

WAKISSHA JOINT MOCK EXAMINATIONS

MARKING GUIDE

Uganda Advanced Certificate of Education

BIOLOGY P530/3

July/August 2023



Question 1

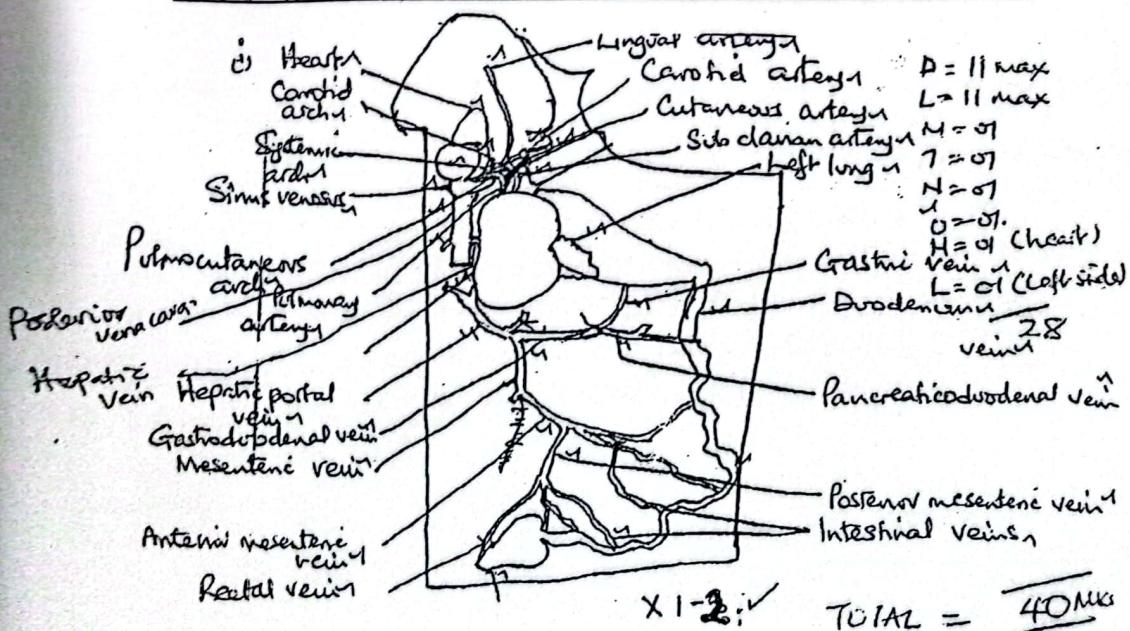
1. a) i) Outline drawn accurately;
 Method for calculating total skin surface area in cm^2 :-
 No. of complete squares ($1\text{cm} \times 1\text{cm}$) + $\frac{\text{Incomplete Sq}}{2} = x \text{ cm}^2$
 Since specimen has skin on dorsal & ventral sides,
 total skin surface area = $x \times 2\text{cm}^2$; **misses a mark without units** 04
- ii) New volume depends on size/volume of specimen D but greater than
 $250 \text{ mls} < 500 \text{ mls}$; **Volume of specimen in change in volume.** 01
- iii) S. Area : Volume = S. Area in a) (i) above: increase in volume above
 250ml in (ii) above. ; **volume of specimen** 02
- iv) Ratio shows specimen D has a large surface area to volume ratio;
 for faster rate of cutaneous gaseous exchange;
Rej. Decimals in ratios. Volume of specimen D
Simplest whole number without units.
 Learner should show ratio.
 Accept: ratio with no units.
 : Simplest number with units.

01

- b) Liver lobes, stomach, Duodenum, Ileum, Colon, Rectum, Bladder, Gall bladder,
 Fat body. **Any correct 8 @ ½ mark** 04

Reject if heart, lungs, xiphoid cartilage and cloaca included ignore any abdominal structure listed when is visible on displacement of other structures.

