NAME: Lawrence Arum Bronsted **SIGNATURE** LAB

END OF TERM EXAMINATIONS, 2022

BIOLOGY PAPER P530/1

2 Hours 30 minutes

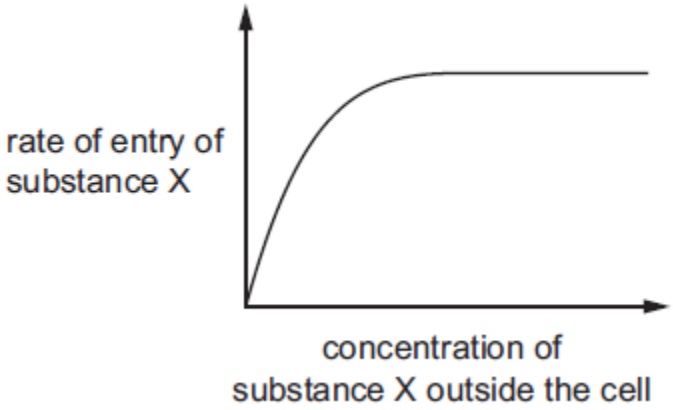
INSTRUCTIONS TO CANDIDATES

Answer **all** questions in both Sections **A** and **B**.
Answers to section **A** should be written in the boxes provided.
Answers to section **B** should be written in the spaces provided.

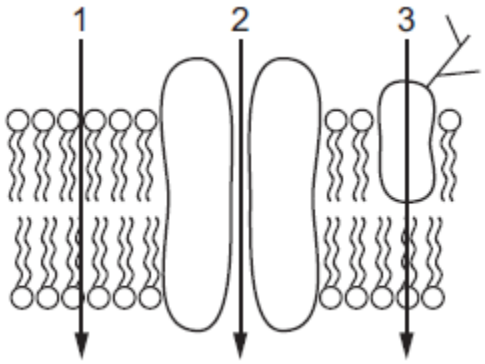
For Examiner's Use Only		
Questions		Marks
Section **A**: 1 – 40		
Section **B**	41	
	42	
	43	
	44	
	45	
	46	
TOTAL		

SECTION A (40 MARKS)

1. On a dry, sunny day, how does water vapour move through the stomata of a leaf?
   A. Into the leaf by diffusion
   B. Into the leaf by respiration
   C. Out of the leaf by diffusion
   D. Out of the leaf by respiration
2. The graph shows how the rate of entry of substance **X** into a cell changes as the concentration of substance **X** outside the cell increases.



Which of the following pathways could substance **X** use to enter across the cell surface membrane in the diagram below.



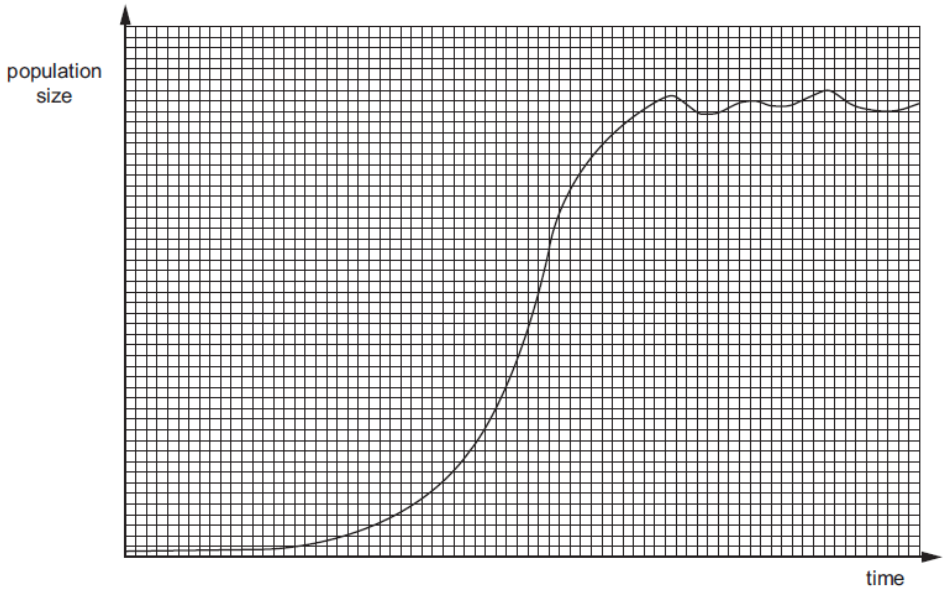
A. 1 and 2
B. 1 only
C. 2 and 3
D. 2 only

3. One strand of a DNA molecule contains the base sequence AGT. What is the base sequence on the other strand of the DNA molecule?
   A. AGT
   B. GAT
   C. TAC
   D. TCA
4. Newborn babies have passive immunity. Why is this only temporary?
   A. No memory cells are produced in the baby.

