

- It has microvilli which increases surface area
- The cells of placenta have many mitochondria which provide energy needed during the transport of nutrient.

**ADVANCED LEVEL CHEMISTRY NATIONAL EXAMINATION PAPER 2007**  
(Biology-Chemistry)

**SECTION A: Attempt ALL questions in this section /55 marks**

01. a) Root nodules are mutualistic relationship between a bacterium and a plant. Explain the benefits of the relationship to:

A: The

plant.....

B: The

bacterium.....

..... 2 marks

b) Name the bacteria genera involved in root nodule formation in:

i) Legumes \_\_\_\_\_

ii) Non-legumes \_\_\_\_\_

2 marks

c) Briefly explain the purpose of planting legumes in crop-rotation. 3 marks

**Answer:**

a) **The benefits to keep the relationship between plant and bacteria in nodules:**

A: the plant receives the available nitrogen ( $\text{NH}_4^+$ ,  $\text{NO}_2^-$ )

B: Bacteria: it receives from the housing/ living environment. It receives the carbohydrate.

b) **The names of species of bacteria in the formation of root nodules for:**

i) Pulses: The rhizobium/ azotobacter

ii) Frankie (Coriana and casiarira)

Nostic/ cyanobacteria (in Cycads)

c) **The objective of planting legumes in crop notation**

The plants enrich the soil in nitrogen. Indeed, thanks to their nodule bacteria, they set (capture) atmospheric nitrogen and convert it into available nitrogen ( $\text{NH}_4^+$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ) by other plants.

02. a) Suggest why viruses are such a difficult group to classify conventionally. 1 mark

b) State whether you regard viruses as a living or non-living. Give reasons for your answer. 2 marks

c) Explain why viruses are classified as obligatory intracellular parasites. 1 mark

**Answer:**

a) **Viruses are a difficult group to classify because conventionally:**

The virus does not conform to any criteria for classification of other conventional forms of life:

- No core (to be classified as prokaryotes or eukaryotes).
- No member or cell wall cellulose (to be classified as plants or animals).
- NO cell organelles (classes to be plants or animals).
- Existence of genetic material (DNA or RNA) not to be regarded as non-living.
- Existence of envelope protein (or protein) not to be regarded as non-living.
- The power to interfere in order not to be regarded as non-living.
- The power to change not to be regarded as non-living.
- The power to die for not being as non-living.
- The power-breeding not to be regarded as non-living.
- Existence of the sensitivity not to be regarded as non-living.
- The absence of breathing in order not to be regarded as living.
- The absence of excretion as not to be considered living.
- The lack of growth in order not to be regarded as living.
- Lack of nutrition not to be considered living.

b) First eventually:

Viruses are considered non-living things because:

- They have the genetic material (DNA or RNA)
- They have an envelope protein
- They have the power to interfere
- They have the power to change. They are sensitive
- They may die
- They can reproduce (they can be multiplied)
- They can move.

Second eventually:

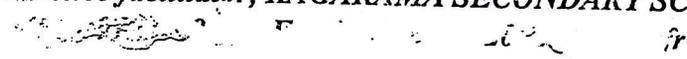
Viruses are considered non-living things because:

- They do not breathe
- They do not shed
- They do not feed us
- They do not grow
- They can crystallize
- They are acellular (no nucleus, no organelles)
- They have no metabolism (without membrane)

c) The viruses are classified as obligate intracellular parasites because:

- They are completely dependent on the use of the structure of the host cell to reproduce.

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Pho: 

- Apart from the host cell, they behave as inert beings/ as dead matter/ crystal as/ as an inert/ non-living beings like. (They do not occur).

