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THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education

231/2 — BIOLOGY — Paper 2

(THEORY)

Apr. 2021 – 2 hours

Name ..... Index Number .....

Candidate's Signature ..... Date .....

Instructions to Candidates

(a) *Write your name and index number in the spaces provided above.*
(b) *Sign and write the date of examination in the spaces provided above.*
(c) *This paper consists of **two** sections; **A** and **B**.*
(d) *Answer **all** the questions in section **A** in the spaces provided.*
(e) *In section **B** answer question **6 (compulsory)** and either question **7** or **8** in the spaces provided after question **8**.*
(f) ***This paper consists of 12 printed pages.***
(g) ***Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***
(h) ***Candidates should answer the questions in English.***

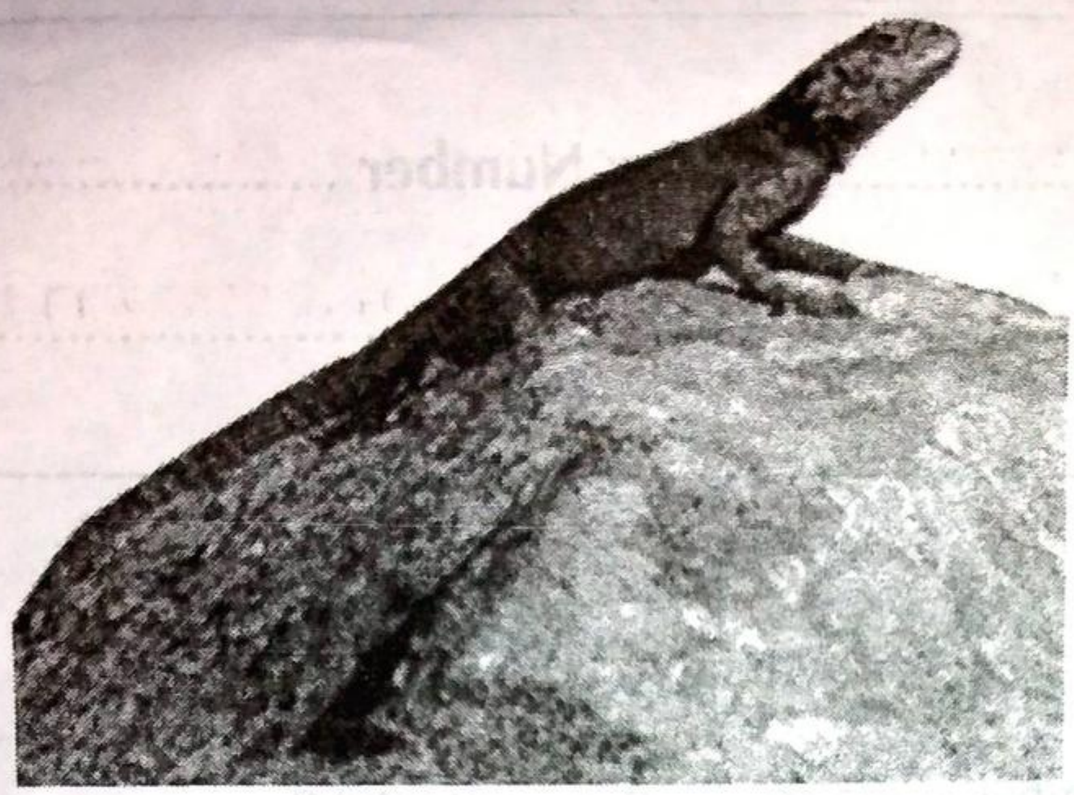
For Examiner's Use Only

Section	Question	Maximum Score	Candidate's Score
A	1	8	
	2	8	
	3	8	
	4	8	
	5	8	
B	6	20	
		20	
Total Score		80	

SECTION A (40 marks)

*Answer **all** questions in this section in the spaces provided.*

1. Below are photographs **E** and **F**, of two organisms, taken from their natural habitats.



E

F

(a) (i) State the **main** nitrogenous waste product of the organism in photograph **E**. (1 mark)

Uric acid;

TIED

(ii) Give a reason for your answer in a(i) above. (1 mark)

Uric acid requires less water to eliminate/removal of uric acid conserving water/less poisonous/Toxic;