B. The antibodies are insufficient in number.
C. The antibodies only act in the mother
D. The immunity is not inherited.

5. Haemophilia is a sex linked recessive condition. A haemophiliac man has one son who inherited haemophilia and two more sons who have not. The man's wife is pregnant again. If this baby is a girl, what is the chance that she will have haemophilia?
   A. 0%
   B. 25%
   C. 50%
   D. 75%
6. What contributes to the movement of water through the xylem vessel elements?
   A. Cohesion of water molecules through hydrogen bonding
   B. Ion movement followed by passive osmosis
   C. Negative water potential in the xylem
   D. Surface tension at the top of the plant
7. Which two polysaccharides both have 1,6 glycosidic bonds **and** are branched?
   A. Amylopectin and amylose
   B. Amylopectin and glycogen
   C. Amylose and glycogen
   D. Glycogen and cellulose
8. Which one of the following processes would be least affected as the fluidity of cell membrane decreases?
   A. Active transport
   B. Diffusion
   C. Endocytosis
   D. Osmosis
9. How many different arrangements of four bases into triplets can be made?
   A. 3 + 4
   B. 3×4
   C. 3^4
   D. 4^3
10. Which structure is **only** found in typical eukaryotic animal cells?
    A. Cell surface membrane
    B. Centriole
    C. Golgi body
    D. Ribosomes

11. Some rabbits colonised an island for the first time.
The graph shows how their population size changed over the next few years.



What explains the way the size of the rabbit population changed during the exponential phase?

A. Birth rate and death rate in equilibrium
B. Increasing number of rabbits able to reproduce
C. Increase in the number of predators
D. Limiting factors begin to take effect.

12. The following events occur during transcription.

(I) Bonds break between complementary bases
(II) Bonds form between complementary bases
(III) Sugar-phosphate bonds form
(IV) Free nucleotides pair with complementary nucleotides

Before the mRNA molecule leaves the nucleus, which events will have occurred twice?

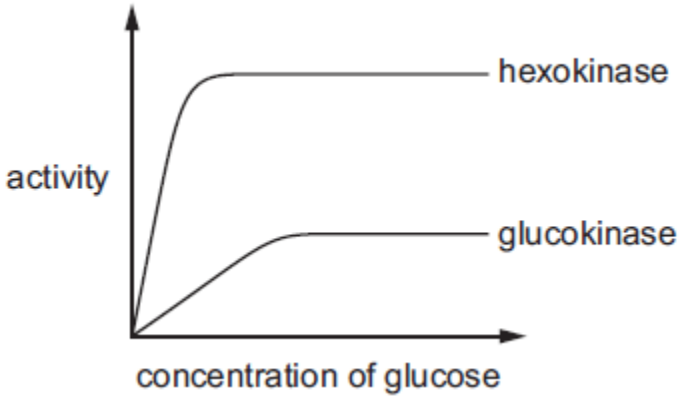
A. (I), (II), (III) and (IV)
B. (I), (III), and (IV) only
C. (II), (III), and (IV) only
D. (I) and (II) only

13. Scientists have shown that the oxygen dissociation curves for haemoglobin of smaller mammals are to the right of those of larger mammals. What does this suggest about the haemoglobin of smaller mammals?

A. It carries more oxygen when the partial pressures of oxygen is higher

B. It releases oxygen less easily at lower partial pressures of oxygen
C. It saturates with oxygen more easily
D. **It unloads oxygen more easily**.

14. The enzyme glucokinase in the liver and hexokinase in the brain both catalyse the phosphorylation of glucose. The activity of each enzyme was measured at different concentrations of glucose. The graph in the figure below shows the results.

