



SIR ARTHUR LEWIS COMMUNITY COLLEGE
ACADEMIC YEAR (2024/2025) – SEMESTER ONE
END OF SEMESTER EXAMINATION

COURSE TITLE : **BIOLOGY I - CELLS AND ORGANISMS**

COURST CODE : **BIO 116**

LECTURER : **DONALDENE THOMPSON**

DATE : **Tuesday 17th December 2024**

TIME : **1.00 – 3.00 PM**

DURATION : **2 HRS**

STUDENT ID# : **.....**

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. Write your student's ID number on all the work you hand in.
2. This paper consists of FOUR (4) Sections A, B C & D.
3. SECTION A consists of 34 multiple-choice questions. *Each correct answer will be one (1) mark.*
4. SECTION B has 16 critical thinking questions. *Each correct answer will be two (2) marks.*
5. SECTION C has 6 structured questions. *Each correct answer will be one (1) mark.*
6. SECTION D has 1 practical question.
7. A mark will not be deducted for a wrong answer.
8. Do not use correction fluid.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

SECTION A

For each multiple-choice question there are four possible answers A, B C and D. Choose the one you consider correct and circle your answer on your question paper.

1. A monosaccharide is formed from a polysaccharide in what kind of reaction?
 - A. oxidation–reduction reaction
 - B. anabolic reaction
 - C. catabolic reaction
 - D. biosynthetic reaction
2. If anabolic reactions exceed catabolic reactions, the result will be _____.
 - A. weight loss
 - B. weight gain
 - C. metabolic rate change
 - D. development of disease
3. Glycolysis results in the production of two _____ molecules from a single molecule of glucose. In the absence of _____ the end product of glycolysis is _____.
 - A. acetyl CoA, pyruvate, lactate
 - B. ATP, carbon, pyruvate
 - C. pyruvate, oxygen, lactate
 - D. pyruvate, carbon, acetyl CoA
4. The Krebs cycle converts _____ through a cycle of reactions. In the process, ATP, _____, and _____ are produced.
 - A. acetyl CoA; FAD, NAD
 - B. acetyl CoA; FADH₂; NADH
 - C. pyruvate; NAD; FADH₂
 - D. pyruvate; oxygen; oxaloacetate
5. Aerobic cellular respiration results in the production of these two products.
 - A. NADH and FADH₂
 - B. ATP and pyruvate
 - C. ATP and glucose
 - D. ATP and H₂O
6. When NAD⁺ becomes NADH, the coenzyme has been _____.
 - A. reduced
 - B. oxidized
 - C. metabolized
 - D. hydrolyzed
7. Lipids in the diet can be _____.
 - A. broken down into energy for the body
 - B. stored as triglycerides for later use
 - C. converted into acetyl CoA
 - D. all of the above
8. Which of the following is a function of the rough ER?
 - A. production of proteins
 - B. detoxification of certain substances
 - C. synthesis of steroid hormones
 - D. regulation of intracellular calcium concentration
9. Choose the answer that best completes the following analogy: Diffusion is to _____ as endocytosis is to _____.
 - A. filtration; phagocytosis
 - B. osmosis; pinocytosis
 - C. solutes; fluid
 - D. gradient; chemical energy

10. The nucleus and mitochondria share which of the following features?
- A. protein-lined membrane pores
 - B. a double cell membrane
 - C. the synthesis of ribosomes
 - D. the production of cellular energy
11. Which of the following sequences on a DNA molecule would be complementary to GCTTATAT?
- A. TAGGCGCG
 - B. ATCCGCGC
 - C. CGAATATA
 - D. TGCCTCTC
12. Transcription and translation take place in the----- and -----_respectively.
- A. nucleus; cytoplasm
 - B. nucleolus; nucleus
 - C. nucleolus; cytoplasm
 - D. cytoplasm; nucleus
13. What is a genetically modified organism (GMO)?
- A. a plant with certain genes removed
 - B. an organism with an artificially altered genome
 - C. a hybrid organism
 - D. any agricultural organism produced by breeding or biotechnology
14. In the reproductive cloning of an animal, the genome of the cloned individual comes from _-----.
- A. A sperm cell
 - B. An egg cell
 - C. Any gamete cell
 - D. A body cell
15. A suggested and testable explanation for an event is called a _____.
- A. hypothesis
 - B. variable
 - C. theory
 - D. control
16. What structures are phospholipids important components of?
- A. the double bond in hydrocarbon chains
 - B. the plasma membrane of animal cells
 - C. the ring structure of steroids
 - D. the waxy covering on leaves
17. Which of the following characteristics is NOT true for saturated fats?
- A. They are solid at room temperature.
 - B. They have single bonds within the carbon chain.
 - C. They tend to dissolve in water easily
 - D. They are soluble in ethanol.
18. Where is cholesterol found in cell membranes?
- A. attached to the inner side of the membrane
 - B. attached to the outer side of the membrane
 - C. floating in the phospholipid tail layer
 - D. penetrating both lipid layers
19. The α -helix and the β -pleated sheet are part of which protein structure?
- A. the primary structure
 - B. the secondary structure
 - C. the tertiary structure
 - D. the quaternary structure