(b) State why the organism in photograph **E** is usually found on top of rock surfaces even during hot, sunny days. (1 mark)

It's an ecto therm/poikilotherm/exotherm;

OWTTE

(c) (i) Which of the two organisms would have a higher biomass if both were left in their natural ecosystem. (1 mark)

F;

TIED

(ii) Give a reason for your answer in c(i). (1 mark)

occupies a lower trophic level/biomass/energy decreased up the trophic level;

Also organism F is eaten by E

(d) With reference to observable features, explain why the organism in photograph **F** is usually found in a wider range of habitats. (3 marks)

- It is dorsal-ventrally flattened, hence able to move through/penetrate crevices (in search of food mates, for safety);
- Has wings to fly;
- Has antennae for sensory purposes;
- Has exoskeleton/cuticle for protection/conservation of H_2O;
- Has legs to enable to move;

2. The genetic make-up of a man was found to be XXY.

(a) Name the syndrome the individual could be suffering from. (1 mark)

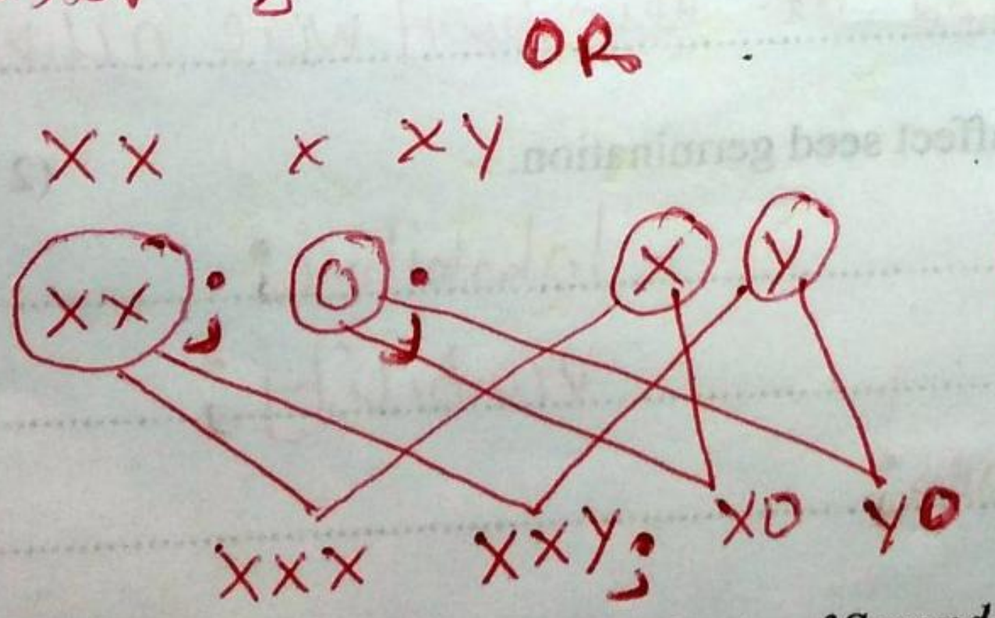
Klinefelter's syndrome; ignore spelling

TIED

(b) Explain how the syndrome occurs. (4 marks)

Chromosomal abnormalities/mutation; result in addition of a whole chromosome; It occurs during the Meiotic division/ Meiosis where the homologous chromosomes/sister chromatids fail to segregate; and so move to the same gamete cell; If gamete with XX fuses with gamete with Y the offspring becomes XXY;

OR



max 3

	X	Y
XX;	XXX	XXY;
0;	XO	YO

(c) (i) State how the chemical, colchicine induces polyploidy in plants. (1 mark)

It prevents spindle formation during cell division; thus leading to a cell with extra sets of chromosomes;

(ii) State **one** advantage of polyploidy in wheat farming. (2 marks)

-Resistant to drought/pests/diseases;
-High yields;
-Early Maturity;

double tick for the first correct 3

3. In an experiment to investigate the effect of temperature on seed germination, soaked maize seeds were subjected to varying temperatures as tabulated below.

Temperature (°C)	0	6	12	17	28	33	41.5	51
Percentage germination (%)	0	0	2.5	5	13	44	26	3

(a) Account for the percentage germination at: (3 marks)

(i) 6°C;

There was no germination; since this was (very) low temperature; which inactivated enzymes;

(3 marks)

(ii) 33°C.