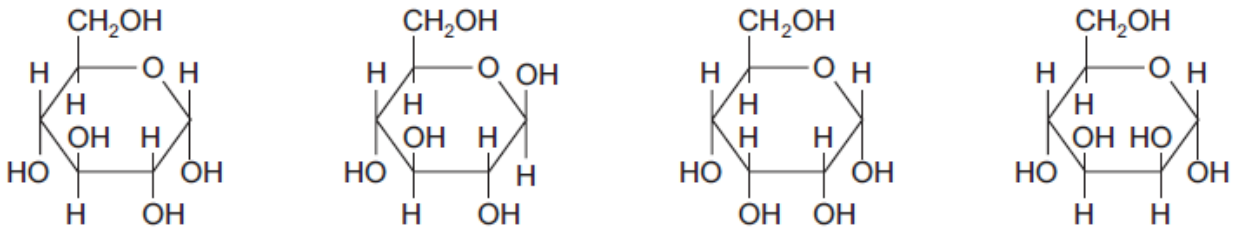


What describes the different activities of the two enzymes?

A. Both enzymes hold glucose and ATP molecules together at the active site.
B. Glucokinase becomes saturated with glucose at a lower concentration of glucose than hexokinase
C. Glucokinase phosphorylates more molecules of glucose per minute
D. The affinity of hexokinase for glucose is greater than that of glucokinase

15. The diagrams show four monosaccharides with the formula $C_6H_{12}O_6$.

1 2 3 4



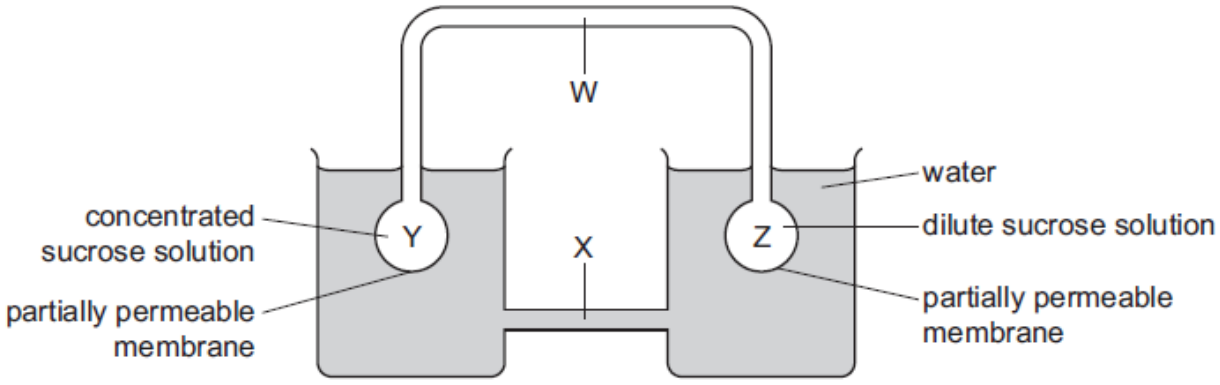
Which diagrams do **not** show glucose molecules?

A. 1 and 2
B. 1 and 4
C. 2 and 3
D. 3 and 4

16. Which changes to the water potential and the volume of liquid in the phloem occur when amino acids are transferred from leaves to be transported to a sink in the phloem sieve tube element?

	Water potential in the phloem sieve tube element	**Volume of liquid in phloem sieve tube**
A	Higher	decreases
B	Higher	increases
C	Lower	decreases
D	**lower**	**increases**

17. Which of the following occur when active immunity is artificially induced?
    A. Non-self antibodies attack self antigens
    B. Non-self antigens attack self antibodies
    C. Self antibodies attack non-self antigens
    D. Self antigens attack non-self antibodies
18. Which substances can pass directly through cell surface membranes **without** using a carrier protein or channel protein?
    (I) Carbon dioxide
    (II) Calcium ions and sodium ions
    (III) Water
    A. (I) and (II)
    B. (I) and (III)
    C. (II) and (III)
    D. (II) only
19. The diagram shows a model to demonstrate mass flow.



In a plant, what are the structures W, X, Y and Z and what is the direction of flow of solution along W?