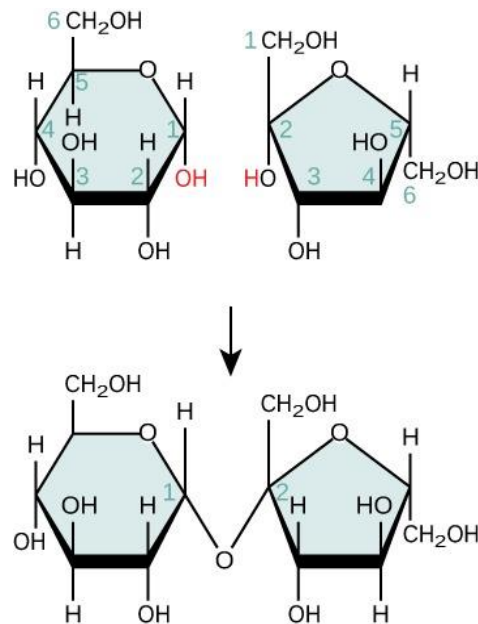
20. Chemiosmosis involves _____.
A. the movement of electrons across the cell membrane
B. the movement of hydrogen atoms across a mitochondrial membrane
C. the movement of hydrogen ions across a mitochondrial membrane
D. the movement of glucose through the cell membrane
21. What is removed from pyruvate during its conversion into an acetyl group?
A. oxygen
B. ATP
C. B vitamin
D. carbon dioxide
22. Which statement about thylakoids in eukaryotes is *NOT* correct?
A. Thylakoids are assembled into stacks.
B. Thylakoids exist as a maze of folded membranes.
C. The space surrounding thylakoids is called stroma.
D. Thylakoids contain chlorophyll.
23. What is the energy of a photon first used to do in photosynthesis?
A. split a water molecule
B. energize an electron
C. produce ATP
D. synthesize glucose
24. Plants produce oxygen when they photosynthesize. Where does the oxygen come from?
A. splitting water molecules
B. ATP synthesis
C. the electron transport chain
D. chlorophyll
25. Which color(s) of light does chlorophyll *a* reflect?
A. red and blue
B. green
C. red
D. blue.
26. Where in plant cells does the Calvin cycle take place?
A. thylakoid membrane
B. thylakoid space
C. stroma
D. granum
27. The observable traits expressed by an organism are described as its _____.
A. phenotype
B. genotype
C. alleles
D. zygote
28. An allosteric inhibitor does which of the following?
A. binds to an enzyme away from the active site and changes the conformation of the active site, increasing its affinity for substrate binding
B. binds to an active site and blocks it from binding substrate
C. binds to an enzyme away from the active site and changes the conformation of the active site, decreasing its affinity for the substrate
D. binds directly to the active site and mimics the substrate
29. What happens if an enzyme is not functioning in a chemical reaction in a living organism that needs it?
A. The reaction stops.
B. The reaction proceeds, but much more slowly.
C. The reaction proceeds faster without the interference.
D. There is no change in the reaction rate.

30. Which of the following is NOT true about enzymes?
- A. They increase the ΔG of reactions.
 - B. They are usually made of amino acids.
 - C. They lower the activation energy of chemical reactions.
 - D. Each one is specific to the particular substrate, or substrates, to which it binds
31. The tails of the phospholipids of the plasma membrane are composed of ----- and are -----?
- A. phosphate groups; hydrophobic
 - B. fatty acid groups; hydrophilic
 - C. phosphate groups; hydrophilic
 - D. fatty acid groups; hydrophobic
32. Water moves via osmosis _____.
- A. throughout the cytoplasm
 - B. from an area with a high concentration of other solutes to a lower one
 - C. from an area with a low concentration of solutes to an area with a higher one
 - D. from an area with a low concentration of water to one of higher concentration
33. Active transport must function continuously because _____.
- A. plasma membranes wear out
 - B. cells must be in constant motion
 - C. facilitated transport opposes active transport
 - D. diffusion is constantly moving the solutes in the other direction
34. Which type of bond represents a weak chemical bond?
- A. hydrogen bond
 - B. ionic bond
 - C. covalent bond
 - D. polar covalent bond