Percentage germination was the highest; since the temperature was (most) favourable/optimum; enzymes worked at their best/were activated;

(2 marks)

(b) State **two** internal factors that affect seed germination. (2 marks)

Embryo; Inhibitors;
Seed coat; Viability;
growth hormones;
Enzyme;

4. A student could clearly read a book placed 10 cm away but could not clearly identify a fellow student 12 m away.

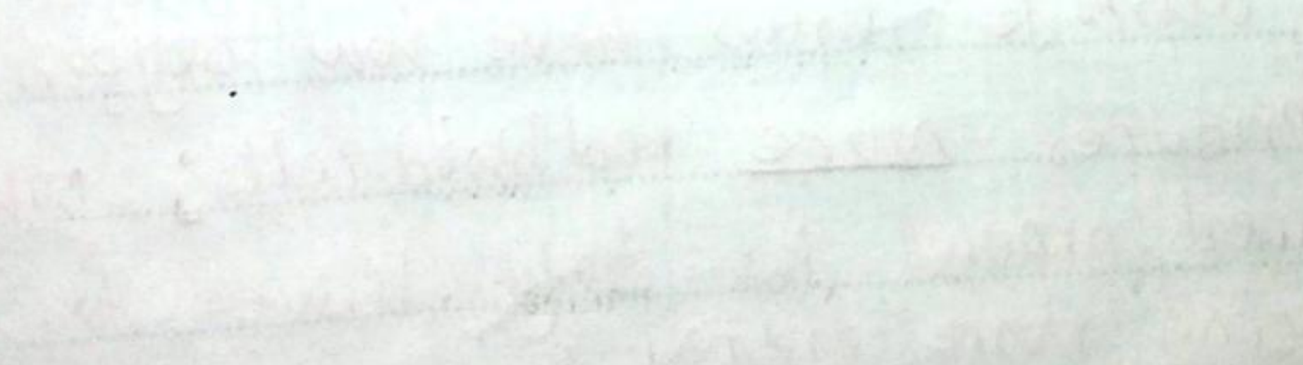
(a) Name the eye defect the student was suffering from. (1 mark)

Short sightedness / Myopia; acc. Near sightedness / Short sight

(b) Explain why the student could **not** clearly identify his colleague yet could read the book. (3 marks)

Has a long eye ball; resulting in the light rays from the Colleague (who is 12M away) being focused at a point in front of the retina; light rays from the book are focused on the retina;

(c) Using a diagram, illustrate how the defect can be corrected. (3 marks)



(d) Name the vitamin whose deficiency in the diet results in poor vision. (1 mark)

(Vitamin) A / Retinal;

5. The table below shows the volume of gases contained in 100 cm^3 of a blood sample tapped at two points in the mammalian circulatory system.

Gas	Blood entering lungs (cm^3)	Blood leaving lungs (cm^3)
Oxygen	8.65	20.25
Nitrogen	0.75	0.75
Carbon (IV) oxide	55.60	31.65

(a) Account for the difference in the gaseous composition of:

(i) Blood entering the lungs; (2 marks)

Blood entering lungs has low(er) concentration of oxygen and high(er) concentration of carbon(iv)oxide; since most of oxygen had been used during respiration; yielding (more) carbon (iv) oxide;

(ii) Blood leaving the lungs. (2 marks)

Blood leaving the lungs has a lower conc. of CO_2 & higher conc. of oxygen; since it has been purified; The volume of nitrogen remains unchanged as it is not used up in respiration;

(b) Name the blood vessel through which blood enters the lungs. (1 mark)

Pulmonary artery;

(c) Explain why most athletes prefer training from high altitude areas. (3 marks)

High altitude areas have low oxygen conc; the body produces more red blood cells; which oxygen is carried around the body tissues for respiration; producing more energy for the athletes;