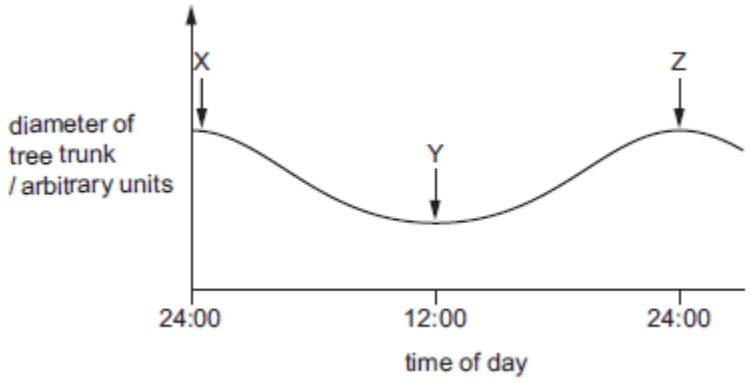
	Phloem	Xylem	Roots	Leaves	Direction of flow along W
A	W	X	Y	Z	from Z to Y
B	**W**	**X**	**Z**	**Y**	**from Y to Z**
C	X	W	Y	Z	from Y to Z
D	X	W	Z	Y	from Z to Y

20. A double stranded DNA molecule was analysed and 29% of its nucleotide bases were found to be adenine. What percentage of its nucleotide bases will be cytosine?
    A. 21%
    B. 29%
    C. 42%
    D. 58%
21. Which organelle is present in large quantities in ciliated epithelial cells?
    A. Golgi body
    B. Lysosomes
    C. Mitochondria
    D. Rough endoplasmic reticulum
22. Which of the following describes possible mechanisms by which sucrose is transferred from mesophyll cells into a companion cell?
    (I) Co-transport with the active transport of hydrogen ions
    (II) Co-transport by passive diffusion of hydrogen ions
    (III) Facilitated diffusion through plasmodesmata
    A. (I) and (III)
    B. (II) and (III)
    C. (I) only
    D. (II) only
23. All the following kinds of plants or animals characterize the initial stages of succession except...
    A. Species that invest large amounts of resources or time into development of progeny
    B. Species that can tolerate poor growing conditions
    C. Pioneer species
    D. Species with good dispersal ability.
24. Which of the following is NOT a component of cell walls?
    A. Chitin

B. Cellulose
C. Peptidoglycan
D. Actin

25. Which roles of the cell surface membrane are a result of the properties of the phospholipid?
(I) To allow cytokinesis to occur in mitotic cell division
(II) To allow entry and exit of oxygen and carbon dioxide
(III) To allow the phagocytosis of a bacterium into a cell
A. (I), (II) and (III)
B. (I) and (II) only
C. (I) and (III) only
D. (II) and (III) only

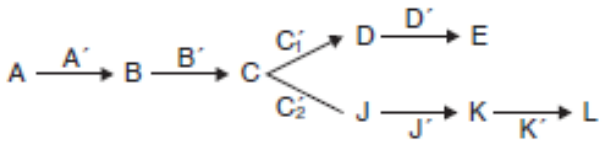
26. The graph in the figure below shows the diameter of a tree trunk at different times.



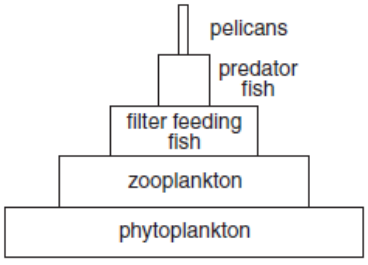
Which statement is correct?
A. X shows the expansion of the trunk as water fills the xylem during transpiration
B. Y shows a reduction in diameter of trunk as water is lost from the xylem due to transpiration
C. Y shows a reduction in diameter of trunk due to water held in tension in the xylem
D. Z shows the expansion of the trunk as the phloem tissue acts as a sink at night.

