

## SAMPLE QUESTIONS OF BIOLOGY FOR S6MCB (Test N°3)

### S6 MCB: Current Unit

- 1) Describe the main types of sensory receptors
- 2) Distinguish between a primary receptor and a secondary receptor
- 3) Which type of receptor detects changes in the internal environment of the body?
- 4) Which one of the five categories of sensory receptors is primarily dedicated to external stimuli?
- 5) Distinguish between an action potential and a generator potential
- 6) Explain the significance of sensory adaptation
- 7) Distinguish between transduction, transmission and perception
- 8) If you stimulated a sensory neuron electrically, how would that stimulation be perceived?

### S4 MCB

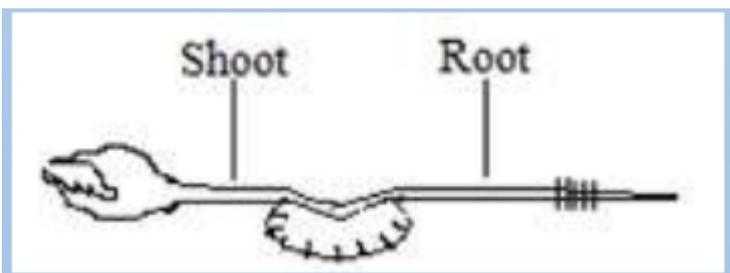
#### Unit 5: Diversity of specialized tissues

- 1) Discuss how unicellular organisms perform their functions.
- 2) Discuss the advantages and disadvantages of being Unicellular organisms.
- 3) What do you think is an advantage of multicellular over unicellular organisms?
- 4) Discuss and present how epithelial tissues have adapted to their functions
- 5) Discuss the statement: “blood is not a true tissue”.
- 6) Describe the three main functions of the blood
- 7) Complete the following table:

Categories of Tissues according to their functions	Examples of tissues
Growth tissues	
Protective tissues	
Storage tissues	
Support tissues	
Conducting tissues	
Secretory tissues	

#### Unit 13: Growth and development in plants and animals

- 1) Describe what is dormancy?
- 2) Explain how dormancy is maintained and broken?
- 3) Suggest the advantage of dormancy in plants?
- 4) What are conditions needed for seed germination?
- 5) Explain the role of enzymes during the process of seed germination.
- 6) Draw and label endospermic and non-endospermic seeds
- 7) What are the plants hormones?
- 8) Describe the role played by each plant hormone.
- 9) Explain why some plants develop lateral shoots when the apex is cutoff.
- 10) What role does phytochrome play in photoperiodism?
- 11) What is the difference between a short-day plant and a long-day plant?
- 12) What could happen if a short-day plant is grown in the long days of summer?
- 13) A bean seedling has been placed on horizontal position as shown by the diagram below.

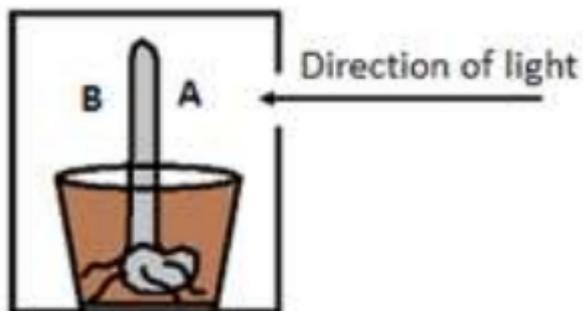


- a) Illustrate the expected shape of the shoot and that of the root after a week.