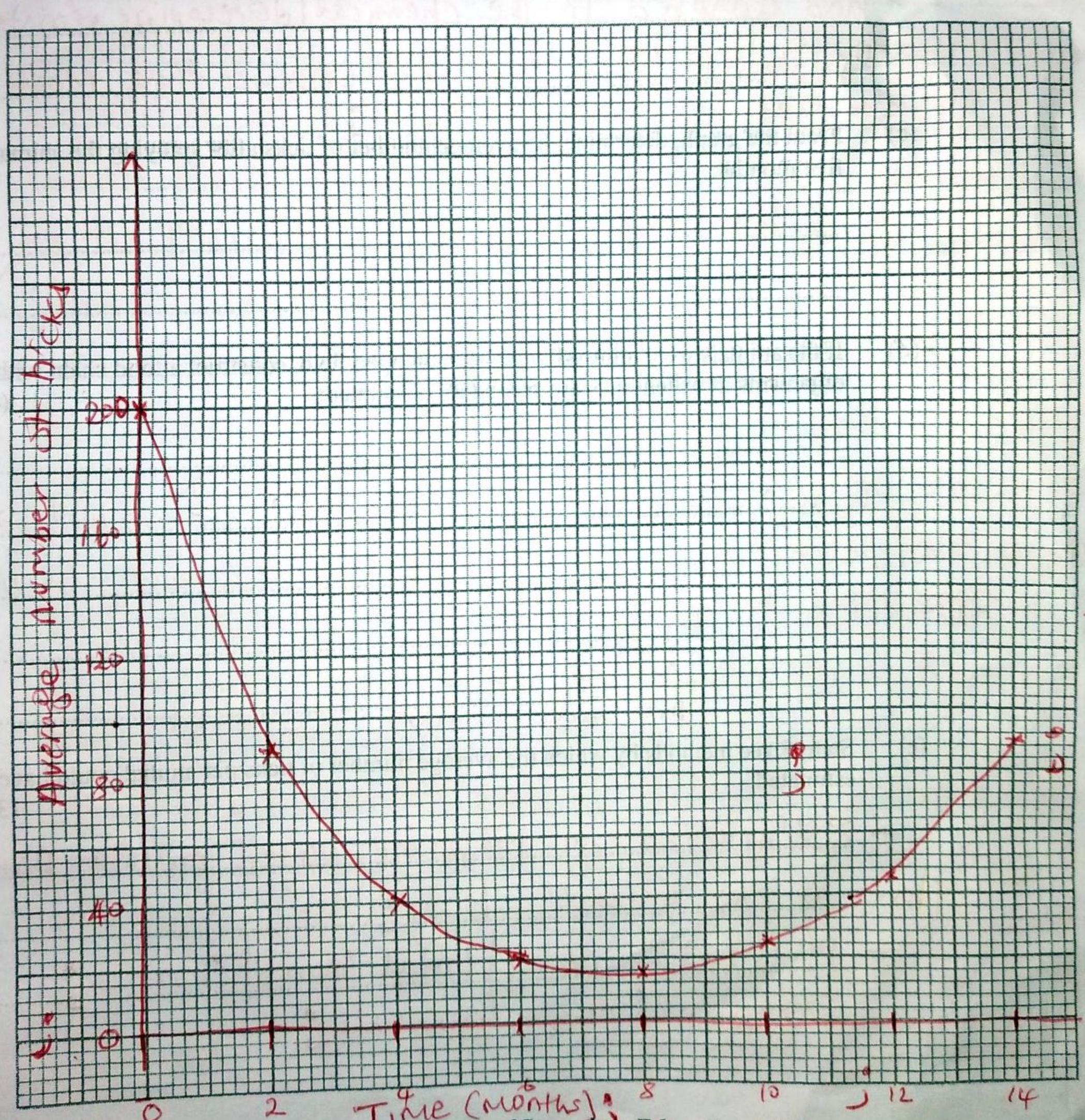
SECTION B (40 marks)

*Answer question **6 (compulsory)** and either question 7 or **8** in the spaces provided after question **8**.*

6. The data below shows the average number of ticks per animal in a certain farm before and after spraying the animals with a certain chemical. The spraying was done once every month. The data was tabulated as shown below.