SECTION B – CRITICAL THINKING QUESTIONS

35. A change in DNA on a chromosome affects all proteins made from that gene for the life of the cell. A change in the RNA involved in protein production is short lived. What is the difference between the effects of the changes in the two types of nucleic acids?
- A. DNA is the genetic material that is passed from parent cells to daughter cells and to future generations.
 - B. DNA would not affect the individuals as the proteins made are finally altered and modified. RNA would cause harm to the person as the RNA is encoded by the DNA and is not altered.
 - C. DNA is the genetic material and is transferred from one generation to another making use of repair mechanisms for every mutation. The RNA does not use a repair mechanism.
 - D. DNA, when mutated, makes use of the repair mechanisms and can be repaired whereas RNA is not repaired and is transferred in generations.
36. What would happen if even one amino acid is substituted for another in a polypeptide? What would be an example?
- A. The change will definitely not be sufficient to have any effect on the function and structure of the protein.
 - B. The amino acid may not show any significant effect on the protein structure and function or it may have a significant effect, as in the case of hemoglobin in individuals with sickle cell trait.
 - C. These changes would increase the possibility of having extra bends and loops in the proteins as in Leber congenital disease.
 - D. These changes would modify the structures of proteins making them nonfunctional.

37.



Complex polymers are built from combinations of smaller monomers. What type of reaction is shown and what is a product of the following reaction?

- A. a synthesis reaction producing glucose
- B. a hydrolysis reaction producing fructose
- C. a condensation reaction producing lactose
- D. a dehydration reaction producing water

38. Read the following questions. Does the statement lend itself to investigation using the scientific method? In other words, is the hypothesis falsifiable (can be proven false)?

- 1. Is macaroni and cheese tastier than broccoli soup?
- 2. Are hummingbirds attracted to the color red?
- 3. Is the moon made out of green cheese?
- 4. Is plagiarism dishonest?

- A. Questions 1 and 2 are subjective and cannot be disproven using scientific method. Questions 3 and 4 can be tested using scientific method.
- B. Questions 3 and 4 are subjective and cannot be disproven using scientific method. Questions 1 and 2 can be tested using scientific method.
- C. Questions 1 and 3 are subjective and cannot be disproven using scientific method. Questions 2 and 4 can be tested using scientific method.
- D. Questions 1 and 4 are subjective and cannot be disproven using scientific method. Questions 2 and 3 can be tested using scientific method.

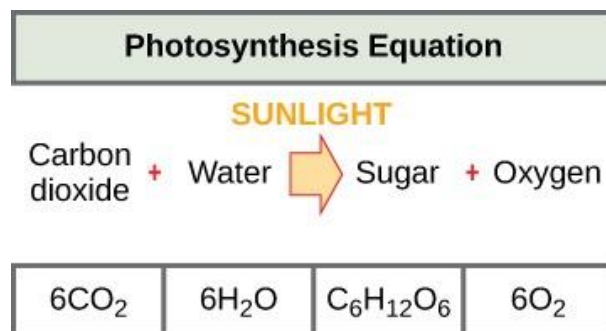
39. Consider the levels of organization of the biological world and place each of these items in order from smallest level of organization to most encompassing: skin cell, elephant, water molecule, planet Earth, tropical rainforest, hydrogen atom, wolf pack, liver.

- A. hydrogen atom, water molecule, skin cell, liver, elephant, wolf pack, tropical rainforest, planet Earth
- B. hydrogen atom, skin cell, water molecule, liver, elephant, wolf pack, tropical rainforest, planet Earth
- C. hydrogen atom, skin cell, water molecule, liver, wolf pack, elephant, tropical rainforest, planet Earth
- D. water molecule, hydrogen atom, skin cell, liver, elephant, wolf pack, tropical rainforest, planet Earth