27. Which of the following are found in both chloroplasts and typical prokaryotic cells?
A. 70s ribosomes and circular DNA
B. 70s ribosomes only
C. 80s ribosomes and circular DNA
D. Circular DNA only

28. Which statement about triglycerides is correct?
    A. They are made up of three fatty acids combined with glycogen
    B. They are more saturated with hydrogen compared with phospholipids
    C. They form a bilayer in the cell surface membrane of cells
    D. They have a lower ratio of oxygen to carbon compared with carbohydrates.
29. All of the following statements are correct except...
    A. Spindle fibers are composed of large microtubules
    B. All eukaryotic cells have centrioles
    C. Centrioles consist of nine triplets of microtubules arranged in a circle
    D. Many of the microtubules in a spindle apparatus attach to kinetochores of chromosomes.
30. Below is a schematic diagram of a series metabolic reactions in which, C_1' catalyses the conversion of C to D, C_2' catalyses the conversion of C to J.



Assume that product E is an allosteric effector that inhibits enzyme D.
Normally, products E and L are consumed by other reactions.
Which of the following would likely to happen if product E were not consumed by other reactions?
    A. The net rate of production of product B would decrease
    B. The net rate of production C would decrease
    C. The net rate of production of product D would decrease
    D. The net rate of production of product J would decrease
31. Roundworms have all the following characteristics except...
    A. A notochord
    B. Bilateral symmetry
    C. A Pseudo coelom
    D. A mesoderm germ layer
32. Below is a pyramid of biomass.



In which trophic level would the biological magnification of pesticide, DDT be most evident?
A. Phytoplankton
B. Zooplankton
C. Pelicans
D. Predator fish

33. Below are properties of water.
    (I) Able to form hydrogen bonds with other molecules
    (II) Less dense when frozen
    (III) Able to hold a lot of heat

    What allows a small insect to rest on the surface of a pond?

    A. (I) and (II)
    B. (II) and (III)
    C. (I) only
    D. (II) only

34. Where does water evaporate from during transpiration?
    A. Inside the guard cells
    B. The outer surface of the epidermal cell layer
    C. The sub-stomatal cavity
    D. The surface of spongy mesophyll cell walls

35. The following glands are involved in digestive role in mammals except,
    A. Simple tubular gland
    B. Simple branched tubular gland
    C. Compound tubular gland
    D. Coiled tubular gland

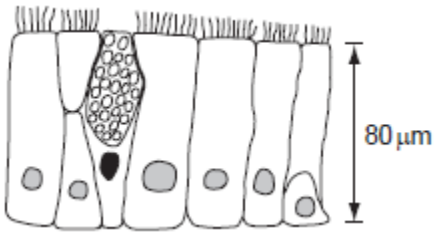
36. Which type of cell has a large number of glycoproteins on the cell surface membrane?
    A. Ciliated cell
    B. Goblet cell
    C. Lymphocyte
    D. Red blood cell

37. Which soil would have the smallest number of denitrifying bacteria?
    A. Compressed agricultural soil
    B. Poorly drained forest soil
    C. Water –logged clay soil
    D. Well –aerated garden soil

38. A cell in the process of meiosis was seen to have a spindle with sister chromatids being drawn towards opposite poles of the cell. In what stage of meiosis was the cell?
    A. Anaphase I
    B. Anaphase II
    C. Metaphase I
    D. Metaphase II

39. Which statements about Protoctista are correct?
    (I) A eukaryote that is not a fungus, plant or animal is a protoctist
    (II) An organism with cellulose cell walls and chloroplasts may be a protoctist
    (III) An organism existing as a group of similar cells may be a protoctist
    (IV) A single-celled heterotrophic eukaryote is a protoctist
    A. (I), (II), (III) and (IV)
    B. (I), (II) and (IV) only
    C. (II) and (III) only
    D. (III) and (IV) only

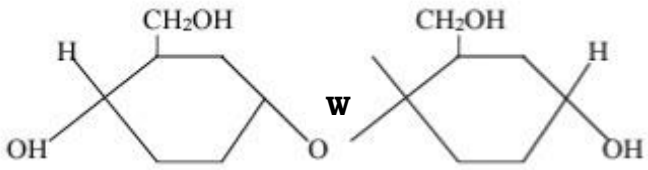
40. The diagram shows a section through a type of epithelium found in the respiratory system.