- b) Suggest names for the expectations in the above experiment.
- c) Based on the above experiment, draw a diagram illustrating the shape and size of cells of both upward and downward side of the root.
- d) Suggest a technique that can be used to minimize the effect of the stimulus in this experiment.
14. (a) What is the difference between 'antagonistic' and 'synergistic' when referring to plant growth substances?
- (b) What are the two plant growth substances that act antagonistically and which act synergistically?
- 15) Copy and complete the following table

Plant growth substance	Site of synthesis	Effect in plant
Auxin		
Gibberellin		
Cytokinin		
Abscisic acid		
Ethene		

- 16) What is metamorphosis?
- 17) Describe the changes that occur during metamorphosis in frog.
- 18) Discuss reasons why complete metamorphosis may have greater adaptive value for an insect than incomplete metamorphosis.
- 19) Compare metamorphosis of a butterfly and that of a grasshopper.
- 20) (a) State any three characteristics of the phytohormones.
- (b) What phytohormone(s) is (are) responsible for the following:
- The falling of some plant organs during the stress
  - The fruit ripening.
  - Development of the lateral buds
  - Stem growth and parthenocarpy
- (c) What is meant by parthenocarpic fruit? Give one example.
- 21) A seedling has been grown in an opaque box receiving the light from a single direction as shown by the diagram below.

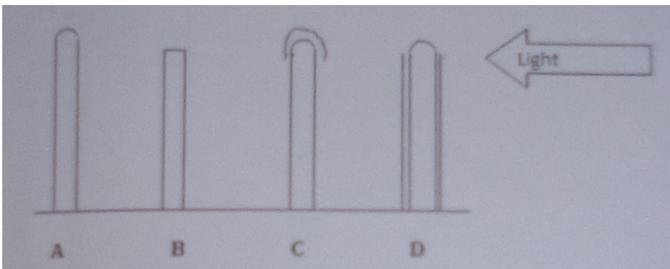


- a) What will happen on the coleoptile (seedling) as it grows?
- b) Show the structures of cells in both side A and B of that seedling and it grows
- c) Suggest a name to the phenomenon investigated in this experiment.
- 22) What would happen if auxin were produced only in the roots of plants?
- 23) The figure below indicates the influence of growth hormones on the given seedling. Observe and answer the related questions



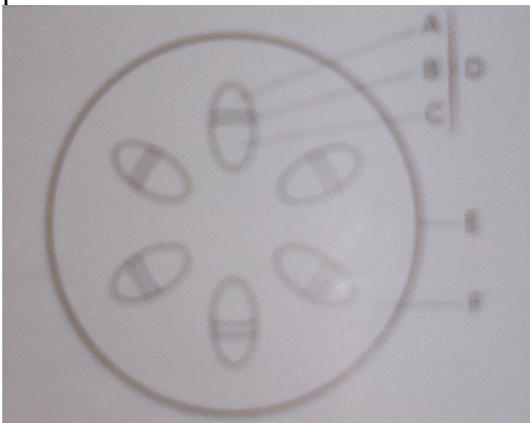
- a) Name the hormone which regulates this growth phenomenon.
- b) Indicate the side A/B which must have the high concentration of the hormone mentioned in a.

24) The diagram below indicates four coleoptiles used to study the effect of light from one direction



- c) How can you arrange these coleoptiles in order for them to receive the light from one direction?
- d) The coleoptiles have been maintained for many days with the light from the direction as it is shown by the diagram above.
  - i. Describe how will be the length of each of the coleoptile?
  - ii. Describe the direction of the growth movement of each coleoptile
    - Coleoptile A
    - Coleoptile B
    - Coleoptile C
    - Coleoptile D
- e) What is the part of the coleoptiles that detects the direction where light comes from?

25) The diagram below shows the position of various tissues in a cross-section through a plant.

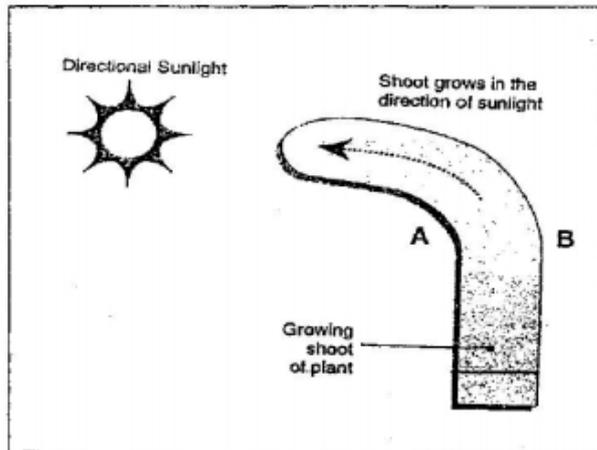


- f) Which part of the plant has its tissues distributed as shown in this diagram?
- g) Name the parts labelled A to F?
- h) Give the label letter and the name of the part which:
  - i. Are vascular tissues