Time (months)	0	2	4	6	8	10	12	14
Average number of ticks	200	90	40	20	16	25	45	90

(a) Plot a graph of number of ticks against time. (6 marks)



(b) Account for the shape of the graph between:

(i) 0 and 8 months; (3 marks)

Decrease in the number of ticks; chemical was poisonous/killing the ticks; ticks had not adapted to the chemical/developed resistance;

(ii) 10 and 14 months. (3 marks)

The number of ticks per animal increased; ticks had adapted to the chemical/developing resistance; Resistant ticks produced enzymes that made the chemical harmless to them;

(c) From the graph, determine the average number of ticks after spraying the animals for five months. (1 mark)

28 ± 2;

(d) If the animals were allowed to graze in an open field, construct a food chain with five organisms in which ticks are secondary consumers. (4 marks)

Grass; → Animal → tick; → bird → vulture;

cc. Correct/specific names of organisms in the food chain

~~Tick~~ Mark for producer (grass)

" " Tick

" " energy flow

" " presence of five organisms

(e) State **three** methods by which the average number of ticks per animal could have been estimated. (3 marks)

- Estimation by mapping based on the various parts of the animal's body;
- Physical counting/total count/census;
- Sampling the animals;

7. (a) Explain the role of the liver in blood sugar regulation. (3 marks)

(b) Describe how human blood is adapted to its function. (17 marks)

8. (a) Explain how the presence of chloroplasts in guard cells affect the opening of stomata. (5 marks)

(b) Describe how various environmental factors affect the rate of photosynthesis. (15 marks)

7a) When blood glucose level is high, insulin hormone acc. Beta cell for pancrease
is produced; by pancrease; stimulating liver cells to convert excess glucose to glycogen/some excess glucose is converted to fats; (Note: pancrease to score once)
When blood glucose level is low glucagon hormone is secreted by the pacreuse; stimulating liver cells to convert the glycogen/fats to glucose;

Acc. Alpha cell

(b) Plasma; is the fluid part of blood, consisting of dissolved and undissolved substances; the plasma acts as a medium in which various substances are transported in the body; it acts as a medium in which various metabolic reactions occur; plays a role in thermoregulation/distribute heat;

platelets; contain protein; that help in blood clotting; preventing loss of blood/anaemia; Also prevent entry of pathogen; (acc. thrombokinase/thromboplastin for protein)

White blood cells; are irregular/amoebid in shape; they project the body against attack by pathogen; by engulfing them; and releasing antibodies; against the pathogens; They are numerous; enhance the body defense mechanism;

- Any correctly named WBC eg Monocyte/Lymphocyte/Agranulocytes
- Lymphocytes & Agranulocyte produced antibodies
- Granulocyte/phagocytes/neutrophil/Eosinophils/Basophils by engurfing.

Red blood cells; are biconcave in shape; to increase surface area for diffusion of gases/squeezing thro blood capillaries; They lack the nucleus; to allow for packing more haemoglobin; Have Haemoglobin; that has high affinity of oxygen; they are also numerous; to increase the surface area to transport more oxygen; Has carbonic anhydrase enzyme; for loading and Ot loading CO_2;

8. (a) Chloroplasts are sites of photosynthesis; during the day photosynthesis take place; glucose is manufactured; glucose being osmotically active, increases the internal concentration of the guard cells; water is drawn into the guard cells; guard cells becomes turgid; bulging outward/unequal expansion of the guard cell results in the opening of the stomata;

ALSO; Starch interconversion theory.

Chloroplasts are sites of photosynthesis; during the day photosynthesis take place; using CO_2 making the pH to rise in the guard cell favouring the conversion of starch into glucose; then....

Potassium theory

→ ... ATP accumulate in the guard cells making guard cell to draw potassium ions; then;

(b) Carbon (IV) oxide Concentration;

Carbon (IV) oxide is a raw material for photosynthesis; an increase of Co_2 lead to an increase in the rate of photosynthesis; up to a given optimum; Beyond optimum the rate of photosynthesis remain constant; due to other limiting factors; acc. correctly named limiting factors.

Light intensity / quality of light; light provides the energy required for photosynthesis / photolysis / light stage; the rate of photosynthesis increases as light intensity increases; up to an optimum level; beyond the optimum the rate of photosynthesis remain constant; due to other limiting factors; and the rate of photosynthesis drops;

Temperature; low temperatures inactivate enzymes; thus reducing the rate of photosynthesis; as temp. increases the rate of photosynthesis increases; up to optimum; high temp above optimum denatures enzymes; reducing the rate of photosynthesis

Water; is a raw material for photosynthesis; it influences the opening and closure of stomata; which in turn affect the diffusion of CO_2 into the leaf;