Which of the following parts of the respiratory system is **not** the correct site of this type of epithelium?
    A. Trachea only
    B. Bronchus only
    C. Trachea and Bronchus
    D. All bronchioles

SECTION B (60MARKS)

41. The carbohydrate illustrated below has been formed from two hexose sugars.



(a) Name the:

(i) hexose sugar from which the carbohydrate above was formed. (**1mark**)

Alpha/α-glucose;✓ **Rej. Glucose alone**

(ii) type of carbohydrate formed above. **(1mark)**

Disaccharide;✓ Rej. Maltose; Double/2-sugar units

(iii) chemical bond, **W** which joins the two hexose sugar units above. **(1mark)**

1, 4 glycosidic bond;✓ Rej Glycosidic alone

(iv) chemical reaction in which the carbohydrate above has been formed.

(1mark)

Condensation; ✓

(b) Outline **two** sources from which the carbohydrate formed above can be obtained. **(2 marks)**

Animals' gut during digestion of starch;✓
Industrially, it is extracted from germinating cereals/barley;✓
Acc; Malt extract;

(c) Of what significance is carbohydrates in living organisms? **(4 marks)**

Oxidised during respiration;✓releasing energy to drive other metabolic activities;✓
Energy store;✓e.g. starch in plants; and glycogen in animals and fungi;
Structural material of plant cell wall; bacterial cell wall; and insect's exoskeleton;✓
Some form an integral part of structure of nucleic acids;✓
@ 1 mark

42. (a) Name the **four** different classification of tissues in animals. **(2 marks)**

Epithelial tissues;✓
Connective tissue;✓
Muscle tissue;✓
Nervous tissue;✓

(b) How are the following tissues suited for their roles in mammals?

(i) Cardiac muscle **(3 marks)**

- **Richly supplied with many blood capillaries; to meet high oxygen and nutrient demands;✓and removal of wastes;✓**
- **Numerous mitochondria in the sarcoplasm;✓provide large amounts of ATP to effect contraction;✓**
- **Numerous sarcoplasmic reticula in the sarcoplasm;✓which store and release calcium ions that initiate the contraction process;✓**

- **Myofibrils each containing actin and myosin filaments;✓ which cause the whole muscle to contract;✓**
- **Sarcoplasm with enzymes that catalyse metabolic activities such as respiration;✓✓**
- **Undergoes rapid rhythmic contractions and relaxations with very long absolute refractory period;✓thus doesn't fatigue;✓**
- **Intercalated discs ensure rapid and uniform spread of impulses through the tissue from cell to cell;✓allowing all cells to contract rhythmically and simultaneously;✓**
- **Intercalated discs also form tough electrical junctions between myofibrils of adjacent cells;✓allowing diffusion of ions across cells;✓**

Any three correct adaptations @ 1 mark

(ii) Areolar tissue **(3 marks)**

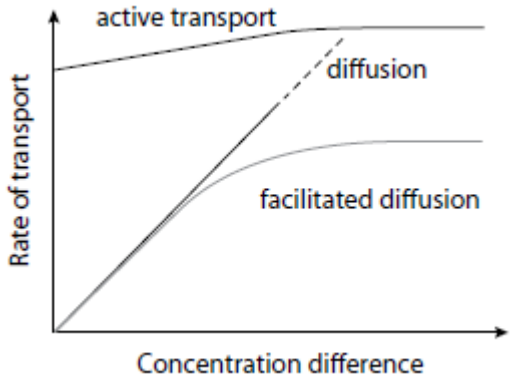
- **Mast cells;✓secrete anticoagulant/heparin;✓that prevents blood clotting within blood vessels;✓blood flows continuously distributing metabolites to respiring tissues;✓**
- **Mast cells also release histamine and cytokines;✓causing local vasodilation; blood flow carrying with it white blood cells to injured sites is increased;✓preventing infection from pathogenic bacteria;✓**
- **Large amoeboid cells/macrophages;✓for defense against infection;✓through phagocytosis of pathogenic bacteria;✓**
- **Made up of tough;✓non-stretchable;✓densely packed collagen fibres;✓with great tensile strength;✓for packing and binding muscles to bones at the tendons;✓**
- **Made up of stretchable elastic fibres;✓permitting tissues to recover shape quickly on distortion such as in larger arteries and alveoli of lungs;✓**
- **Elastic fibres are also strong;✓allowing binding of bones together at the ligaments;✓**
- **Fat cells;✓store fats in body structures;✓insulating the body against heat loss in cold weather;✓and forms a sheath around body organs;✓separating them from each other reducing interference with each other's activities;✓**
- **Fibroblasts;✓produce collagen fibres and elastic fibres;✓**