- ii. Transport the products of photosynthesis
- iii. Transport water
- iv. Divide by mitosis
- v. Support the plant

26)

Directional light: A pot plant is exposed to directional sunlight near a window and as it grows, the shoot tip turns in the direction of the sun. If the plant was rotated, it adjusted by growing towards the sun in the new direction.



- a) Name the hormone that regulates this growth response. **(1 mark)**
- b) State which side A and B would have the highest concentration of the hormone. **(1 mark)**
- c) Give the full name of this growth response. **(1 mark)**
- d) State how the cells behave to cause this change in shoot direction at:
  - Point A: ----- **(2 marks)**
  - Point B: ----- **(2 marks)**
- e) Draw a diagram of the cells as they appear across the stem from point A to B. **(3 marks)**

27)

- a) Describe two benefits of the transpiration stream for the plants. **(2 marks)**
- b) Account for the role of the following in providing support for vascular plants.
  - i. Lignin **(2 marks)**
  - ii. Turgor pressure **(2 marks)**
  - iii. Vascular bundles **(2 marks)**
  - iv. Secondary xylem. **(2 marks)**

## S5MCB

### Unit 6: Proteins synthesis

1. What do you understand by: [4marks]?
  - a) Aminoacyl-tRNA synthetases
  - b) Autosomes
  - c) Allosomes
2. Can two normal individuals of the same species with sexual reproduction have identical genomes and identical karyotypes? How the human karyotype is usually represented?
3. Concerning their final products (daughter cells and their ploidy) what are the differences between mitosis and meiosis?

4. tRNA, mRNA, and rRNA are different nucleic acids based on their respective functions and origins. Explain this statement.
5. The addition or deletion of three nucleotides in the DNA sequence of a gene often has less effect on the encoded protein than the addition or deletion of a single nucleotide.
6. Mutation may lead to genetic diseases or genetic disorders. Discuss about the albinism.
7. **Using the information provided in the table, write out the base sequences of**
  - (a) Messenger RNA (mRNA)
  - (b) Double stranded DNA molecule that would produce the following chain of amino acids.

**[2marks]**

**Methionine-glycine-isoleucine-valine-glutamic acid-glutamine-asparagine-arginine-alanine.**

<b>CUU</b> leucine	<b>CCU</b> proline	<b>CAA</b> glutamine	<b>CGU</b> arginine	<b>UCA</b> serine
<b>AUU</b> isoleucine	<b>ACU</b> threonine	<b>AAU</b> asparagine	<b>GUU</b> valine	<b>AUG</b> methionine
<b>GCU</b> alanine	<b>GAA</b> glutamic acid	<b>GGU</b> glycine	<b>UGG</b> tryptophan	<b>UGG</b> tryptophan

8. What is the difference between the concepts of karyotype and genome?
9. Can two normal individuals of the same species with sexual reproduction have identical genomes and identical karyotypes? How the human karyotype is usually represented?
10. How many chromosomes does a human normal haploid cell have? How many chromosomes does a human normal diploid cell have? How many are the sex chromosomes within each of them?
11. a) Give advantages for DNA to be negatively charged in the structure of a chromosome?  
b) Suggest the roles of Euchromatin and Heterochromatin
12. How does the quantity of genetic material vary within the cell during the sequential phases of the cell cycle?