40. Mitochondria are observed in plant cells that contain chloroplasts. Why do you find mitochondria in photosynthetic tissue?
- A. Mitochondria are not needed but are an evolutionary relic.
 - B. Mitochondria and chloroplasts work together to use light energy to make sugars.
 - C. Mitochondria participate in the Calvin cycle/light independent reactions of photosynthesis.
 - D. Mitochondria are required to break down sugars and other materials for energy
41. What happens to the proteins that are synthesized on free ribosomes in the cytoplasm? Do they go through the Golgi apparatus?
- A. These proteins move through the Golgi apparatus and enter in the nucleus.
 - B. These proteins go through the Golgi apparatus and remain in the cytosol.
 - C. The proteins do not go through the Golgi apparatus and move into the nucleus for processing.
 - D. The proteins do not go through the Golgi apparatus and remain free in the cytosol.
42. How does enzyme feedback inhibition benefit a cell?
- A. Feedback inhibition benefits the cell by blocking the production of the products by changing the configuration of enzymes. This will prevent the cells from becoming toxic.
 - B. Feedback inhibition benefits the cell by blocking the production of the reactants by changing the configuration of enzymes. This will prevent the cells from becoming toxic.
 - C. Feedback inhibition benefits the cell by blocking the production of the products by changing the configuration of reactants. This will prevent the cells from becoming toxic.
 - D. Feedback inhibition benefits the cell by blocking the production of the products by reducing the reactants. This will prevent the cells from becoming toxic
43. What is phosphorylation as it occurs in chemical reactions?
- A. Phosphorylation refers to the attachment of a phosphate to another molecule to facilitate a chemical reaction.
 - B. Phosphorylation is the uptake of a phosphorous molecule by an ATP molecule to power chemical reactions.
 - C. Phosphorylation is the release of a third phosphorous molecule of ATP during hydrolysis.
 - D. Phosphorylation is the breakdown of a pyrophosphate molecule which gives phosphate ions
44. How does ATP supply energy to chemical reactions?
- A. ATP dissociates and the energy released by breaking of a phosphate bond within ATP is used for phosphorylation of another molecule. ATP hydrolysis also provides energy to power coupling reactions.
 - B. ATP utilizes energy to power exergonic reactions by hydrolysis of ATP molecule. The free energy released as a result of ATP breakdown is used to carry out metabolism of products.
 - C. ATP utilizes energy to power endergonic reactions by dehydration of ATP molecule. The free energy released as a result of ATP breakdown is used to carry out metabolism of products.
 - D. ATP utilizes the energy released from the coupling reactions and that energy is used to power the endergonic and exergonic reactions.

45. Describe the connection between anabolic and catabolic chemical reactions in a metabolic pathway.

- A. Catabolic reactions produce energy and simpler compounds, whereas anabolic reactions involve the use of energy to make more complex compounds.
- B. Catabolic reactions produce energy and complex compounds are formed, whereas in anabolic reactions free energy is utilized by complex compounds to make simpler molecules.
- C. Catabolic reactions utilize energy and gives simpler compounds, whereas in anabolic reactions reactions, energy is produced and simpler compounds are used to make complex molecules.
- D. Catabolic reactions produce energy and water molecules, whereas in anabolic reactions this free energy is utilized by simpler compounds to make only proteins and nucleic acids.



46. How does the equation relate to both photosynthesis and cellular respiration?

- A. Photosynthesis utilizes energy to build carbohydrates while cellular respiration metabolizes carbohydrates.
- B. Photosynthesis utilizes energy to metabolize carbohydrates while cellular respiration builds carbohydrates.
- C. Photosynthesis and cellular respiration both utilize carbon dioxide and water to produce carbohydrates.
- D. Photosynthesis and cellular respiration both metabolize carbohydrates to produce carbon dioxide and water.

47. What is the overall outcome of the light reactions in photosynthesis?

- A. NADPH and ATP molecules are produced during the light reactions and are used to power the light independent reactions.
- B. NADPH and ATP molecules are produced during the light reactions, which are used to power the light dependent reactions.
- C. Sugar and ATP are produced during the light reactions, which are used to power the light independent reactions.
- D. Carbon dioxide and NADPH are produced during the light reactions, which are used to power the light dependent reactions.

48. The ABO blood groups in humans are expressed as the I^A , I^B , and i alleles. The I^A allele encodes the A blood group antigen, I^B encodes B, and i encodes O. Both A and B are dominant to O. If a heterozygous blood type A parent ($I^A i$) and a heterozygous blood type B parent ($I^B i$) mate, one quarter of their offspring are expected to have the AB blood type ($I^A I^B$) in which both antigens are expressed equally. Therefore, ABO blood groups are an example of:

- A. multiple alleles and incomplete dominance
- B. codominance and incomplete dominance
- C. incomplete dominance only
- D. multiple alleles and codominance

49. Consider a pendulum swinging. Which type(s) of energy is/are associated with the pendulum in the following instances:

1. the moment at which it completes one cycle, just before it begins to fall back towards the other end
2. the moment that it is in the middle between the two ends
3. just before it reaches the end of one cycle (before step 1)

A.