03. Name the organs for excreting nitrogenous wastes in each of the following animals:

- a) Flat worm \_\_\_\_\_ c) Insects \_\_\_\_\_  
 b) Earthworm \_\_\_\_\_ d) mammals \_\_\_\_\_ 2 marks

Answer:

- a) Protonephridia  
 b) Nephridia  
 c) Malpighian tubule  
 d) Kidney
04. a) Discuss why mammals are able to produce a concentrated urine. 2 marks  
 b) Suggest why alcohol consumption (especially to excess) causes dehydration and thirst. 2 marks

Answer:

- a) Mammals may produce concentrated urine because of:  
 The tubular reabsorption of substances such as  $H^+$ ,  $NH_4^+$ , urea, uric acid, bilirubin,
- b) The excessive consumption of alcohol causes: dehydration and thirst as follows:  
 Alcohol inhibits the secretion of ADH.
- Reduces the tubular reabsorption of water.
  - Increases urination. Sweating causes  
 There is thirst for the loss of water.
05. a) State how a plasmodium parasite enters the body. 2 marks  
 b) Suggest ways in which villagers could reduce the occurrence of malaria carrying mosquitos in their immediate area. 2 marks

Answer:

- a) The plasmodium parasite enters the human body:
- Through the bite of infected female anopheles mosquito/ mosquito bites
  - By blood transfusion of infected blood.
- b) Ways to reduce the presence and persistence of malaria in the immediate environment are the following:
- Brushing
  - Avoid stagnant water ponds.
  - Sleeping in mosquito nets.
  - Remember to close doors and windows at night.
  - Spraying (spray) of insecticides or pesticides. Be treated.
  - Respect the cure
  - Avoid the shelter of mosquito larvae. (ex: car tires)
  - Make bio control (intake of animals that eat mosquitoes).

06. a) How many chromatids are present in a human cell nucleus at the end of interphase, before the first division of meiosis begins? **1 mark**
- b) State the advantage of the chromosomes contracting and coiling up in prophase 1. **1 mark**
- c) Discuss the advantages of the DNA of the chromosomes stretching out during interphase of meiosis. **2 marks**

**Answer:**

- a) **In the nucleus of a human cell at the end of interphase, before the first meiotic division begins, there are 92 chromatids.**
- b) **The concentration and curling of paired chromosomes: Chiasm crossover.**
- c) **The benefits of DNA chromosomes during interphase extension of meiosis:**
- **Hold in terms of protein/ intervene in the synthesis of proteins.**
  - **Hold genetic information.**
  - **Coordinate (provide) the metabolism (check cell activity).**
  - **Formation of mRNA duplication**
  - **The equitable distribution of the number of chromosomes in cells – females**
  - **The conservation of the number of chromosomes (or karyotype) of the species.**
07. a) What is produced from the splitting of water during the light-dependent reaction and what is this process called? **2 marks**
- b) Describe what happens when sun light strikes chlorophyll. **2 marks**
- Answer:**
- a) **When the separation of water during the reaction which depends on the light, occur: Oxygen, hydrogen ions (protons, hydrogen) and electrons. This process is the water photolysis.**
- b) **When the sun reaches the chlorophyll ionizes.**
08. a) What quantity does a pyramid of biomass express?
- b) Suppose an ecosystem has a greater number of individual herbivores than individual producers. How would this affect the shape of the ecosystem's pyramid of numbers? **2 marks**
- c) Write short-notes on the following ecological terms:
- i) Ecosystem.
  - ii) Habitat.
  - iii) Community. **3 marks**
- Answer:**
- a) **A pyramid of biomass expresses the mass (or weight) of living things (or each link).**
- b) **If the number of herbivores is higher than that of the producers:**

- The second rectangle is wider than the 1/ the summit will be larger than the base.
  - The pyramid will be reversed.
  - The ecosystem is in balance.
- c) Explanation of ecological terms as follows:
- i) = biocenose + biotope/ ecosystem of living organisms and their environment.
  - ii) Housing+ living environment/ habitat/ site/ cottage
  - iii) Community: all living beings of different species that occupy an environment (biotope) was given one point.
09. a) Parasites cause some harm to their host but do not usually kill it. Why would it be a disadvantage for Taenia to kill its host? 1 mark
- b) Why is mucus needed to protect the cells lining the gut from protein-digesting enzymes? 1 mark
- c) The PH in the stomach is very acidic-about PH<sub>2</sub>. Why would it be a problem if the PH in the small intestines was 2? 2 marks

Answer:

- a) It would be a disadvantage for the tapeworm to kill its host because: the host death results in death of the tapeworm.
- b) The mucus is necessary for the protection of cells along the gut against the protein digesting enzymes:
- To avoid direct contact between cells and enzymes.
  - To prevent that these cells are digested/ or broken/ destroyed
- c) It would be problematic to have a pH of 2 in the small intestines because:
- The action of enzymes is inhibited.
  - Or the enzymes are inactive.
  - Enzymes of the intestines act mildly alkaline (neutral).
  - Enzymes of the small intestines are not acting in the acidic environment.
10. Differentiate between the following terms:
- i) Endopeptidases.
  - ii) Exopeptidases. 2 marks

Answer:

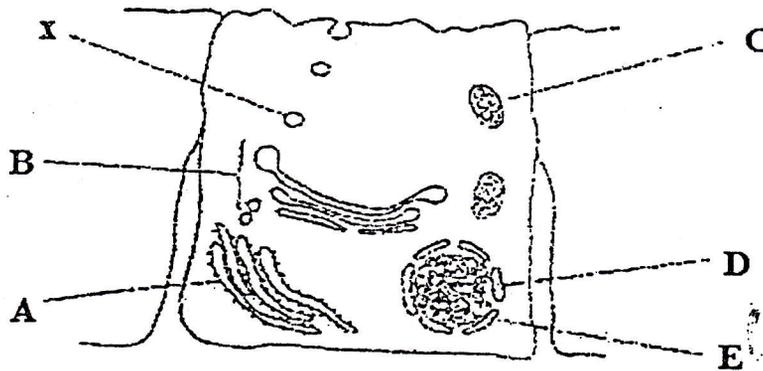
- i) The endopeptidases are digesting enzymes:
- That breaks the bonds of peptides (peptide bonds) in middle (inside) of the polypeptide chain.
  - Transforming long polypeptide chains into short chains.
- ii) The exopeptidases are enzymes digest protein:
- That breaks the bonds of the peptides (peptide bonds) at the end of chain peptide.
  - Which tear (that post) terminal amino acids

- That converts amino acids into polypeptides.

11. a) What do the teeth of a fox reveal about its diet? **1 mark**  
 b) How do mammals compare with birds and reptiles in terms of temperature regulation and structure of the heart? **2 marks**

**Answer:**

- a) The teeth of a fox about his diet revealed that it is a carnivore/ predator.  
 b) Mammals and birds are homeotherms or temperature constant while reptiles are poikilotherms/ or variable temperature.  
 Mammals and birds have a heart with 4 cavities (rooms), while reptiles have generally a heart with 3 cavities.
12. The diagram below is of a cell from the epithelial lining of the mammalian intestine.



- a) Name the structures labeled A to E. **2.5 marks**  
 b) Explain the functional relationship between the structures A, B and X. **1.5 marks**  
 c) Outline at least one role of organelle C in the metabolism of the cell. **1 mark**

**Answer:**

- a) The drawing shows a cell in the epithelial lining of the intestine of a mammal, the following letters represent the following structures:  
 A: rough endoplasmic reticulum (granulated)! Ergastroplasm.  
 B: Golgi or Saccule dictyosome vesicle Golgi  
 C: Mitochondria/ chondriosome  
 D: nuclear envelope/ nuclear membrane/ outer nuclear layer/ core.  
 F: Network chromatin/ nucleoplasme  
 Nuclear membrane/ nucleolus/ caryolymphe
- b) The functional relationship between the structures A, B and X:  
 A: Synthesizes/ conduct proteins.  
 B: serves as a maturation / packaging/ sorting/ concentration, storage/ shipping/ protein excretion/ transport (conduction)  
 X: (vesicle export) transports/ exported proteins
- c) During the metabolism of the cell, the organelle C serves:
- Place of cellular respiration
  - Cellular oxidation

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- Reactions of the respiratory chain
- Producing energy (ATP)