@ ½ mark

(c) Give **two** structural differences between a bone and cartilage. **(2 marks)**

Bone	Cartilage
Matrix is ossein	**Matrix is chondrin**
Surrounded by periosteum	**Surrounded by perichondrium**
Blood vessels and nerves present	**Blood vessels and nerves absent**
Matrix consists of inorganic material such as calcium and phosphate ions	**Matrix lacks inorganic materials**
Matrix has Harversian canal	**Matrix lacks Harversian canal**
Osteoblasts are arranged in concentric layers	**Chondroblasts are scattered randomly in the matrix**
Have concentric circles of lamellae with lacunae and canaliculi	**Lacks lamellae and canaliculi**

43. The graph in the figure below shows the effect of concentration difference on the rate of movement of substances across a cell surface membrane by the three transport processes.
Study it and answer the questions that follow.



(a) Explain the;

(i) Rates of transport observed when the concentration difference is zero. **(3 marks)**

Rate of active transport is high;✓occurring even if no concentration difference exists;✓because molecules/ions are being pumped;✓✓
No net exchange/transport across membrane by both diffusion and facilitated diffusion;✓only occur along a concentration gradient;✓✓
@ ½ mark

(ii) Difference between the rate of transport by diffusion and facilitated diffusion. **(4 marks)**

Rate of transport by diffusion increases linearly with increase in concentration difference;✓with no maximum; while rate of transport by facilitated diffusion attains a maximum;✓✓because facilitated diffusion depends on presence of transport proteins;✓with receptor sites becoming more saturated with increasing concentration;✓✓ and fully saturated at very high concentration;✓✓ consequently rate reaches a maximum;

@ ½ mark

(b) (i) Which one of the processes would stop if a respiratory inhibitor were added? **(1 mark)**

Active transport;✓

(ii) Explain your answer in (i) above. **(2 marks)**

Depends on supply of ATP;✓from respiration;✓

44. (a) Explain the following observations.

(i) Fruit growth is suppressed if a ring of bark between the fruit and mature leaves is removed. **(2 marks)**

Removal of the bark removes phloem;✓transport of sugars to the fruit for fruit development/ formation of food store in the fruit stops;✓

(ii) Translocation in the phloem may be stopped by metabolic inhibitors. **(3 marks)**

Metabolic inhibitors denature respiratory enzymes;✓✓ energy formation in form of ATP stops;✓✓preventing loading of sucrose from the mesophyll cells to the phloem;✓ an active process;✓

@ ½ mark

(b) How is the structure of the phloem suited for translocation? **(5 marks)**

- **Sieve tube elements are joined end to end;✓allowing long distance transport of manufactured food;✓**
- **End walls of sieve tubes are perforated forming sieve pores allowing flow of materials from one cell to another;✓**

- **Sieve tubes lack nucleus when mature, and with little peripheral cytoplasm more room is created for passage of organic materials in solution;✓**
- **Numerous mitochondria in transfer cells (modified companion cells) to provide large amounts of energy for active transport of materials;✓**
- **Transfer cells also have many internal projections of the cell wall; increasing the surface area of the plasma membrane for uptake of substances from the surrounding mesophyll cells;✓**
- **Plasmodesmata allow lateral movement of materials between sieve tubes and companion cells;✓**
- **Cytoplasmic strands/ protein filaments aid in cytoplasmic streaming; whose movements sweep with them materials thus transporting materials from one part of cell to another;✓**
- **Polysaccharide, callose of sieve plate quickly seals and blocks the pores in the sieve plate if the sieve tube is damaged;✓ preventing loss of valuable solutes during translocation;✓**
- **Sclereids and fibres have lignified walls offering extra strength to tissues preventing their collapse during translocation;✓**
- **Phloem parenchyma have the ability to divide forming more phloem cells;✓increasing surface area for transporting of organic food materials;✓**

Any correct five adaptations @ 1 mark
Featured tied with correct function;

45. (a) State **two** characteristics which fungi;

(i) share with Plantae **(2marks)**

- **Both have rigid cell walls;✓**
- **Both have carbohydrate stores;✓**
- **Both can reproduce sexually and asexually;✓**
- **Both produce vast quantities of spores;✓**
- **Both are non-motile/Sessile;✓**
- **Both are eukaryotes/ Have true nucleus/ Nucleus surrounded by nuclear envelope;✓**