- a. potential and kinetic
- b. potential and kinetic
- c. kinetic

B.

- a. potential
- b. potential and kinetic
- c. potential and kinetic

C.

- a. potential
- b. kinetic
- c. potential and kinetic

D.

- a. potential and kinetic
- b. kinetic
- c. kinetic

50. Which of the following comparisons or contrasts between endergonic and exergonic reactions is false?

- A. Both endergonic and exergonic reactions require a small amount of energy to overcome an activation barrier.
- B. Endergonic reactions have a positive ΔG and exergonic reactions have a negative ΔG .
- C. Endergonic reactions consume energy and exergonic reactions release energy.
- D. Endergonic reactions take place slowly and exergonic reactions take place quickly.

SECTION C – SHORT ANSWER QUESTIONS

51. The properties of water dictate many chemical interactions present in the cell.

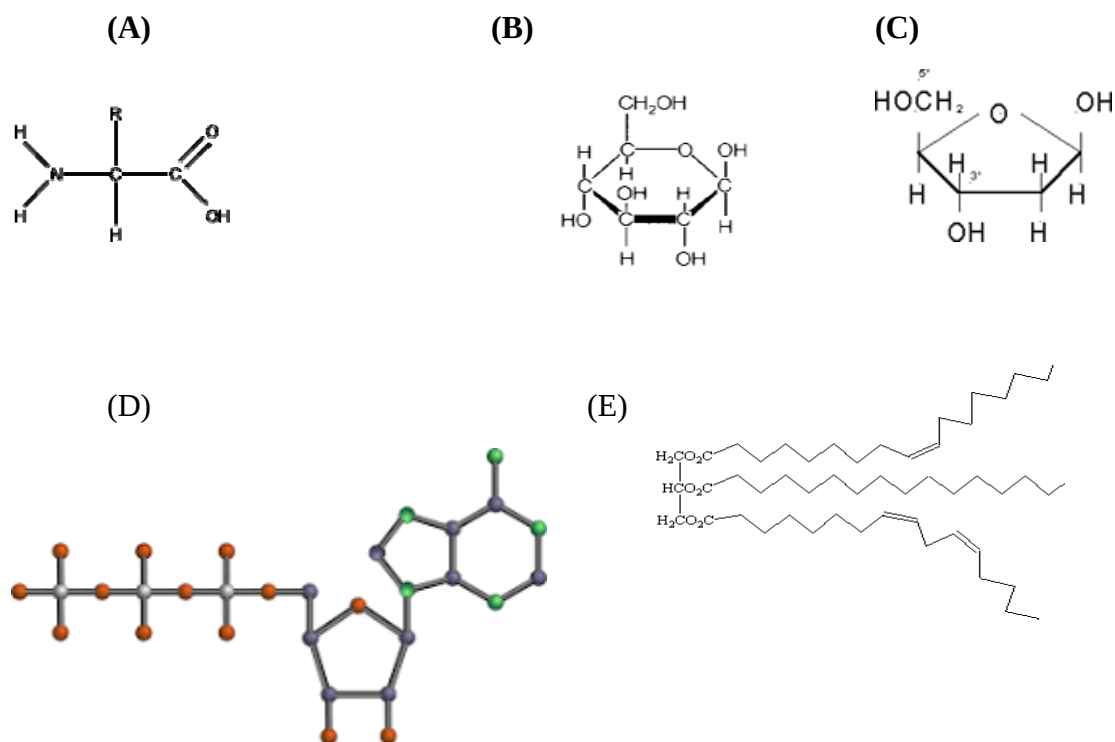
Property: Water is cohesive.

(i) Define cohesive (1 mark)

(ii) Explain the chemical interactions and properties that make water cohesive. (4)

Questions 52 – 55 refer to the following chemical structures.

After each statement indicate the correct molecule each refers using its assigned letter adjacent.