**I. Choose whether the following statements are True (T) or False (F) (10marks)**

1. The main role of t-RNA is to decode the codons on m-RNA.
2. The main role of m-RNA is to carry genetic information in a series of codons.
3. Ribosomes are made up only by proteins.
4. RNA polymerase doesn't need any factor to initiate transcription.
5. Pre-m-RNA needs to undergo RNA processing to become functional m-RNA.
6. The RNA polymerase II transcribes precursor of mRNA (pre-mRNA) or hnRNA
7. The primary eukaryotic mRNA transcript is much longer and is functional.
8. Most proteins do not undergo the post-translational modification in order to perform well their specific functions.
9. RNA polymerase III is responsible for transcription of tRNA and snRNA.
10. The transcription initiation complex is only made up of promoter and RNA polymerase II.

**II. Multiple Choice Questions (10marks)**

1. Which of the following are the characteristics of genetic code?
 

(a) Triplet code	(b) Almost Universal
(c) Nonoverlapping	(d) All of these.
2. The wrong stop codon is
 

(a) UUA	(b) AUU
(c) UAG	(d) UGA

3. The word “wobble” means

- (a) Jumping (b) Synthesis  
 (c) Unsteady (d) Stable

4. Which of the following are related to eukaryotes?

- (a) RNA Processing (b) Introns & exons  
 (c) Poly (A) tail (d) All of these

5. After the fact that it is based on information from mRNA, the process of protein synthesis is called:

- (a) Translation (b) Transfer RNA  
 (c) DNA-replication (d) Transcription.

**III. Complete the following sentences with the appropriate biological terms**

- (i) ..... is a process of adding poly A tails to pre mRNA whereas.....is a process of adding mGpp to the hnRNA.  
 (ii) ..... are removed by RNA splicing.  
 (iii) ..... is a start codon.  
 (iv) ..... allows an organism to translate genetic information into proteins.  
 (v) Process of translation occurs in three stages as ....., ..... and .....  
 (vi) tRNA is also known as .....

**IV. Long Answer Type Questions (70marks)**

1) The following is the double helix of nuclear DNA molecule and the RNA genetic codes:

5’.... ACC-ATG-AAA-TGG-CCC-AGG-TTT-CTC-TCA-TAA-CGC-ATT-TAG....3’  
 3’.... TGG-TAC-TTT-ACC-GGG-TCC-AAA-GAG-AGT-ATT-GCG-TAA-ATC....5’

- a) By the process “transcription” give the mRNA  
 b) By translation, give the polypeptide chain  
 c) What will happen to the polypeptide chain during the translation if:  
 (i) The nucleotides UA in codon n°10 of the mRNA are replaced by the nucleotides GC respectively?  
 (ii) The insertion of C and U occurs between AA of the 10th codon and UA of the last codon respectively?  
 (iii) The deletion of nucleotide A occurs in the second codon of mRNA?

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

2) Copy and complete the following table to distinguish between the processes of transcription and translation.

	Transcription	Translation
Site in cell where process occurs		
Molecule used as a template in process		
Molecule produced by the process		
Component molecule (monomers) used in process		
One other molecule that is essential for the process to occur		

- 4) The addition or deletion of three nucleotides in the DNA sequence of a gene often has less effect on the encoded protein than the addition or deletion of a single nucleotide
- 5) Describe the structure of ribosome allowing it to perform its function.
- 6) List all characteristics of genetic code.
- 7) With one example on your choice, explain Wobble hypothesis.
- 8) The table shows all the messenger RNA (mRNA) codons for the amino acid leucine. Copy the table and write it in, for each codon, the transfer RNA (tRNA) anticodon that would bind with it and the DNA triplet from which it was transcribed.

mRNA codon	tRNA anticodon	DNA triplet from which mRNA was transcribed.
UUA		
UUG		
CUU		
CUC		
CUA		
CUG		

9) Complete the table below

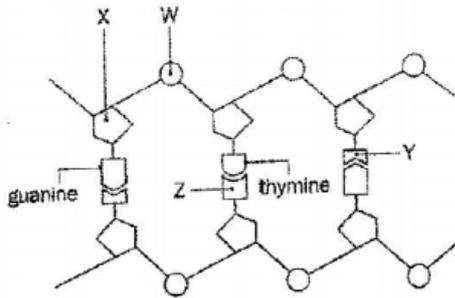
	DNA replication	Transcription	Translation
Location in the cell			
Enzymes involved			
End products			

10)

- What are the three basic components of a nucleotide?
- In terms of the structure of DNA molecule, explain why the base pairings are not adenine with guanine and thymine with cytosine?
- Suggest a reason why the base pairings of adenine with cytosine and guanine with thymine do not occur?
- If 19.9% of the base pairs in human DNA is guanine, what percentage of human DNA is thymine?

