

P530/2
BIOLOGY
Paper 2
Nov./Dec. 2015
2¹/₂ hours

MR. GUIDE



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

BIOLOGY

(THEORY)

Paper 2

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

*This paper consists of section **A** and **B***

*Answer question **one** in section **A** plus **three** others from section **B**.*

Candidates are advised to read the questions carefully, organise their answers and present them precisely and logically, illustrating with well labelled diagrams wherever necessary

SECTION A (40 MARKS)

- In an experiment, the rate of uptake of glucose by the blood using simple and facilitated diffusion at varying extracellular concentration of glucose, was measured. The results are shown in figure 1. Study the information and answer the questions that follow.

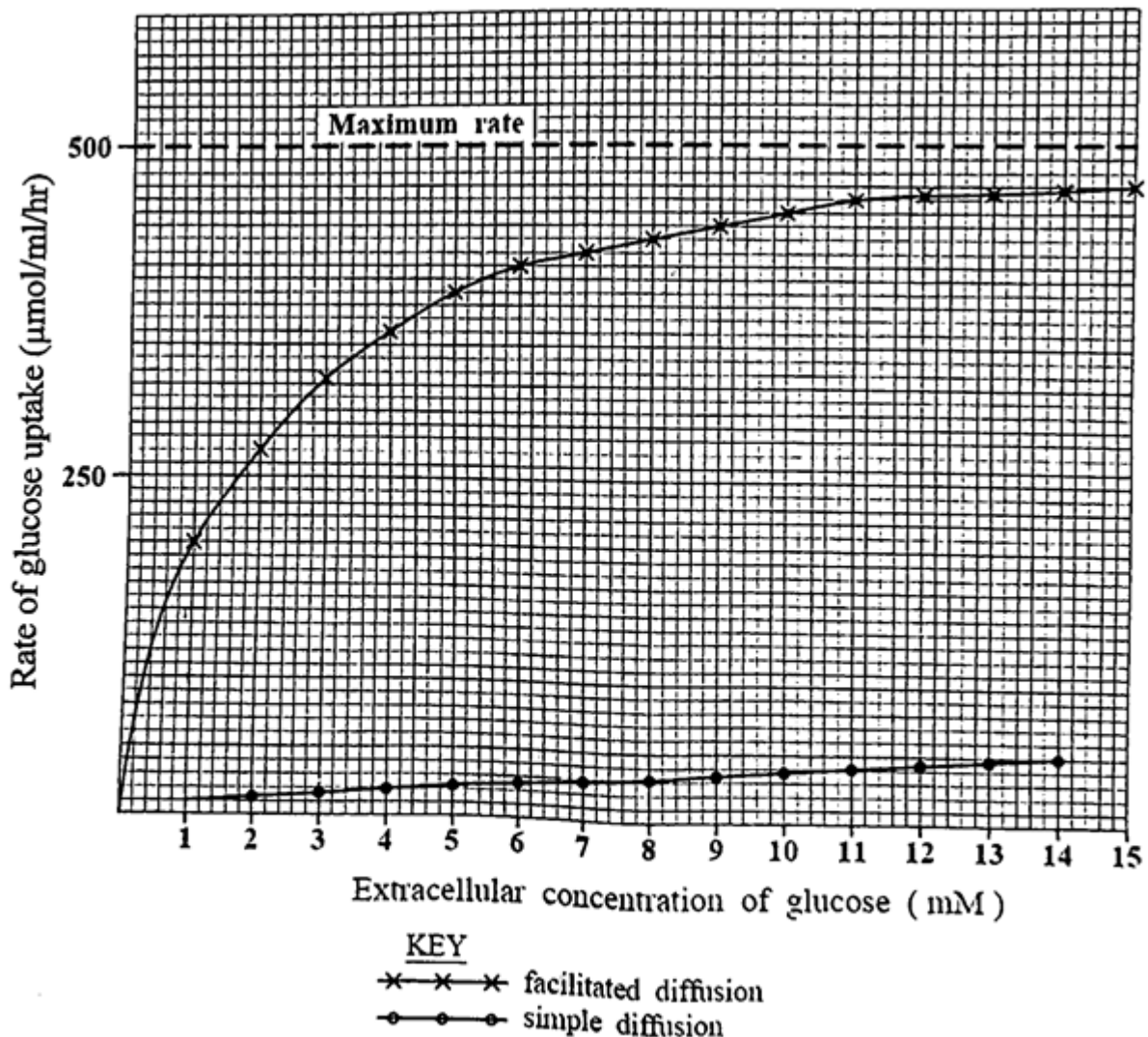


Fig. 1

- Describe the rate of glucose uptake with increasing extracellular concentration when diffusion is facilitated. (08mks)