52. Can be modified and used as the fundamental component of a cell membrane _____

53. Is the building block of both hemoglobin and chlorophyll _____

54. is responsible for providing energy for nearly all endergonic reactions in the human body _____

55. a carbohydrate utilized in the synthesis of polymers of DNA _____ -

56. For each sequence of DNA is shown. Write the complementary RNA sequence underneath the letters, then use the codon chart below to determine the amino acid sequence:

a. DNA → T A C C A T G G A A G T A C T

RNA →

Amino Acids →

b. DNA → T T C A A T G G T C T A G G G

RNA →

Amino Acids →

c. DNA → A C A T T T C A G A C C G T C

RNA →

Amino Acids →

mRNA Codon chart

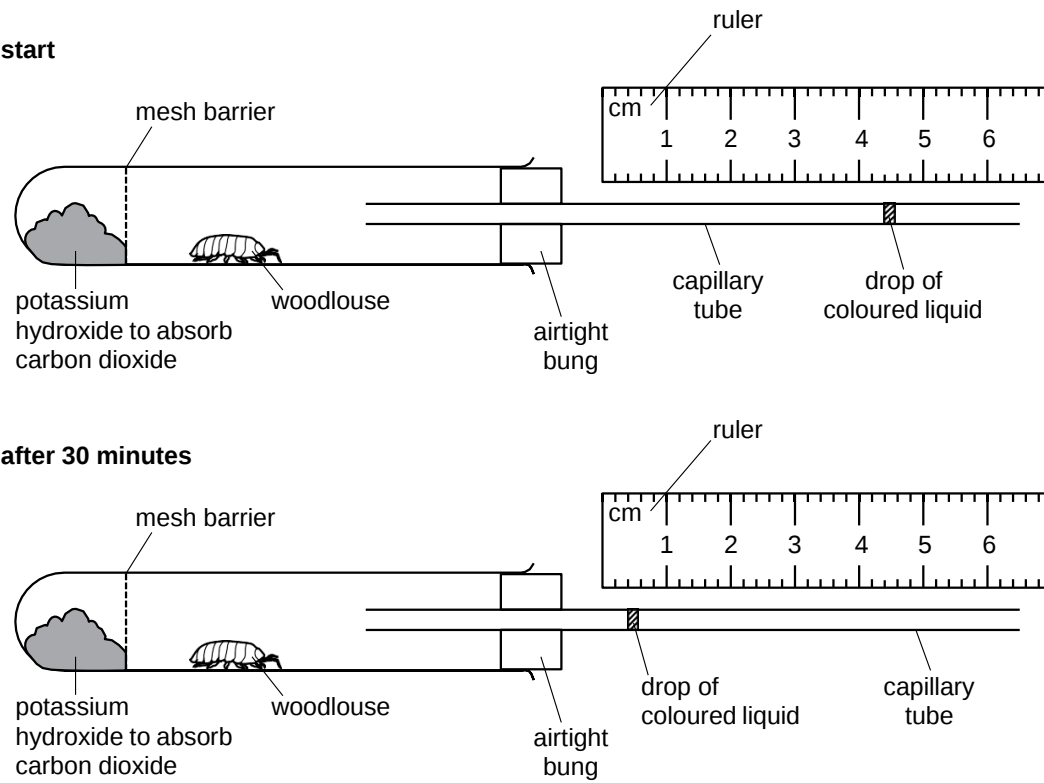
		Second Letter					
		U	C	A	G		
1st letter	U	UUU Phe UUC UUA Leu UUG	UCU Ser UCC UCA UCG	UAU Tyr UAC UAA Stop UAG Stop	UGU Cys UGC UGA Stop UGG Trp	U C A G	3rd letter
	C	CUU Leu CUC CUA CUG	CCU Pro CCC CCA CCG	CAU His CAC CAA Gln CAG	CGU Arg CGC CGA CGG	U C A G	
	A	AUU Ile AUC AUA AUG Met	ACU Thr ACC ACA ACG	AAU Asn AAC AAA Lys AAG	AGU Ser AGC AGA Arg AGG	U C A G	
	G	GUU Val GUC GUA GUG	GCU Ala GCC GCA GCG	GAU Asp GAC GAA Glu GAG	GGU Gly GGC GGA GGG	U C A G	

SECTION D – PRACTCAL QUESTION

1 A woodlouse is a small animal.

The rate of respiration of a woodlouse can be measured using a simple respirometer as shown in Fig. 2.1.

As the woodlouse respire the drop of coloured liquid moves along the capillary tube.



- A. Record the position of the drop of coloured liquid in the capillary tube shown in FIG. 2.1 at the start and after 30 minutes.

Start _____ mm

After 30 minutes _____ mm

- B. Calculate the distance moved by the drop of colored liquid in 30 minutes.

Distance moved _____ mm

- C. Calculate the rate of movement of the drop of colored liquid in mm per minute.

Give your answer to one decimal place. SHOW WORKING

END OF EXAMINATION