Award marks for any first two correct characteristics

(ii) have but are absent in the Plantae **(2marks)**

- **No chlorophyll, thus feed heterotrophically;✓**
- **Store sugars as glycogen;✓**
- **Cell wall made of chitin;✓**

Award marks for any first two correct characteristics

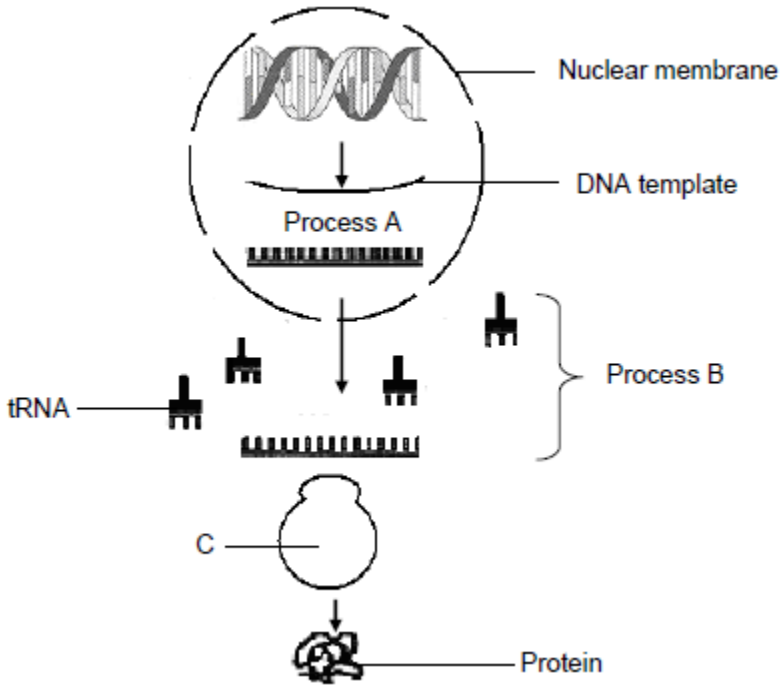
(b) Explain why fungi are wide spread and in vast numbers **(4 marks)**

- **Feed on dead decaying organic matter, which are in plenty;✓**
- **Can tolerate a wide range of temperatures and pH;✓**
- **Reproduce both sexually and asexually;✓**
- **Can respire both aerobically and anaerobically;✓**
- **Produce small and lighter spores easily dispersible by wind;✓**
- **Spores can remain dormant to survive harsh weather conditions;✓**
- **Produce vast quantities of spores; each of which can germinate into a new individual;✓**
- **Live in association with other organisms; thus occupy places where it would not live alone;✓ Any four @ 1 mark**

(c) Explain the ecological importance of fungi in nature **(2marks)**

Decay plant and animal material;✓recycling nutrients;✓
Rej: Economic importance of fungi

46. Diagram below is a schematic representation of protein synthesis.



(a) Name;

(i) Processes **A** and **B**. **(2 marks)**

A: Transcription;✓
B: Translation;✓

(ii) Organelle labeled **C**. **(1 marks)**

Ribosome;✓

(b) Briefly describe how process **A** occur in the cell. **(4 marks)**

RNA polymerase enzyme;✓moves alongtranscribing/template/coding strand in the 5' to 3' direction;✓adding free complementary RNA nucleotides;✓bound together forming mRNA;✓
Transcription stops on reaching a special stop sequence, terminator on the DNA;✓RNA polymerase detaches;✓and the mRNA formed passes via the nuclear pores of the nuclear membrane to the ribosome in the cytoplasm for translation;✓
@ ½ mark
Ignore details of formation of the template strand

(c) Outline **three** differences between processes **A** and **B**. **(3 marks)**

Process A (Transcription)	Process B (Translation)
mRNA copied from DNA	**Assembles amino acids into polypeptide/protein**
Occurs in nucleus	**Occurs at the ribosomes**
No tRNA involved	**Involves tRNA**
Catalysed by RNA polymerase enzyme	**Catalysed by Peptidyl transferase enzyme**

Award differences if the processes in (a) are correctly identified.

END **LAB/2022**