Section One: Multiple-choice **30% (30 Marks)**

This section has **30** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet (pink) provided. For each question shade the box to indicate your answer. Use only a **pencil** to shade the boxes. If you make a mistake, erase your choice 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: 30 minutes.

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 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.

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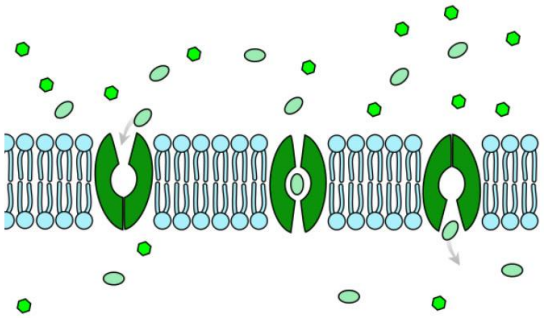
Question 5 and 6 refer to the diagram below:



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.

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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

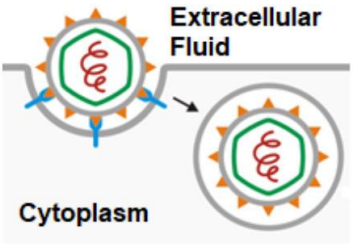
17. Muscle tissue which shows a lack of striations is known as

    (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.
    (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.
(d) vesicular transport.

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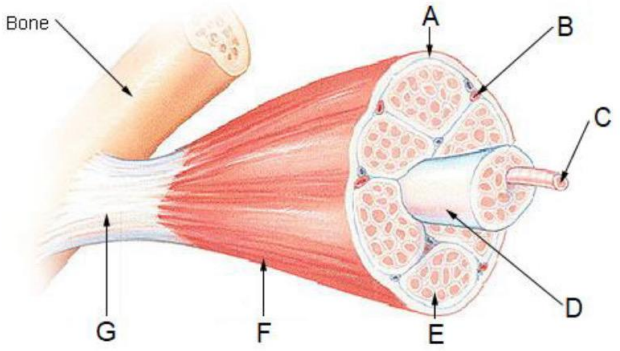
23. Asthma narrows the breathing airways. This can affect the actions of breathing as

(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) ligament.
(c) muscle fibre.
(d) 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

Section Two: Short answer **50%(84 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.

Suggested working time: 80 minutes.

Question 31 **(14 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.
(4 marks)

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Metabolic rate (MR) is the measurement of energy required to perform all body functions such as movement and digestion.

(b) Unborn babies have an opening between their atriums known as the foramen ovale. This allows mixing of blood between the two chambers. This allows blood with some oxygen in it to travel to the lungs, which is necessary because unborn babies get their oxygen directly from the mother and not from the lungs.
Referring to MR explain why this can happen in an unborn baby, but would negatively impact on an adult.
(4 marks)

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(c) Crohn's disease is a gastrointestinal disorder in which the villi of the small intestine become atrophied, breaking down and wasting 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)

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

(1 mark)

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Question 32 **(11 marks)**

A group of Year 11 Human Biology students decided to investigate the relationship between the height of an individual and their lung capacity. 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 height range was calculated.

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

Effect of height on lung capacity

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

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

(2 marks)

(i) Independent.

_____

_____

(ii) Dependent.

_____

_____

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

(1 mark)

_____

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_____

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

(5 marks)

A spare grid can be found at the back of booklet.

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

(2 marks)

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_____

_____

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

(1 mark)

_____

_____

Question 33 **(11 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)

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(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.

(4 marks)

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

(4 marks)

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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)

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

(2 marks)

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

(3 marks)

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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)

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

(6 marks)

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Question 35 **(13 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)

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

(1 marks)

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(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
	Decreases the angle between articulating bones	
	Movement of bone around its long axis	Moving the head to the left and the right
Abduction		

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)

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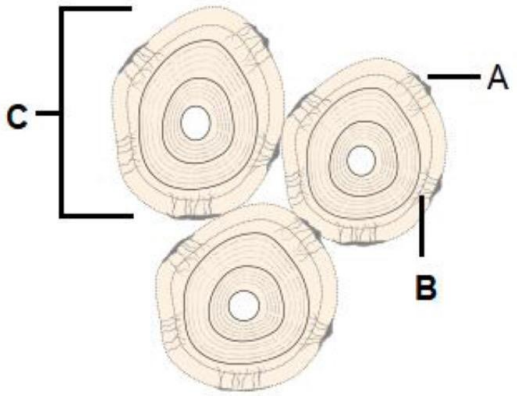
(e) The diagram below shows the structure of a section of compact bone.



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

(1 mark)

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

(2 marks)

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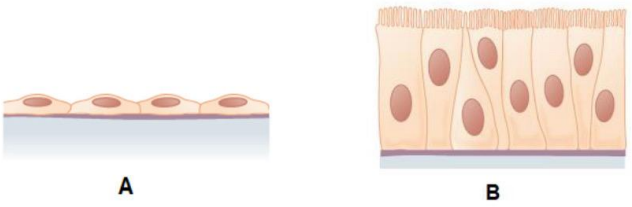
Question 36 **(9 marks)**

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)

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

(1 mark)

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

(3 marks)

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

(2 marks)

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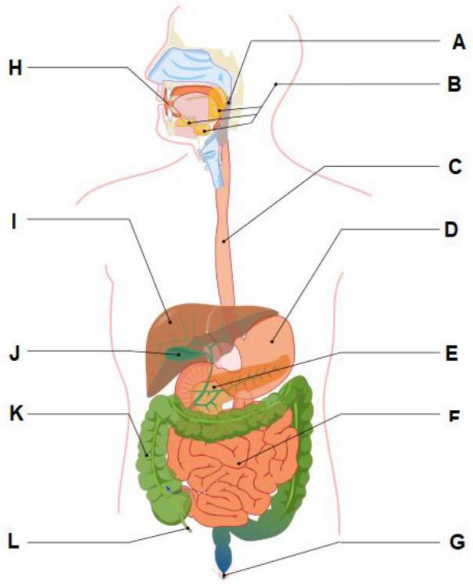
Question 37 **(12 marks)**

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



(a) State the name of the organs labelled:

(2 marks)

C: _____

D: _____

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

(2 marks)

_____

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_____

(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)

(d) Explain the role that bile plays in digestion

(3 marks)

(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)

Answer any **two (2)** questions from Questions 38 to 40.

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

☐ **Question 38** **(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)

(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)

Question 39 **(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)

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

(8 marks)

(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)

Question 40 **(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)

(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)