At 1mM; glucose uptake is low; glucose in extracellular fluid increases rapidly to 5mM; rate of glucose uptake increases rapidly;

4/5 up to 10/11; rate of glucose uptake increases gradually; 11 up to 15mM; rate of glucose uptake is very slow/ almost constant;

- Compare the rate of glucose uptake when diffusion is facilitated and when it is not. (08mks)

In both

increase in concentration in extracellular glucose; results in increase in glucose uptake; However, facilitated diffusion causes a much higher levels of glucose uptake; than simple diffusion;

also the rate of increase in glucose uptake for simple diffusion is constant/ low with increase in concentration while that for facilitated diffusion is high at low concentration; but slows down; as the concentration of glucose increases;

Accept

- Both did not reach maximum rate;
- Rate of facilitated diffusion is not directly proportional to increase in extracellular concentration of glucose; while simple diffusion is directly proportional;
- Facilitated diffusion increases rapidly while simple diffusion increases gradually;
- Uptake of glucose in facilitated diffusion shows a curve while uptake of glucose by simple diffusion is linear;

(c) Explain the effect of increasing extracellular concentration of glucose on the uptake of glucose, when diffusion is facilitated. (09mks)

Results in more rapid uptake of glucose; because protein molecules; offer glucose transport channels/ carriers; all not saturated; steep concentration gradient; rapid diffusion;

Above 4-6mM; low rate of glucose uptake; because most protein channels are saturated;

(d) Suggest what would happen to the rate of glucose if a respiratory poison was introduced into the cell membrane. Give an explanation for your answer. (06mks)

No effect/ uptake of glucose continues; because facilitated diffusion does not require energy/ passive process; does not require enzymes; and uptake continues whenever concentration gradient exists;

(e) Explain why

(i) facilitated diffusion occurs. (06mks)

- when molecules are large; e.g. amino acids;
- when molecules are polar; e.g. amino acids;
- when particles are charged; e.g. ions;

(ii) the cell membrane is able to carry out facilitated diffusion. (03mks)

cell membrane have special protein molecules; which are large; and traverse; the lipid bilayer; these proteins are of two types;

- channels proteins; have fixed shape; but with hydrophilic pores; and for selective transport of ions;
- carrier proteins; rapidly change shape; to bind specifically to the molecules they assist to carry over;

SECTION B: (60 MARKS)

2. (a) What problems of support and locomotion do terrestrial animals face? (04mks)

- Resistance by ground surface through friction;
- Resistance by wind;
- Mechanical/ compressional stress due to body weight or mass/ gravitational pull;
- Pressure from surrounding air;

(b) (i) How is support achieved in woody plants? (06mks)

By use of turgid cells in young parts of the plant; collenchyma tissues; with cell walls thickened with cellulose; use of sclerenchyma tissues; and xylem tissues; in which cell walls are strengthened with deposition of lignin;

- (ii) Describe the changes that take place in a cell that eventually develops into a xylem vessel element. (10mks)

The cells of the procambium strand divided by mitosis; the cell formed elongates/ enlarges; and vacuoles appear in cytoplasm; cross walls between adjacent swell; cross wall disintegrate forming perforation; which is continuous with that of adjacent cells; A secondary wall is formed; by addition of extra cellulose; and lignin; this results in death of the cells; leaving the cell with an empty lumen/ hollow;

3. (a) Describe the biological function of amino acids. (05mks)

Amino acids are building blocks/ monomers for protein synthesis; act as buffers/ amphoteric; taking up hydrogen ions in acidic solution; and losing hydrogen ions in alkaline solutions; act as intermediate pathways in metabolic pathways, e.g. citric acid pathways; release energy in times of starvation;

- (b) Describe how amino acids form a polypeptide. (06mks)

Two amino acids combine to form a dipeptide; through condensation reaction; linked by peptide bonds; dipeptide formed; possesses a free carboxyl group at one end; and a free amino group that attract further amino acids to a dipeptide; to form a polypeptide;

- (c) How do inhibitors change the rate of enzyme controlled reactions? (09mks)

Competitive inhibitors; have shapes similar to their substrate and so fit into the active site of the enzyme; prevents formation enzyme-substrate complex; and so reduce the rate; such inhibitors are concentration dependent;

Non-competitive inhibitors; bind to a site away from the active site; distorting the shape of the enzyme molecule including the active site; substrate no longer fit; no enzyme-substrate complex formed, reducing the rate the rate of reaction;

4. (a) Differentiate between aerobic and anaerobic respiration. (05mks)