Drawing showing blood vessels draining visceral abdominal organs and supplying blood to head and chest of D with heart in dorsal view.



- Ignore: abdominal structures labeled.
 N/A – arterial, if any artery labeled other than above.
 N/A – Venous, femoral, sciatic, pelvic vein, anterior venacava.
 A – 72hrs germinated soya bean seedlings.
 B – 24 hours germinated soya bean seedlings.
 C – 144 hrs germinated soya bean seedlings.
 S – Urine of cow/bull.

TOTAL = 40 MARKS

Question 2

2. a) i) Appearance of Extract Nature of residue
 B – Very turbid / milky; Fine / smooth texture;
 C – Less turbid / milky; Coarse / Rough and fibrous;
- 01
- ii) Extract B very turbid due to presence of much starch being stored; with fine / smooth residue since tissues are not yet formed; while extract C is less turbid since it has less starch / (some hydrolyzed into sugar for energy production;) of new tissues since the residue is rough and fibrous;
- @ ½

b)

Deny observations if no procedure.

Accept milky / turbid for

TESTS	OBSERVATIONS
1. To 1cm ³ of extract was added 1/2/3 drops of iodine solution;	A – Turbid solution; turned to pale black; B – Turbid solution; turned to black; C – Turbid solution; turned to blue / grey
2. To 1cm ³ of extract was added 1 cm ³ of NaOH solution; followed by 1/2/3 drops of CuSO ₄ solution;	A – Turbid solution; turned to purple solution; B – Turbid solution; turned to deep purple solution; C – Turbid solution; turned to pale purple/ violet solution;

10 marks

- (i) Extract from youngest B, A and C; → oldest seedlings:-

Accept breakdown / hydrolysed

- (ii) B had highest amount of starch and proteins which are still stored; while C had the least amounts since much of the starch had been hydrolyzed; (into sugar) for energy production; needed for growth of new cells/tissues; from hydrolysis of proteins; **A had moderate starch and proteins since moderate hydrolysis of substrates occurred**

01

05

- c) i) B 1 – 2 drops
 ii) C 3 – 5 drops

Number of drops in C > B

25 marks

- d) i) On addition of Litmus solution there is change in color from clear solution/turbid solution to pale blue/purple solution; indicating formation of a weak alkaline product in the period of 90 minutes; After reaching the end point on addition of drops of acid, the color changed to pale red/pink; due to the excess acid;
- ii) Fewer drops added in B than C due to more alkaline product formed in C; since extract C had higher concentration of an active substance increased activity; that catalyzed the breakdown of solution S at faster rate than in B; Solution C had more/higher number of drops than B, because it contains **more active substance**, thus **more chance of collisions/ activity between active substance and substances**. Catalysed the breakdown of substrate S at a faster rate than B to move alkaline molecules.

03

05

TOTAL = 30 MARKS**Question 3**

(iii)

Rounds	X			Y			Z		
No. of pairs	WW	WB	BB	WW	WB	BB	WW	WB	BB
	10	20	10	14	12	6	15	10	01
Ratio	1	2	1	2.3	2	1	15	10	01

Accept trend in table

09

NB: - No of pairs should add as follows-

$$X = 40 \quad Y = 32 \quad Z = 23$$

- Difference / deviation from figure above should be + - 1 and observe the trend for each round as above.

- (i) black & white seed color – alleles / genes; since they occur on the seeds; (factors for inheritance/genes)

Reject: gametes

:Phenotype / Genotype.

02

- (ii) Envelopes A & B – heterozygous parents; since we draw from the envelopes; and each envelope has seeds of both colors; **accept parents**.

Reject gametes.

02

- (iii) Picking seeds – gametogenesis/meiosis; since seeds are picked singly from each envelope (parent)

Accept / formation of gamete release/production.