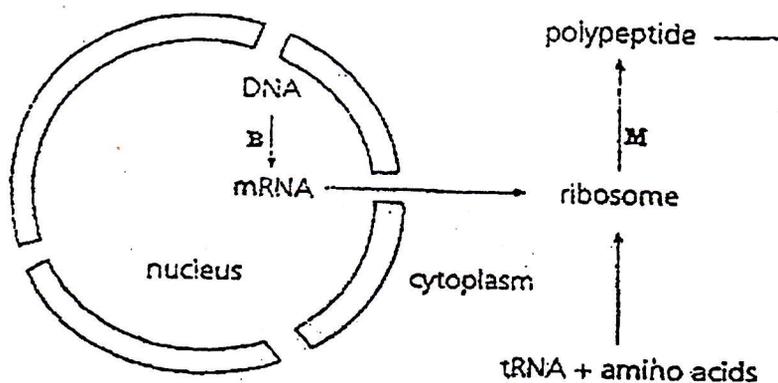
13. a) Name the type of bond that holds together the two strands of nucleotides in a DNA molecule. **1 mark**

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:

- The base sequence on the corresponding part of the coding strand of a molecule of DNA.
- The base sequence on the antisense drug that binds to this mRNA. **2 marks**
- This figure shows the flow of information in Protein synthesis.



Name the processes:

- B \_\_\_\_\_
- M \_\_\_\_\_ **1 mark**

Answer:

- The type of link that connects the 2 fibres in the nuclear DNA molecule: Link (bridge) hydrogen
  - the base sequence on the corresponding part of the coding of a DNA molecule: TGC AAT CGA.
    - The sequence of bases on the drug: UGC AAC CGA.
  - B: DNA Transcription/ copy. Reading DNA.
    - M: Translation
14. Suggest a possible advantage to mammals in having haemoglobin confined to red blood cells rather than free in the placenta. **1 mark**

Answer:

An advantage for mammals to have haemoglobin in red blood cells confined rather than free flow in the plasma.

Haemoglobin cannot be filtered by the kidneys when it is confined to red blood cells/ may not be discharged into the urine.

15. List two features of a chloroplast and show how they aid photosynthesis. **2 marks**

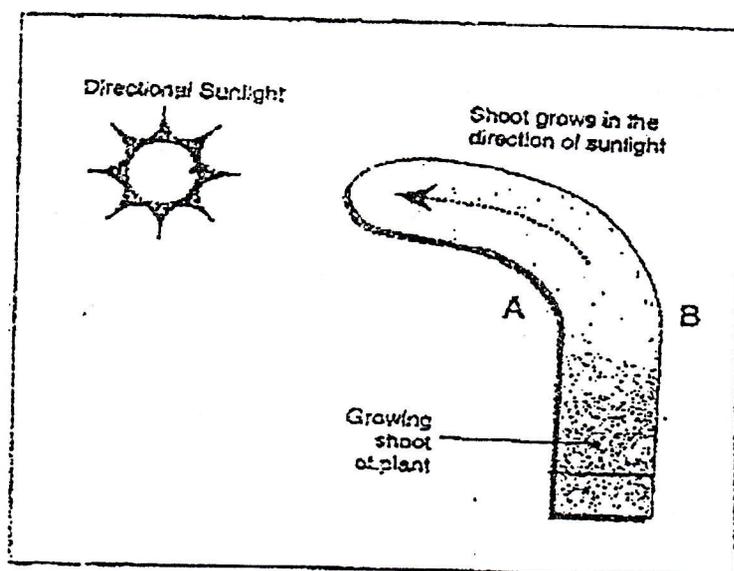
**Answer:**

**Two features of chloroplasts and how they contribute to the photosynthesis:**

- Contains chlorophyll/pigment green: that captures light energy (solar) and transforms it into chemical energy.
- Contains enzymes that promote the progress of photosynthesis.
- Contains the stroma: as a reaction medium
- The chloroplast is green to capture radiation.
- Thylakoid membrane that provides a large surface absorption.
- Contains DNA that synthesizes proteins or enzymes.