11)

The diagram below show a part of a DNA molecule.



What do each of the following letters on the diagram represent?

- W.....
- X.....
- Y.....
- X.....

12)

a) Name the type of bond that holds together the two strands of nucleotides in a DNA molecule. **(1 mark)**

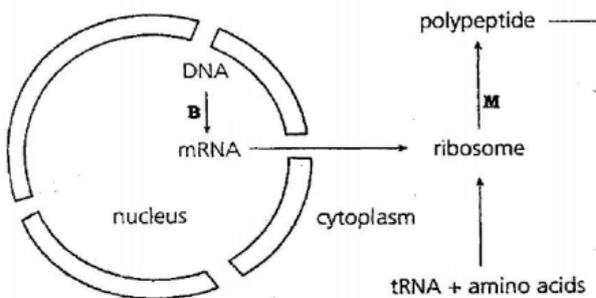
b) The table below shows the square of bases on part of a molecule of mRNA.

Base sequence on coding strand of DNA									
Base sequence on mRNA	A	C	G	U	U	A	G	C	U
Base sequence on anti-sense drug									

Complete the table to show:

- i. The base sequence on the corresponding part of the coding strand of a molecule of DNA. **(1 mark)**
- ii. The base sequence on the antisense drug that binds to this mRNA. **(1 mark)**

c) This figure shows the flow of information in Protein synthesis.



Name the processes:

- i. B
- ii. M

### Unit 7:Autotrophic nutrition

1. The types of autotrophic nutrition are described according to where organisms get energy.
  - (i) Give these types of autotrophic nutrition and their respective chemical reactions
  - (ii) According to you, which among these types of autotrophic nutrition would be more efficient than others?
  - (iii) Justify and explain your answer in (ii).
2. Photosynthesis is the most important chemical reaction for life on Earth. Explain this assertion in details.
3. Suggest the conditions required for photosynthesis to take place.

4. The leaves are the major sites of photosynthesis. By analyzing the internal structure of a leaf, suggest the adaptations of the leaf to perform well the process of photosynthesis.
5. Explain the role of water in photosynthesis, especially during light-dependent reactions.
- 6.

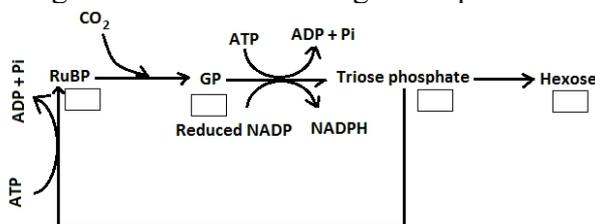
- a) Draw a simple flow diagram of the Calvin cycle to show the relative positions in the cycle of the following molecules:  
 CO<sub>2</sub>  
 Phosphoglycerate/PGA  
 G3P/PGAL/Triose phosphate  
 RuBP
- b) Show the point at which the enzyme rubisco is active.

7. List any three differences between the light dependent reactions and the light independent reactions of photosynthesis.
- 8.

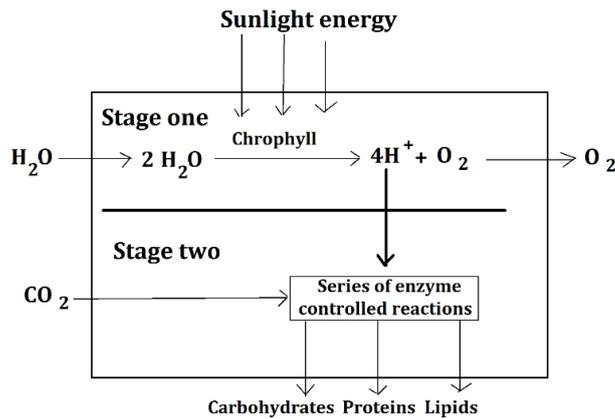
- a) Copy and complete the table to show the differences between mesophyll and bundle sheath cells in C<sub>4</sub> plants. Insert a tick when an item is present in the cell and a cross when it is not