03

18

- (iv) Pairing seeds – pollination followed by random fertilization; since seeds picked from separate envelopes (heterozygous parents) are brought together;

03

Envelopes shaken thoroughly to mix the white and black seeds uniformly to ensure random picking of the seeds;

02

Suggesting and explaining the genetic principles exhibited by results in round;

- (i) X – Mendel's 1st law of segregation in alleles or independent assortment;- when heterozygous F₁ parents are selfed, during gamete formation / meiosis; the pair of

alleles separate in gametes and are transmitted independent of each other; such that all possible genotypes result in F_2 in ratio 1:2:1

- (ii) Round Y and Z – Natural selection;- due to changing environment there is selection pressure on the gene pool resulting into the advantageous alleles (w) being selected for; while the disadvantages alleles (B) is selected against; With successive generations Y and Z there is high specialization/adaption in Specie WW which dominate in the population; while specie BB with disadvantageous characteristics is eliminated;
- (e) (i) Directional selection. This is because with subsequent generation crosses the homozygous black individual numbers decreases yet the heterozygous and homozygous white individual increase.
- (ii) Still all the individual woulds appear, WW, WB and BB because no gene / allele can be excluded / eliminated from the population because both homozygous white and heterozygous individuals are selected for.

TOTAL = 30 MARKS

END



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1. (a) (i)

At 0 weeks, as weed density was high bean seed density was low;

From 0 to 4 weeks as the weed density decreased rapidly, bean density increased rapidly; to a peak; at 5 weeks.

From 5 to 7 weeks, as weed density decreased gradually, bean density also decreased rapidly.

From 7 to 9 weeks as weed density remained constant bean seed density increased; rapidly

Accept almost constant

Ignore: - Comparison terms i.e as, while / whereas

- Learner should clearly state the relationship

(05 marks)

(a) (ii)

At 0 weeks as weed density was high and bean seed density was low because **interspecific competition** was high; weeds outcompeted beans for resources; as weeds germinate and grow faster; preventing beans from obtaining sufficient resources hence many fail to flower; or produce seeds.

Learner should specific the type of competition.

From 0 to 5 weeks as weed density decreased bean density increased because of decreased interspecific competition; For resources making more resources available for beans; which multiply and grow rapidly; and many flower; to produce seeds.

From 5 weeks to 7 weeks, as weed density decreased bean seed density also decreased little because of increased intraspecific competition between bean plants; for resources due to high density causing increased death rate; more than reproductive rate due to the population of weeds;

From 7 to 9 weeks, as weed density remained constant bean seed density increased; due to reduced intraspecific and little interspecific competition or reduced competition; so reproductive rate is greater than death rate many bean plants flower producing seeds;

@ 1 mark (11 marks)

(b) Interspecific competition;

Importance

- leads to resource partitioning, allowing populations of different species to co-exist in a given habitat /occupying different niches; / niche specialization.
- leads to competitive exclusion (decrease in number of organisms of a given species in a habitat;
- increase survival of better adapted organisms;
- regulate population density;
- influences organism

**Any 3 points, 3 marks for importance
1 mark for relationship (04 marks)**

- (c) At a distance of 5 meters from the road side, seed production per plant was low; / less due to the short distance, hence more dust particles settled on the leaf surfaces, reducing light penetration and blocking many stomata; preventing entry of carbon dioxide; hence reducing rate of photosynthesis / productivity which in turn reduced seed production per plant. Dust particles prevent pollination by blocking stigma and makes flowers inconspicuous to pollinators.