**SECTION B: ATTEMPT ANY THREE QUESTIONS. (30 MARKS)**

16. Directional light: A pot plant is exposed to directional sun light 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:-----

Point B:-----

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- e) Draw a diagram of the cells as they appear across the stem from point A to B. 3 marks

Answer:

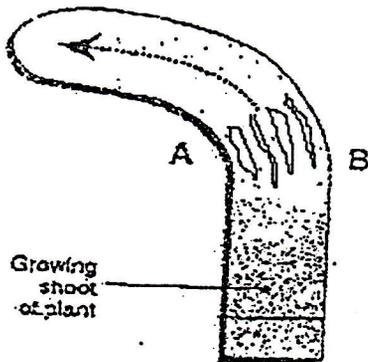
- a) The hormone that regulates the growth response which is auxin.  
 b) The side which should have the high concentration is the side B opposite to the light wog.  
 c) The full name of this reflex is growth phototropism/ or heliotropism positive.  
 d) Item A:

- Cells are small.
- Cells elongate rapidly than the other side (as exhibit B)
- Cells grow slowly.
- Cells divide faster than the other side.

Item B:

- The cells divide more rapidly than the other side.
- The cells grow faster.

e)



17. 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  
 ii) Turgor pressure  
 iii) Vascular bundles  
 iv) Secondary xylem. 8 marks

Answer:

- a) Benefits of continuous movement of plant transpiration:

- Allows the flow of matter (water, salts, minerals, organic matter) in the plant allows movement of organic matter.
- Facilitates the aspiration of leaf
- Sets the amount of water in plant
- Allows water balance

- Eliminates excess water.
- Facilitates the absorption of water by the plant (or minerals by the plant)
- Allows the regulation of temperature (cool off plants)
- Control the water cycle/ release of water vapor in atmosphere/ favors precipitation

b) Role of:

i) Lignin: the rigidity (or hardening)

ii) The pressure turgid:

- Provides stiffness
- Allows elongation
- Allows the opening of the stomata.
- Prepares sheets
- Prevents the plant wilts

iii) The vascular bundles:

- Lead saps
- Increase the capacity of stem
- Leads the sap mineral

iv) Secondary xylem:

Xylem is the specialised tissue of vascular plants that transports water and nutrients from the plant–soil interface to stems and leaves, and provides mechanical support and storage. The water-conducting function of xylem is one of the major distinguishing features of vascular plants.



c) Discuss the sequence of events at cholinergic synapses and neuromuscular junctions. 5 marks

Answer:

a) The difference between neurotransmitter and hormone:

- The neurotransmitter acts locally while acting hormone remote (transported by blood)
- The neurotransmitter is produced by a neuron while the hormone is produced by an endocrine gland.
- The neurotransmitter allows the passage of nerve impulses at a synapse, while the man is involved in metabolic regulation.

b)

A: Synaptic vesicle/ or neurotransmitter

B: Mitochondria

C: Membrane pre-synaptic/ membrane of axon/ membrane of neurotic

D: Slot synaptic/ synaptic space/ Textiles synaptic

E: Membrane post-synaptic/ membrane fiber muscle/ cytoplasm or sarcoplasm.

F: Same as E1 post- synaptic/ membrane of muscle fiber sarcolemma/ sarcoplasm, or cytoplasm.

c) Sequence of events in the cholinergic synapses and neuromuscular functions:

- Arrival of the nerve impulse (action potential) in the synaptic knobs.
- Entry of  $Ca^{2+}$  in the synaptic knobs/ touch  $ca^{2+}$  and synaptic vesicles
- Release of the neurotransmitter (acetylcholine) in the synaptic cleft.

19. a) Briefly comment what is meant by a target tissue. 2 marks

b) Name at least three target tissues and explain how named hormones control their activities.

i) Target

tissue:.....

...

Hormone

activity:.....

2 marks

ii) Target tissue:

.....

Hormone activity:

..... 2 marks

iii) Target

tissue:.....

.....

## Hormone

activity:.....