Item	Mesophyll cell	Bundle sheath cell
PEP carboxylase		
Rubisco		
RuBP		
Enzymes of Calvin cycle		
High concentration of oxygen		
Light dependent reactions		
Contact with air spaces		

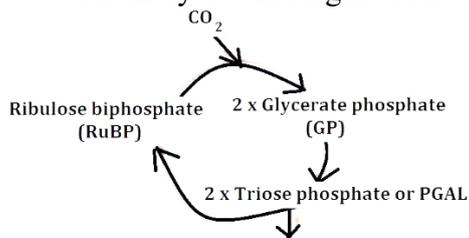
- b) Explain what is meant by photorespiration.
9. Explain the final products of the two photosystems involved in the light dependent reactions of photosynthesis.
10. The diagram summarizes the light independent reactions of photosynthesis



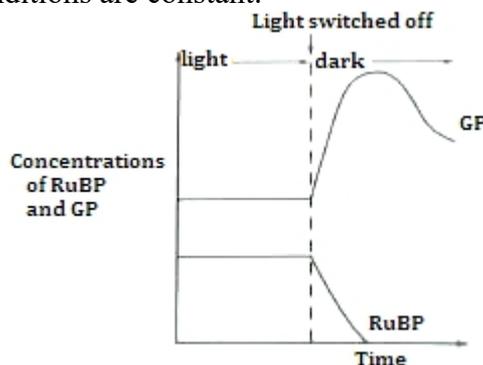
- a) Copy the diagram and complete the four boxes to show the number of carbon atoms in a molecule of each substance.
- b) Where in the chloroplast does the light independent reactions take place?
- c) Explain why the amount of GP increases after a photosynthesizing plant has been in darkness for a short time.
- d) Describe the role of water in the light dependent reactions of photosynthesis.
11. The chart below is a summary of photosynthesis. Study it then answer the questions that follow:



- Name raw materials required for stage one of this process.
  - State the name given to stage one and two of this process.
    - Stage one .....
    - Stage two .....
  - From the above chart, what is the origin of the oxygen given out by plants during photosynthesis?
  - State the role of light in photosynthesis.
12. In the majority of photosynthetic organisms, fixation of carbon dioxide occurs in the Calvin cycle. The figure below shows a summary of the Calvin cycle



- State:
  - The name of the five carbon sugar in the cycle.
  - The name of the enzyme that fixes carbon dioxide.
  - Where in the chloroplast the Calvin cycle occurs?
  - The name of another compound that is produced in the light dependent reactions that is used in the Calvin cycle.
- The figure below the changes in the relative concentrations of RuBP and GP produced in the Calvin cycle before and after a light source is switched off. All other conditions are constant.



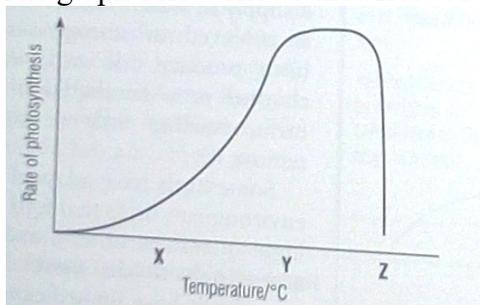
Explain the changes in the relative concentrations of RuBP and GP after the light source is switched off.

13. The process of photosynthesis can be subdivided into two stages, one dependent on light; the other independent of light.

- a) Copy and complete the table to show the substances used in, and the end products of, each of these stages. (Do not include solar energy).

