contrast anabolic and catabolic reactions in a cell, giving an example of each, and explain how these biochemical processes are controlled.

(8 marks)

| Description | | Mark |
|---|---|---|
| **Anabolic** | **Catabolic** | 1-2 |
| uses energy/ATP | releases energy/ATP | |

| | | |
|---|---|---|
| builds complex molecules from simpler ones | break down complex molecules into simpler ones | |
| example of anabolic could include:<br>- protein synthesis/glycogen synthesis/lipid synthesis | | 1 |
| example of catabolic could include:<br>- cellular respiration/hydrogen peroxide to water | | 1 |
| series of chemical reactions/involve multiple steps | | 1-4 |
| enzymatic control | | |
| different enzymes at each step/enzyme changes substrate at each step/each step catalysed by a specific enzyme | | |
| regulates the release of energy/small amounts of energy released per step | | |
| **Total** | | **8** |

(c) Biochemical processes within all systems of the body and the digestive system itself results in the production of wastes.

Explain the difference between elimination and excretion, and describe how amino acids are excreted from the body.

(8 marks)

| Description | Mark |
|---|---|
| Excretion: | |
| - removal of metabolic wastes<br>- associated with the excretory system/occurs in the liver, kidneys/lungs/sweat glands/alimentary canal | 1-2 |
| Elimination: | |
| - removal of undigested/indigestible material<br>- associated with the digestive system/faeces | 1-2 |
| Any four of the following for 1 mark each: | |
| - deamination | 1-4 |

SEE NEXT PAGE

| | |
|---|---|
| - amino group/$NH_2$ removed (from amino acid)<br>- converted to ammonia<br>- converted to urea<br>- eliminated in the urine/transported to kidneys | |
| **Total** | **8** |

**Question 41** **(20 marks)**

(a) The circulatory system is sometimes compared to that of a busy transportation system due to the link between the internal environments of the body.

Describe the structure of blood and explain how blood is used as a medium to transport oxygen, carbon dioxide and nutrients around the body.

(12 marks)

| Description | Mark |
|---|---|
| consists of plasma and formed elements | 1 |
| plasma is majority water | 1 |

| | |
|---|---|
| formed elements include:<br>- erythrocytes/red blood cells (RBC)<br>- leukocytes/white blood cells (WBC)<br>- thrombocytes/platelets | 1-3 |
| Any two of the following (oxygen): | |
| - majority (97%) carried combined to haemoglobin in RBC/erythrocyte<br>- small amount (3%) carried in solution/dissolved in plasma | 1-2 |
| Any three of the following (carbon dioxide): | |
| - majority (70%) as bicarbonate ions carried in solution/dissolved in plasma<br>- small amount (8%) carried in solution/dissolved in plasma<br>- remainder (22%) combined with haemoglobin in RBC/erythrocyte | 1-3 |
| Any two of the following (nutrients): | |
| - carried in solution/dissolved in plasma<br>- inorganics transported as ions | 1-2 |
| **Total** | **12** |

(b) A meniscus tear of the knee is a common cartilage injury in sports such as AFL and basketball. Depending on the severity of the injury, some players may be told not to play sport for up to 8 weeks, others will require surgery and take up to 3 months to heal.

Describe the microscopic structure of cartilage and explain why injured cartilage takes longer to heal than bone.

(8 marks)

| Description | Mark |
|---|---|
| Any 3 of the following: | |
| - firm matrix<br>- collagen fibres embedded in matrix<br>- collagen fibres vary in thickness<br>- spaces within matrix house chondroblasts<br>- chondrocytes trapped in lacunae | 1-3 |
| Any 3 of the following: | |
| - cartilage doesn't contain blood vessels/avascular<br>- nutrition depends on diffusion<br>- diffusion is slow<br>- therefore metabolism/cell division is slow | 1-3 |
| Any 2 of the following: | |
| - bone contains blood vessels/vascular<br>- greater activity/metabolism of osteoblasts<br>- more abundant number of osteoblasts than chondrocytes | 1-2 |
| **Total** | **8** |

**End of Section Three**

## ACKNOWLEDGEMENTS

**Question 5** Adapted from Ruiz Villarreal, M. (2007). Facilitated Diffusion in cell membrane [Image]. Retrieved November, 2018, from:

https://commons.wikimedia.org/wiki/File:Scheme_facilitated_diffusion_in_cell_membrane-en.svg

**Question 19** Adapted from Nossedotti (Anderson Birto). (2011). Viral entry [Image]. Retrieved November, 2018, from: https://commons.wikimedia.org/wiki/File:Viral_entry_(Endocytosis_and_fusion).svg

**Question 24** Adapted from Public Domain (2006). Structure of a Skeletal Muscle. [Image]. Retrieved December, 2018, from: https://commons.wikimedia.org/w/index.php?curid=1197565

**Question 33** Adapted from Lawson, R. (2008). Anatomy and Physiology of Animals Structure Plasma Membrane [Image]. Retrieved November, 2018, from: https://commons.wikimedia.org/wiki/File:Anatomy_and_physiology_of_animals_structure_plasma_membrane.jpg

**Question 35** Gal, M. (2007). Graph of Enzyme Activity against Temperature [Image]. Retrieved November, 2018, from: https://commons.wikimedia.org/wiki/File:Enzyme-temperature.png

**Question 36** Adapted from Cancer Research UK (2014). Diagram of an osteocyte – a type of bone cell. [Image]. Retrieved November, 2018, from: https://commons.wikimedia.org/wiki/File:Diagram_of_an_osteocyte_-_a_type_of_bone_cell_CRUK_031.svg

**Question 37** Adapted from OpenStax College (2013). Summary of Epithelial Tissue. [Image]. Retrieved November, 2018, from: https://commons.wikimedia.org/wiki/File:423_Table_04_02_Summary_of_Epithelial_Tissue_CellsN.jpg

**Question 38** Adapted from Termininja (2012). Digestive System [Image]. Retrieved November, 2018, from: https://commons.wikimedia.org/wiki/File:Digestive_system.svg