Max 4marks

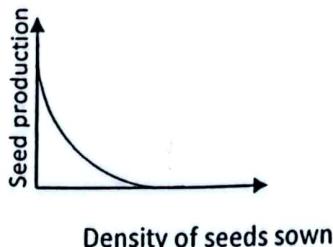
From a distance of 5 meters to 30 meters from the road side, seed production per plant increased rapidly / steeply / drastically; where a maximum was reached; distance from the road was increasing thus a rapid decrease in amount of dust particles that settle on leaf surface; increasing light penetration; and number of open stomata for entry of more carbondioxide; increasing rate of photosynthesis net primary productivity. More pollination occurs, as less stigma blocked and flowers are more conspicuous. **Max 4marks**

From distance of 30 meters to 35 meters, seed production per plant increased gradually / slowly; because dust is no longer a limiting factor other factors are limiting seed production. E.g. increased competition limiting seed production / photosynthesis / productivity.

From distance of 35 meters to 40 meters, seed production per plant remained almost constant / constant; because carrying capacity is reached (maximum seed production per plant is reached) / available resources cannot support any further increase in seed production; **Description 1 mark**

@ 1 mark, max = 13 marks

- (d) - Low density of seeds sown results in high seed production this is because of low intraspecific competition for the available resources. Increase in density of seeds sown increases intraspecific competition and thus reduced seed production



Any 04 marks

Graph - 1 mark
Description – 1 mark
Explanation – 2 marks

- (e) - Reduces competition for food; leading to reduced death rates.
- Increases species diversity; due to availability of food;
- Reduces carbon dioxide accumulation in the atmosphere;
- Increases oxygen release for aerobes;
- Decreases species extinction;

Each 1 mark

Any = 03 max = 03

TOTAL = 40 MARKS

SECTION B

2. (a) (i)

Carrier proteins present; have binding /receptor sites on which molecules like glucose can bind; then the carrier proteins alter shape; permitting specific molecules to be moved from where there concentration is higher into the cell; by facilitated diffusion;

Carrier proteins carryout active transport of molecules; where ATP bind onto them and the hydrolysis of the ATP release energy which allow movement of molecules / ions from where the concentration is low into the cell.

Channel proteins have pores which open; allowing passive diffusion of ions / molecules into the cell;

@1 mark, max = 08 marks

(a) (ii)

- Prevent release of hydrolytic enzymes e.g. in lysosomes that would cause autolysis;
- Mitochondria – energy production.
- Nucleus – control cell's activities.
- Chloroplast – photosynthesis.
- E.R- transport, synthesis, production of cpds.
- Golgi apparatus – production of glycoproteins, production of enzymes.
- Sarcoplasmic – storage support.
- Lysosomes – release/store enzymes.
- Peroxisomes – production & storage of cpds.

-Max = 04 marks -Organelle – ½ mark -Importance – ½ mark

(b) Competitive inhibitors have similar shapes to enzyme /substrate active site; so fit into the active site of enzyme; preventing formation of enzyme – substrate complexes; and so reduce the reaction rate; such inhibitors are concentration dependent;

Non – competitive inhibitors have shapes not complementary to enzyme active site; so inhibitors bind at site away from active site; changing shape of active site; preventing formation of enzyme substrate complexes, reducing rate of reaction; these are substrate independent;

Max = 08 marks

TOTAL = 20 MARKS

3. (a)

Anaerobic respiration in yeast	Anaerobic respiration in muscle tissue
- Final product is ethanol	- Final product is lactic acid
- Involves an intermediate step of forming ethanol	- Pyruvate is directly converted (reduced) to lactic acid
- Ethanol is substrate reduced by NADH_2	- Pyruvate is the substrate reduced by NADH_2
- Mediated by two enzymes i.e. pyruvate decarboxylase and alcohol dehydrogenase	- Mediated by only one enzyme; lactate dehydrogenase
- Accompanied by production of carbon dioxide	- Not accompanied by carbon dioxide production
- Involves decarboxylation & dehydrogenation	- Involves only dehydrogenation

Any 4 @ 1 mark 4/5 marks

Similarities

- Both release energy in form of ATP;
- Both are enzyme controlled reactions;
- Both occur within the cytoplasm of the cell;
- In both NAD is involved as hydrogen acceptor;
- Both occur in absence of oxygen