Anaerobic respiration	Aerobic respiration
No oxygen	Oxygen required;
Lower energy	Higher energy;
Toxic products (ethanol and/ or lactic acid)/ incomplete oxidation	Products are non-toxic (carbon dioxide and water) and their oxidation is complete;
Shorter pathways	Longer pathways;
Non-cyclic (glycolysis)	Cyclic (Krebs' cycle);
Various metabolic pathways from pyruvate	Single metabolic pathway;

- (b) Describe what happens to the end product of glycolysis in absence of oxygen. (10mks)

The end product of glycolysis is a 3 carbon compound called pyruvate; which in animal accepts hydrogen atoms; from reduced Nicotinamide Adenine Dinucleotide (NADH₂); using lactate dehydrogenase enzyme; to form lactic acid/ lactate; no energy is used up or released;

In plants the pyruvate is first converted to ethanol (acetaldehyde); through the removal of carbon dioxide; using pyruvate decarboxylase; ethanol is reduced to ethanol; by the hydrogen atoms from reduced NADH; in the presence of enzyme alcohol dehydrogenase; no more ATP is produced;

Accept equations

In plants,

pyruvate; Pyruvate decarboxylase; → ethanol; + CO₂

Ethanol + NADH₂; Alcohol dehydrogenase; → ethanol + NAD;

No ATP is produced;

Overall equation

Pyruvate → ethanol + CO₂

In animals

*Pyruvate $\xrightarrow[\text{NADH}_2]{\text{Lactate dehydrogenase;}} \text{lactate (lactic acid);}$
NAD⁺;*

No ATP produced;

(c) Why is it important to produce ATP during cellular respiration? (05mks)

Large amounts of energy produced in respiration may not be required for immediate use; and can be stored as ATP; otherwise too much heat would be produced that could destroy the cell content; or some energy simply lost as heat; so ATP is an easy carrier of energy;

5. (a) Explain the biological significance of the following forms of behaviour.

(i) Territorial behaviour. (09mks)

- *Territoriality ensures organisms and their offspring are adequately spaced;*
- *It ensures that animals receive share of the available resources; such as food; breeding space;*
- *It ensures that only the fittest; breed to pass genes to the next generation;*
- *It is associated with intraspecific competition and act as the means of regulating population size;*
- *Species achieve maximum utilization of the habitat;*
- *Leaves animals free from disturbances during pair formation;*
- *Reduces risk of infection/ diseases;*
- *Ensures protection of members/ prevent direct conflict;*

(ii) Courtship. (07mks)

- *Courtship attract partners; by use of sound; which are genetically determined/ species specific;*
- *Ensures pairing between members of the same species; mating occurs among sexually mature individuals;*
- *Enables males to determine whether female is receptive or not;*
- *Females respond with correct behaviours leading to fertilization/ suppresses aggressive behaviours;*

(b) Distinguish between learned and instinctive behaviour. (04mks)

Instinctive behaviour	Learned behaviour
<i>In born</i>	<i>Learned/ acquired;</i>
<i>Fixed/ not adaptable</i>	<i>Easily adapted;</i>
<i>Similar among members of the same species</i>	<i>Varies among members of the same species;</i>
<i>Unintelligent</i>	<i>intelligent;</i>
<i>Comprise of chain of actions</i>	<i>No fixed sequence of actions;</i>
<i>Permanent</i>	<i>Temporary;</i>

6. (a) What is meant by a **food chain**? (02mks)

It is transfer of energy; from green plants/ primary producer; through sequence of organisms/ consumers; in which each eats one below it in the chain; and is eaten by the one/ organisms above it;

- (b) Explain how energy flows through an ecosystem. (08mks)

Green plants called producers; trap sun energy; manufacture sugars in a process of photosynthesis; non-producers feed on producers; and are called primary consumers; they are herbivores; but also include plant parasites; e.g. fungi and some bacteria;

Some heterotrophs feed on other heterotrophs; these are called secondary consumers if they feed on herbivores; and tertiary consumers; if they feed on other carnivores;

Energy is thus passed along a chain of organisms; however only a little of the energy is passed from one trophic level to the next; most of it is lost as heat; during the respiratory processes; and indigestible materials of each organism in the chain;

- (c) How does temperature influence the distribution of organisms? (10mks)

Small temperature range; because enzymes work within narrow optimum temperature range; most organisms are found where temperature is moderate; like in tropics and temperate regions; high temperatures cause enzyme denaturation; rapid evaporation of water; dehydration; low temperatures inactivate enzymes; makes crystals in cells so killing them; therefore very few inhabit regions with extreme high/ low temperatures;

END