	Light dependent stage	Light independent stage
<b>Substances used</b>	1. Water 2. Inorganic phosphate 3. ADP 4. NADP	1. Reduced NADP 2. ATP 3. .... 4. ....
<b>End products</b>	1. ATP 2. .... 3. ....	1. NADP 2. ADP 3. Inorganic phosphate 4. Carbohydrate

- b) What are the functions of reduced NADP and ATP in the light independent stage of photosynthesis?  
 c) The graph below shows the effect of temperature on the rate of photosynthesis.



- Explain why increasing the temperature from X°C to Y°C increases the rate of photosynthesis.
- Explain why increasing the temperature from Y°C to Z°C decreases the rate of photosynthesis.

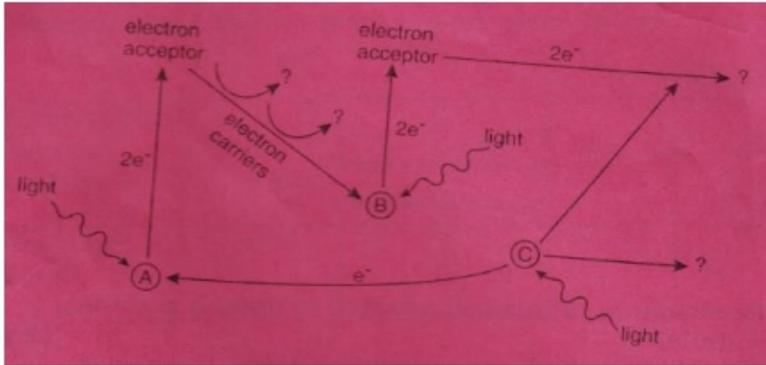
14.

Explain how the structure of the following relate to their function in photosynthesis? **(4 marks)**

- Palisade mesophyll cells
- The xylem.
- Air space in spongy mesophyll
- Guard cells

15.

The figure below shows the sequence of events that take place in the light dependent reactions



- Identify the points labelled A and B. **(2 marks)**
- What process is taking place at C? **(1 mark)**
- What are the products of the light dependent reactions? (They are indicated by '?' on the diagram). **(3 marks)**

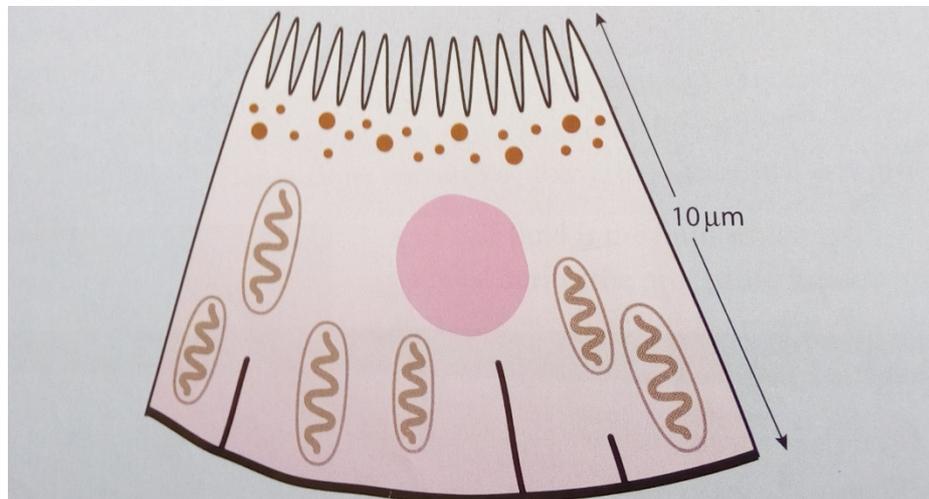
## S6MCB

### Unit 7: Excretion And Osmoregulation

1. Fill in the following table

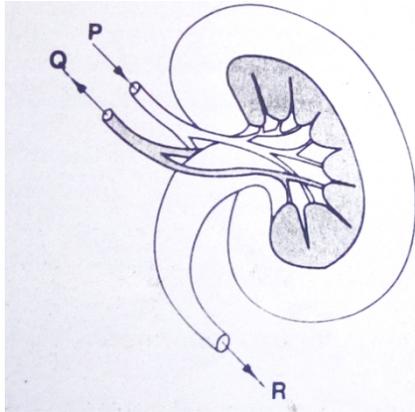
Animal	Excretory organ	Excretory substrate
Reptile		
Paramecium		
Earthworm		
Cockroach		