Correct Any @ 4 points 4 marks

(b) Short term effects of exercise

- Cardiac output increases
- Blood pressure increases
- Vasodilation of blood vessels of heart and muscles.
- Heart rate increases
- Stroke volume increases.
- Vasoconstriction of vessels to non – vital organs;
- Increased ventilation rate

Any Correct 3 points 3 marks

Long term effects on; circulatory system;

- Blood supply to lungs increases
- Affinity of blood / hemoglobin for oxygen increases
- Red blood cell count increases.
- Heart / heart chambers become enlarged;
- Mass of muscles on heart wall increases;
- Increased capillarity density.
- Increased concentration of blood.

**Any 2 correct points
Max = 02 marks**

Respiratory system;

- Respiratory muscles become stronger and thicker.
- Concentration of respiratory enzyme in cells increases.
- Number and size of mitochondria in cells increases;

**Any 2 correct point @ 1 mark
Total 2 marks**

Max = 02 marks

- (c)**
- Being very many increases surface area for gaseous exchange.
 - Thin epithelium reduces diffusion distance.
 - Moist lining dissolves gases for easy diffusion.
 - Rich blood supply maintains steep concentration gradient.
 - Well ventilated to maintain steep concentration gradient.
 - Pores on walls / permeable walls for passage of gases

@ 1 mark, max = 05 marks

TOTAL = 20 MARKS

4. (a) Differences between,

Fertilization in flowering plants	Fertilization in mammals
- Double fertilization occurs	- It's a single fertilization;
- Takes place within embryo sac.	- Takes place within oviduct / fallopian tube;
- Chemical attract male gametes towards the female gametes	- Male gametes swim to get into contact with the female one by chance;
- Immediate processes prior to fertilization occur slowly	- Immediate processes prior to fertilization occur fast / rapidly;
- Both a diploid zygote and triploid endosperm are formed;	- Only diploid zygote is formed;
- Male gametes involved are pollen grains	- Male gametes involved are sperms;
- Male gametes are carried in pollen tube to reach the female one	- Male gametes (sperm) swim on their own to reach the female gamete (egg);

@ 1 mark, max = 06 marks

(b) (i)

Sperm head penetrates into the secondary oocyte; cortical granules in the cytoplasm secrete enzymes; which causes zona pellucida to thicken and harden; the enzyme also destroy sperm receptors on membrane of the secondary oocyte / zona pellucida; no any other sperm can penetrate other than the first sperm which successfully entered into the secondary oocyte;
In humans the ovum and sperm has a single nucleus.

@ 1 mark, max = 06 marks

(b) (ii)

Human chorionic gonadotrophic hormone (HCG); maintains the activities of the corpus luteum; which continues to secrete oestrogen and progesterone.

Oestrogen; stimulates further development of receptors in the endometrium sensitive to oxytocin / inhibit secretion of FSH, Prolactin, so inhibit lactation / stimulate development of mammary glands;

Progesterone; stimulates development of milk glands in the breast / maintain thickness of the lining of endometrium; inhibits concentration of myometrium / inhibit secretion of FSH / Prolactin;

Hormone – 1 role

Human Placental Lactogen (HPL); stimulates the growth and development of the breast in preparation for Lactation / stimulates oestrogen and progesterone to cause development of the breasts;

Relaxin – relaxes connective tissues which causes enlargement of cervix prior to birth.

@ 1 mark, max = 08 marks

TOTAL = 20 MARKS

5. (a) How micro-organisms are denied entry into bodies.

- Thick epidermis
- Having wax.
- Having / secretion of mucus
- Possession of follicles / hairs on bodies / cilia

- Different uncondusive PH ranges in cavities e.g. Vagina, mouth, stomach
- Clothing
- Sneezing, vomiting, diarrhea
- Enzymes that digest organism e.g. in saliva & tears
- Muscles assist in closure e.g. eye lids & anal sphincter muscles
- Blood clotting.
- Personal hygiene & sanitation.

