

MARKING GUIDE

Uganda Advanced Certificate of Education

BIOLOGY
(Theory)

Paper 2

SECTION A: (40 MARKS)

Question 1 is compulsory

1. An experiment was carried out on a dog which was made to drink water to full capacity. Measurements were then taken to determine the changes in the rate of urine production and concentration of urine. After ten minutes, a saline solution, hypertonic to the blood plasma was injected in to its carotid artery. Measurements were continued for another 40 minutes.

Figures 1(a) and (b) shows the results of the investigations.

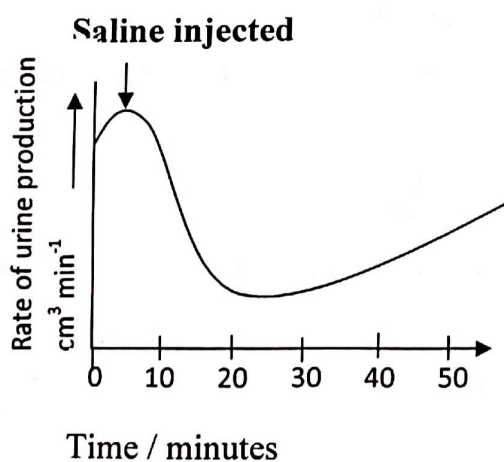


Fig. 1(a)

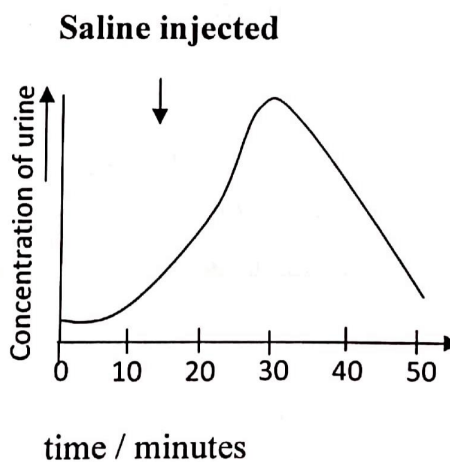


Fig. 1(b)

Turn Over

- (a) Describe the effect of the saline solution on each of the following; (02 marks)
- (i) Rate of urine production.
Injection of saline reduced the rate of urine production; to a minimum; but later the rate of urine production increased;
- (ii) Concentration of urine. (03 marks)
Injection of saline increased the concentration of urine; up to a peak, and thereafter, the concentration of urine decreased.
- (b) Explain the effects of the saline solution on the;
- (i) Rate of urine production. (08 marks)
Injection of saline into the blood lowers the water content of blood; and raises its pressure; which increases the filtration rate in the glomerulus; more glomerular filtrate is produced from which large amounts of water are reabsorbed into blood; so that now the rate of urine produce reduces; (rather than increasing)
As more water is reabsorbed into blood, its pressure reduced; which in turn reduces the filtration rate in the glomerulus; with a consequent decrease in rate of urine production.
- @ = 1 mark max = 08 marks
- (ii) Concentration of urine. (06 marks)
Injection of saline increases the concentration of urine; because the saline lowers the water content of blood; stimulating the anterior pituitary gland; to secrete large amounts of anti diuretic hormone; that increases permeability of renal tubules to water;

As more water is reabsorbed, the secretion of antidiuretic hormone reduces; decreasing the permeability of renal tubules to water;

(c) Explain the changes in each of the following before injection of the saline solution;

(i) Rate of urine production (08 marks)

From 0 to 10 minutes, the rate of urine production increase; because drinking large amounts of water increases the blood volume; and therefore blood pressure; which in turn increases also the blood pressure in the glomerulus; As a result; the filtration rate increases; increasing the rate of urine production;

@ = 1 mark (Max = 06 marks)

(ii) Concentration of urine. (04 marks)

Urine concentration remains fairly constant; because drinking large amounts of water reduced the osmotic pressure of blood; inhibition. The release of anti diuretic hormone causing loss of much water through urine with an equivalent amount of salts; resulting from tubular secretion within proximal convoluted tubule; and active pumping from blood into renal fluid within the distal convoluted tubule; so that there was no significant change in urine concentration.

@ = 1 mark max = 06

(d) Suggest and explain what would happen to the rate of urine production if the;

(i) Saline had been injected into the vein in the neck of a dog.

(04 marks)

- *Injection of saline into a vein would have no effect on the rate of urine production; because once in the vein, the saline is transported first to the heart before it joins the systemic circulation; and while in the heart , its effect is cancelled out by respiration / metabolism of the heart; so*

that the osmotic pressure of blood remains intact; hence that in the glomerular capillaries;

@ = 1 mark

(ii) Pressure of blood fall.

(03 marks)

- *When the blood pressure falls, the pressure in glomerular capillaries also drops; when the glomerular capillary pressure drops below that of the osmotic pressure of the plasma proteins, the plasma (water and soluble components) is held back; in the capillaries. This stops the formation of glomerular filtrate leading to no urine productivity.*

Total = 40

SECTION B

Attempt any THREE questions from this section

2. (a) What is meant by chemosynthesis? **(03 marks)**

This is the synthesis of organic compounds; form inorganic materials; using energy derived from oxidation of inorganic compounds ;

(b) Compare photosynthesis in purple sulphur bacteria with that in a higher plant. **(07 marks)**

Similarities

- *Both use photosynthetic pigments;*
- *Both use energy from sunlight*
- *Both have an inorganic source of carbon*
- *Both result in the production of carbohydrates;*