2. The proximal convoluted tubule of a part of the nephron (kidney tubule). Its function is selective reabsorption of substances useful to the body.
- Outline how the liquid flows through the proximal convoluted tubule is produced.
  - Water and mineral salts are selectively reabsorbed by the proximal convoluted tubule. State the names of one other substance that is selectively reabsorbed.
    - State the names of the processes used to reabsorb water and salts.
- The drawing below shows the structure of a cell from the wall of the proximal convoluted tubule.



- c) The actual size of the cell is shown on the diagram. Calculate the linear magnification of the drawing. Show your working.
- d) Explain how the structure of the proximal convoluted tubule, as shown in the diagram, is adapted to carry out selective reabsorption.

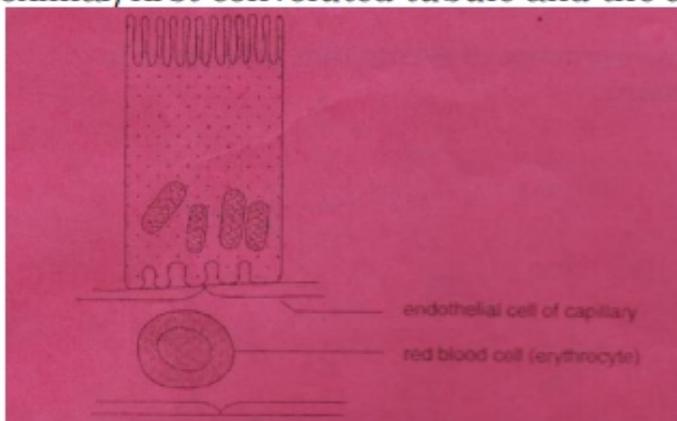
3. The figure below illustrates an internal section of a kidney



- a) State the differences in the composition of fluids passing through vessels P and Q.
- b) State two similarities between vessels P and Q in terms of composition of fluids passing through them.
- c) State the substances that would be in high concentration as fluids that pass through vessel R in individuals
  - i. Suffering from diabetes mellitus
  - ii. Suffering from nephritis
- d) Name the organ where R empties its contents.

4.

The diagram below shows the detailed structure of a cell of the proximal/first convoluted tubule and the adjacent capillary.



- a) How is the structure of this cell adapted to absorb materials from the tubule? **(2 marks)**
- b) Describe the way in which glucose and water are removed from the filtrate into the capillary? **(2 marks)**

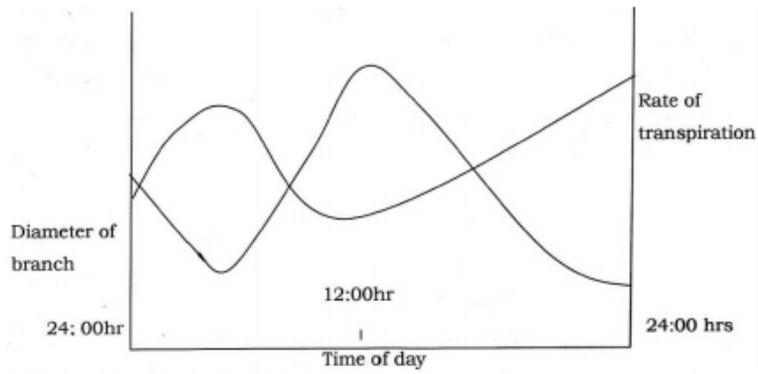
5.

Describe the role of the mammalian liver in:

- a) Protein metabolism
- b) Carbohydrates metabolism

6.

The graph below shows the relationship between the rate of transpiration and the diameter of a branch.



- a) Explain the graph. **(2 marks)**
- b) Explain why Carbohydrates are transported as sugars and not starch. **(2 marks)**