2 marks

c) Explain why it is an advantage for hormones to be carried in the blood. 2 marks

Answer:

a) The target tissue: is the tissue where the hormone acts in the question. With tissue-specific hormone receptors. Tissue stimulated by the hormone.

b) Some examples:

Target tissue	Hormone	Activity
Kidney	ADH	Increasing reabsorption of water
Mammary gland	Prolactin	Secretion of milk
Gland thyroid	TSH (thyroid stimulating hormone or thyrotrophic or TSH)	Stimulate secretion of the hormone thyroxin or thyroidien.

c) Advantage:

- To quickly reach the target tissues/ to be released into the target tissues
- To be protected against digestion (destruction)

20. a) Briefly describe the significance (and their importance) occurring at each of the following stages of fertilization.

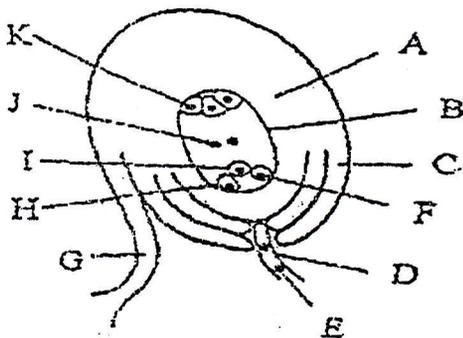
i) Fusion of egg and sperm plasma membrane.

ii) Acrosome reaction. 2 marks

b) i) Suggest why the foetus is partially prone to damage from drugs towards the end of the first trimester (2-3 months).

ii) Explain the purpose and importance of the amniotic sac to the developing embryo. 2 marks

c) Look at the diagram below and answer the following:



Use the letters indicated and name the structure which:

i) Is produced from the whole megaspore. 1 mark

ii) Will form the seed coat. 1 mark

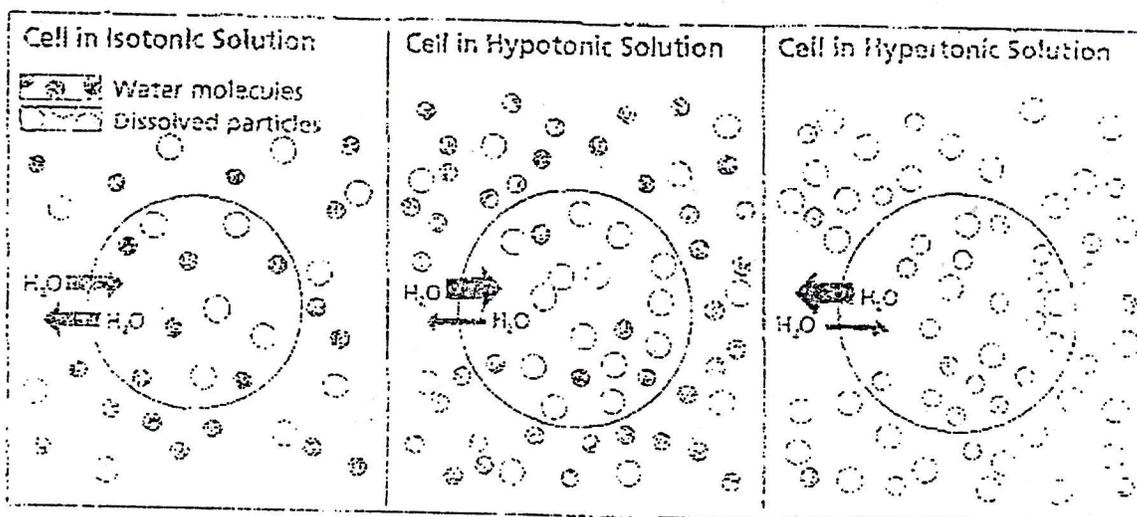
- iii) Will fuse with a male gamete to produce azygot. 1 mark
- iv) Will fuse with two nuclei which are genetically different from each other. 1 mark
- v) Will fuse with two nuclei which are genetically identical to each other. 1 mark
- vi) Carries male gamete to the ovule. 1 mark

Answer:

- a) i) The merger of the egg and the membrane of the sperm:
  - Allows the activation of the egg (from the quiescent state has the state of life)
  - Allows for recovery of gas exchange (and trophic)
  - Allows continuation of oogenesis (causes completion of meiosis/ emission of second polar body/ completion of an oogenesis)
  - Allows formation of the membrane (fertilization/ avoid polyspermy).
- ii) The reaction of the acrosome:
  - Production of enzymes to weaken or puncture the membrane.
  - Training acrosomal tubule.
- b) i) the dude has a tendency to deteriorate because of the medication at the end of 1 quarter (2-3 months)  
The placenta is not yet well established/ no placenta.
- ii) The amniotic sac protects:
  - Against shocks (movements)
  - Against the drying (or dehydration)
  - Reduces the circular (or dystocia)
  - Maintains a constant temperature.
- c) The letters on the diagram and their corresponding structures:
  - i) Structure has produced everything from the megaspore:  
B: Embryo sac
  - ii) Structure that forms the envelope of the seed:  
C: tegument
  - iii) structure which combine with a male gamete giving a zygote: I: oosphere
  - iv) Structure, which will merge with two polar nuclei (or center 2<sup>nd</sup> central)
  - v) The structure which will merge with two genetically identical nuclei.  
E: Antherozoid
  - vi) The structure which carries a male gamete to the egg D: Pollen tube.

**SECTION C: ATTEMPT ONLY ONE QUESTION. (15 MARKS)**

21. Three neighbouring cells are shown in the diagram.



- Explain the behaviour of water molecules in the isotonic solution. **4 marks**
- Does osmosis occur if a cell is placed in isotonic solution? Give reason for your answer. **2 marks**
- Why does water enter in a cell that is placed in a hypotonic solution? **4 marks**
  - How are facilitated diffusion and active-transport similar? How are they different? **5 marks**

Answer:

- In isotonic solution, the amount of water molecules that are cell so that/ there is no net movement or medium is in equilibrium.
- In an isotonic solution, there is no osmosis (or not) because concentrations are equal because it must be one of the media more concentrated than the outer/ because there is no net movement water.
- Water enters a cell in a hypotonic solution :
    - To balance the concentrations on both sides of the cell membrane (inside balance the concentrations and outside of the cell).
    - Because the osmotic pressure in the cell is higher than an outside.
    - By what the water potential is higher OUTSIDE than inside the cell.
  - The two types of transport are similar in that they all require the 2 factor or agent or carrier/ or enzymes (proteins) to achieve conveyor/ They differ in that:
    - Facilitated diff can accomplish against the concentration gradient.
    - Active transport requires energy (ATP), whereas facilitated diffusion requires no energy.

- Why is a blue-black colour not proceduced if iodine solution is added to glycogen or cellulose? **2 marks**
  - Give a brief explanation on the procedures for biological tests for each type of the following carbohydrates:

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- i) Test for reducing sugar
- ii) Test for starch. 4 marks

Answer:

- a) The color black blue does not occur when iodine solution is added to glycogen or cellulose as no starch/ reagent was moved the starch/ reagent is not suitable for glycogen or cellulose.
- b) Test for reducing sugars
  - i) The first possibility:
    - The student addresses in sense of reducing sugars
    - Take a sample/ small quantity containing a reducing sugar.
    - Add a few drops of Fehling's solution
    - Heat
  - The second possibility:
    - i) the high tackles in the direction of non-reducing sugar:
      - Take a sample
      - Add the water or iodine solution, benedict (and heating)
      - Color red (brick) or red precipitate.
      - Contingency 2: Dark blue staining for iodine.
    - ii) For starch
      - Take a sample (food)
      - Y add iodine (iodized water, Lugol solution, tincture of iodine)
      - Stain dark blue (dark blue)

**ADVANCED LEVEL BIOLOGY NATIONAL EXAMINATION PAPER 2008  
(BCG, MCB, PCB)**

**SECTION A: Answer ALL questions /55 marks**

01. List the organelles that can be seen with the electron microscope:

- a) In both animals and plant cells 2 marks
- b) In plant cells only. 1 mark

Answer:

- a) Plant cell larger, plant cell has cell wall chloroplasts, large central vacuole, a tonoplast surrounds the vacuole, plant cell has a more regular shape.
- b)
  - Cell surface membrane
  - Vacuoles
  - Golgi body
  - Rough endoplasmic reticulum
  - Smooth endoplasmic reticulum

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