Differences

- | | |
|--|--|
| - <i>Purple sulphure bacteria</i> | <i>higher plants</i> |
| - <i>Source of hydrogen is hydrogen sulphide</i> | <i>source of hydrogen is water</i> |
| - <i>Produce sulphur as a bi-product</i> | <i>Produce oxygen as a bi- product</i> |
| - <i>Use bacteria chlorophyll</i> | <i>Use chlorophyll as the</i> |

as the pigment

photosynthetic pigment

- (c) Explain the mutualistic relationship between mammals and the microorganisms in their digestion tract. (10 marks)

The microorganism secrete cellulose enzyme; that digests cellulose; into simple sugars / glucose; which is absorbed along the walls of the tract; and then assimilated; they also synthesize B – vitamins for the host;

The microorganisms gains shelter; warmth; constant food supply; and protection; from the host;

1 mark @ = 10 mark

3. (a) Describe the functions of the human placenta. (12 marks)
- *Allows exchange of materials between the mother and fetus; without the two bloods mixing.*
 - *Allows maternal antibodies to pass into the fetus to provide it with some immunity.*
 - *Protects the fetus; by preventing certain pathogens and their toxins from crossing into the fetal circulation;*
 - *Acts as a barrier; to maternal hormones and other chemicals; in the mother's blood that can adversely affect fetal development*
 - *Permits the blood system of the mother and fetus to operate at different pressures; so that neither is harmed;*
 - *During pregnancy, it secretes reproductive hormones that maintains the pregnancy; and suppress ovulation together with menstruation;*

1 mark @

- (b) Explain the advantages of internal fertilization. (08 marks)

- Avoids wastage of gametes; since the chances of fertilization are high;
- Leads to internal development of embryo, so it is nourished; and protected from predation; and drying out. 1 desiccation.

1 mark @

4. (a) Differentiate between hormonal and nervous coordination. (07 marks)

Hormonal coordination	Nervous coordination
<ul style="list-style-type: none"> - Message is chemical - Slow response - Response is long lived - Effect is wide spread - Origin of stimulus is a gland - Message is transmitted through blood stream - Receptor is the target organ - Destination of stimulus is all over the body 	<ul style="list-style-type: none"> - Message is electrical - Rapid response; - Response is short lived - Effect is localized; - Origin of stimulus is sensory receptor - Message is transmitted through nerve fibre - Receptor is the effector / muscle / gland - Destination of stimulus is to a specific point.

(b) Explain how unequal distribution of auxins influences tropic responses in plants. (07 marks)

- Unequal distribution of auxins results in one side of a plant apex having more auxins than the other side; as a result more growth occurs on the side having much auxins in shoot; causing curvature to directional stimuli; resulting into a positive tropic response;
- Less growth occurs on the side having little auxins in shoots; causing no curvature to dissectional stimuli; resulting into a negative tropic response;

@ = 1 mark, 07 marks

(c)

Tropic response	Importance
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- <i>Positive phototropism</i>	- <i>Plants absorb light for photosynthesis</i>
- <i>Negative phototropism</i>	- <i>Roots grow down in soil to absorb water/ mineral salts</i>
- <i>Positive geotropism</i>	- <i>Roots grow down in soil to obtain support / water or mineral salts;</i>
- <i>Negative geotropism</i>	- <i>Plant shoots grow upwards to obtain light for photosynthesis</i>
- <i>Positive hydrotropism</i>	- <i>Root absorb water for growth</i>
- <i>Negative hydrotropism</i>	- <i>Shoots obtain light for photosynthesis</i>
- <i>Positive thigmotropism</i>	- <i>Shoots or roots clasp on to others for support</i>
- <i>Positive herotropism</i>	- <i>Plant shoots absorb oxygen for aerobic respiration</i>

5. (a) How is support achieved in herbaceous plants? (05 marks)

- *Parenchyma cells absorb water; by osmosis; and become turgid; which makes them rigid; to resist compression and tension; forces.*
- *They have wilenchyma and sclerenchyma; which are all thickened; to increase on their support;*

@ = ½ mark

(b) (i) What problems are faced by plants growing in water logged soils? (05marks)

- *Lack of oxygen; causing insufficient root respiration; hence death / drying of the plant*
- *Mineral nutrient deficiency; as most are leached*
- *Absorption of excess water than is needed;*

(ii) Explain how some plants have been able to overcome the above problems. (10 marks)

- *Development of a tap root system e.g. in encalyptus; to tap deeper mineral supplies*
- *Breathing roots e.g. in red mangrove, to obtain sufficient oxygen from the air.*

- *Elongated leaf lamina; as in papyrus, to increase surface area for water loss*
- *Broad lamina; provides a large surface for water loss*
- *Carnivorous / root nodules; for obtaining sufficient nitrogen*

@ = 1 mark , 10 marks

(a) Describe the causes of genetic variation in a population. (14 marks)

- *Crossing over; in prophase I of meiosis; separates linked genes; leading to gene mixing;*
- *Independent assortment; at metarphase I of meiosis; leads to production of new gene combinations in the germetes;*
- *Random fertilisatio; mixes parental genes; in different combination; producing varied offsprings;*
- *Mutation; alters the structure of DNA, and chromosomes; increasing variability;*

@ = 1 mark , Total = 15 marks, max = 14

(b) How does variation influence the adaptation of a species to the environment? (06 marks)

- *When environmental conditions change; advantages variations are retained; while disadvantageous ones are eliminated;*
- *Advantageous variations are inherited and passed on to next generations; so that offspring of subsequent generation are better adapted to survive; an environmental change.*

END