Any 7 well explained (7 marks)

(b) (i) Plants adaptations against herbivory

- Thick cuticle
- Having thorns and hooks.
- Reduced surface area e.g. leaves
- Awful and unpalatable
- Secretion of bad odours / smells once epidermis is damaged.
- Being poisonous and toxic.
- Secretion of itchy substances e.g. Sap
- Thick cell wall / having cellulose cell walls.
- Growing long especially Juicy parts are high up
- Thigmotropism, closing of leaves.
- Mimicry as in stone plant.
- Attracting herbivore natural predators like waste.
- Brightly coloured leaves.
-

Any 7 well explained @ 1 mark

Total 7 marks

(ii) Herbivorous adaptations to herbivory

- Possession of long digestive system
- Having diastema.
- 4 chambered stomach
- Have cellulose digestive enzyme. / form symbiotic relationships with cellulose secretly enzymes.
- Thick fur.
- Thick skin / epidermis
- Having waxy fur
- Tall to reach up in the canopy
- Long tongue
- Large molar/premolars
- Have teeth with open roots.
-

Any 6 @ 1 mark total (6 marks)

TOTAL = 20 MARKS

(a)

1. CO_2 combines with RUBP to form GP catalyzed by RUBISCO's
2. GP is phosphorylated; using ATP from light stage to form; TP and
3. Reduced; using reduced NADP from light stage; to form; TP;
4. TP is converted to RUP;
5. RUBP is phosphorylated using ATP from light stage; to form RUBP;
6. 2 molecules of TP combine to form hexose sugars.
7. Hexose sugar is converted to proteins; fats; polysaccharides;

@ 1 mark, max = 07 marks

(b) Similarities

Molueenzymes;

Differences

Efficiency of C₄ plants	Efficiency of C₃ path way
- Results into more rapid increase in dry mass of plant	- Less rapid increase in dry mass of plants.
- PEP & RUBP are CO ₂ acceptor	- RUBP are CO ₂ acceptor
- Occurs in bundle sheath & mesophyll cells.	- Occurs only in mesophyll cells .
- 1 st cpd is OAA a 4C compound.	- 1 st cpd is GD a 3c cpd
- Better adapted in drier regions / more tolerant to drier conditions	- Better adapted in cooler & conditions.
- Maximum rate of CO ₂ fixation is greater	- Maximum rate of CO ₂ fixation is less / lower.
- Light saturation takes place at higher light intensities	- light saturation takes place at lower light intensities
- Faster growth	- Slower growth
- Steep CO ₂ conc. Gradient is maintained between environment when plants stomata are reduced	- CO ₂ conc. Gradient is reduced when stomata reduces.
- Optimum temp ⁰ C for growth on C ₄ is higher.	- Optimum temp ⁰ C is lower
- Require extra energy to fix CO ₂	- Requires less energy to fix CO ₂
- Photorespiration does not occur	- Photorespiration occurs
- Involves RUBP carboxylase which is inefficient	- PEP carboxylase &RUBP are more efficient.
- Co ₂ fixation occur twice	- Co ₂ fixation occur once

Max = 0

- (c) Produces sugars; which are food for heterotrophes and are used in synthesis of other complex substances such as polysaccharides; proteins; and lipids;
 Calvin cycle regenerates ADP; and NADP; which are utilized in light stage to produce ATP; and NADPH₂'s
 Regenerates RUBP which is a carbon dioxide acceptor;
 Intermediates like Glycerate 3 – phosphate are used in other processes e.g. Respiration

Max = 0

TOTAL = 20 MARKS

END

**SECTION A (40 Marks)**

- | | | | |
|-------|----------|-------|-------|
| 1. C | 11. B | 21. C | 31. B |
| 2. C | 12. D | 22. A | 32. C |
| 3. B | 13. A | 23. C | 33. A |
| 4. A | 14. D | 24. C | 34. D |
| 5. A | 15. C | 25. C | 35. B |
| 6. A | 16. B | 26. B | 36. B |
| 7. A | 17. A | 27. D | 37. C |
| 8. C | 18. A | 28. D | 38. A |
| 9. C | 19. D | 29. D | 39. D |
| 10. D | 20. free | 30. B | 40. C |

1 mark @ $40 \times 1 = 40$ marks
Sub-Total = 40 marks

SECTION B (60 Marks)

41. (a) Compensation point is that time of day where photosynthesis and respiration proceed at the same rate; and there is no net gain or loss in carbohydrate/CO₂ or O₂; 1 mark @ (1 x 2 = 2) (02 marks)
- (b) Single CO₂ fixation occurs in mesophyll cells in C₃ plants; whereas C₄ plants have double CO₂ fixation both in mesophyll cells and bundle sheath cells; increasing the CO₂ concentration; consequently the photosynthetic rate; (04 marks)
- (c) (i) 1 - Triose phosphate/ phosphorylated 3 carbon sugar;
2 - Acetyl COA/ Acetyl co-enzyme A;
3 - Krebs cycle/Trilcarboxylic acid cycle; $\frac{1}{2}$ mark @ $\frac{1}{2} \times 3 = 1\frac{1}{2}$ (1 $\frac{1}{2}$ marks)
- (ii) The Krebs cycle is important in the synthesis of ATP; and hydrogen carrier molecules; like the NADH and FADH; which will be feed into the Electron transport system; to generate more ATP molecules; Accept: oxidative decarboxylation leading to ATP production; $\frac{1}{2}$ mark @ $\frac{1}{2} \times 5 = 2\frac{1}{2}$ (2 $\frac{1}{2}$ marks)

TOTAL = 10 MARKS

42. (a) (i) Is made of two polynucleotide chains; held together by hydrogen bonds through organic bases; and twisted along an axis to form a double helix; 1 mark @ $3 \times 1 = 3$

Accept: polynucleotide strands.

(03 marks)

- (ii) Parent DNA double helix separates into two polynucleotide stands; free DNA nucleolides pair with each other on the polynucleolide strands; forming two daughter double helices; in which one strand is exactly the same as that of the parent DNA molecule; $\frac{1}{2}$ mark @ $4 \times \frac{1}{2} = 2$

(02 marks)

(b) $\% A = \% T$ $\% C = \% G$ let $\% \text{ of } G = x$
 $38 + 38 + x + x = 100\%$ where $x \%$ of guanine
 $76 + 2x = 100$
 $2x = 24$
 $x = 12 \%$ of Guanine = 12%;

1mark @ method and answer
 $2 \times 1 = (02 \text{ marks})$

- (c) Linked alleles tend to be passed from generation to generation as an inseparable unit; that they fail to assort independently during prophase II of meiosis ; denying genetic recombination of alleles / genes hence no variation;

1mark @ $3 \times 1 = (03 \text{ marks})$

TOTAL = 10 MARKS

43. (a) (i) After ripening period is the period allowed for mature viable dormant seeds to undergo physical and chemical changes; so as to be able to germinate; after harvest / shedding off / falling of the parent plant;

Reject if after harvest/shedding off is missing.

1 mark @ Total marks = 2

- (ii) - The activity of a number of enzymes rises especially catalase, peroxidase, hydrolases;
- Protein digestion and level of soluble nitrogen compounds increases;
- The rate of respiration rises to increase the amount of ATP;
- Reserve lipids are used up;
- The levels of gibberillic acid and cytokinin increases;
- The levels of abscissic acid and growth inhibitors decrease;

1 mark @ Any 4 $4 \times 1 = 04 \text{ marks}$

- (b) The seed have alight receptor pigment called phytochrome; that exists in two interconvertible forms ; / PR and PFR when they receive light PR is converted into PFR; which promotes germination;

Accept: photochrome red / pr & phytochrome for red / pfr

1 mark @ $4 \times 1 = 4 (04 \text{ marks})$

TOTAL = 10 MARKS

44. (a) (i) Sickle – cell haemoglobin differs from normal haemoglobin only in the sixth amino acid of the beta (β) chain; whereas normal haemoglobin has glutamic acid, sickle cell haemoglobin has valine;
- 1 mark @ (02 marks)
- (ii) Sickle – cell haemoglobin does not bind with O₂ very well, at low O₂ concentration it becomes deoxygenated; polymerizes causing the red blood cells to become elongated and pointed at the ends;
- 1 mark @ 2x1 = (02marks)
- (iii) Symptoms
- Intense pain in muscles;
 - Kidney & heart failure;
 - Paralysis/ stroke
 - Fatigue/tiredness
 - General body weakness;
 - Enlarged chest;
- $\frac{1}{2}$ mark @ $2 \times \frac{1}{2} = 1$ (01marks)

- (b) (i) Haemoglobin molecule consists of 4 protein chains called globins; 2 are alpha (α) and 2 are beta (β) chains; each conjugated with a non-protein molecule called haem groups which bind O₂ to a ferrous ion;
- Accept: A correctly labeled diagram of haemoglobin if drawn
(03 marks)
- (ii) When one haem group of the 4 combine with O₂, the result is a change in the conformation structure of the haemoglobin molecules; exposing the remaining 3 haem group the result is an increased affinity for these haem groups to combine with more O₂ molecules;
- 1 mark @ $2 \times 1 = 2$ (02 marks)

TOTAL = 10 MARKS

45. (a) (i) Water potential is the average kinetic energy of water molecules in a system; while solute potential is the lowering of water potential due to presence of solute molecules in a system;
- 1 mark @ $2 \times 1 = 2$ (02 marks)
- (b) (i) Water potential increases rapidly; from flaccid to turgidity;
Reject: decreases
- (02 marks)
- (ii) As pressure potential increases; solute potential also increases;
- 1 mark @ (02 marks)
- (c) As water potential rapidly increases solute potential also increases; because the cell absorbs water by osmosis; thus there will be more water molecules than solute molecules; causing the solute potential to become less negative;
- 1 mark @ $4 \times 1 = 4$ (04 marks)

TOTAL = 10 MARKS

46. (a) When a sensory neurone is stimulated by the arrival of a nerve impulse, it results into the movement of Sodium ions into the axoplasm and potassium ions out of the axoplasm; A point is reached when the outside becomes negatively charged and inside is positively charged, this is called the action potential; Accept: An action potential is aware of depolarization that travels along an axon of a neurone / nerve cell;
1 mark @ 2x1 = 2 (02 marks)

(b)

Somatic Nervous system	Autonomic Nervous system
- Involves skeletal muscles	Involves glands, smooth muscles, cardiac/heart muscles
- One nerve fibre from CNS to effector is involved	Two nerve fibres are involved.
- No ganglia	Nerves synapse at ganglia
- Neurotransmitter Acetylcholine (Ach)	ACh and norepinephrine (NE)
- Always excitatory	Excitatory and inhibitory
- Voluntary/consciously controlled	Involuntary/Not consciously controlled
- Cranial & spinal nerves are involved	Sympathetic and parasympathetic nerves

(04 marks)

- (c) (i) Parasympathetic nerves terminal ganglia is near or within target organs which result into direct stimulation of the target organs thus more selective; as compared to the sympathetic nerves whose ganglia are located further away from the target organs;
1mark @ 2x1 = 2 (02 marks)

- (ii) Somatic nerves are thicker / big and are myelinated, the end result is faster impulse conduction speed; whereas autonomic post-ganglionic nerve fibres are thin / small and/or are unmyelinated thus have low conduction speeds;

1 mark @ (02 marks)

TOTAL = 10 MARKS

END