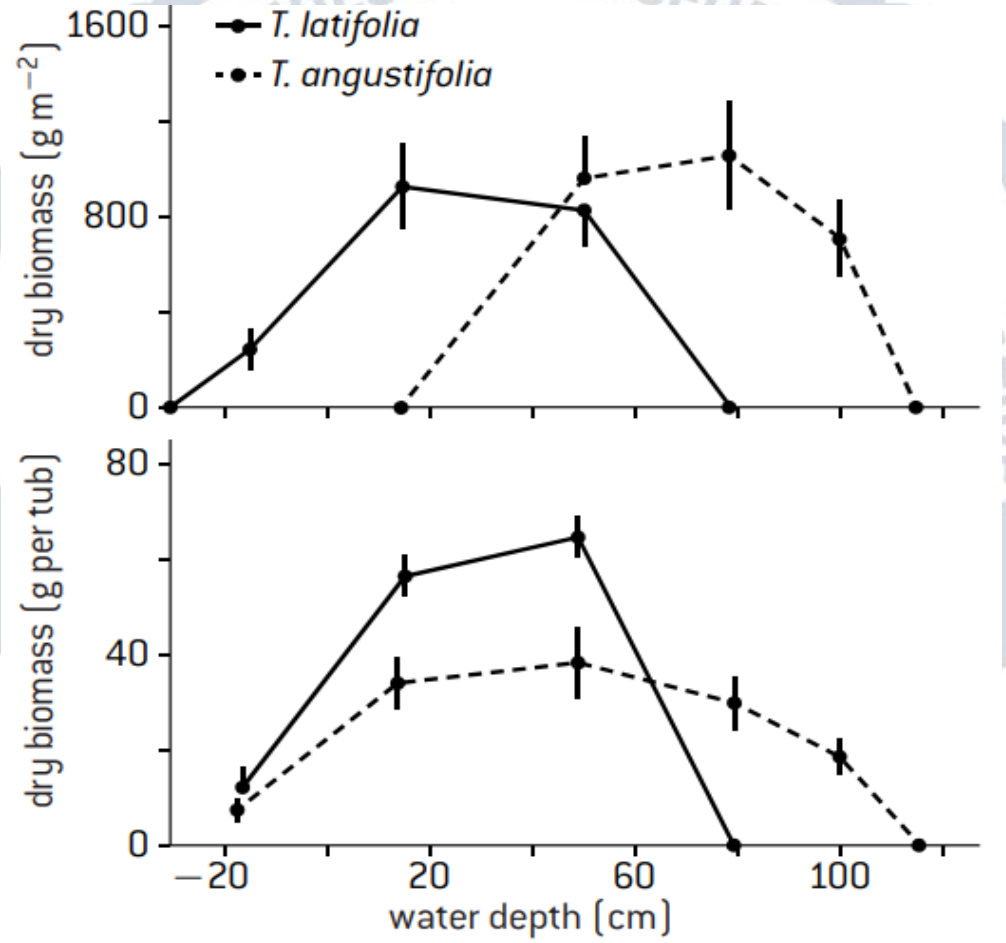
Marking Guide For Paper 2 Post Mock-2024

N.B- <u>QUESTION ONE IS COMPULSORY TO ALL CANDIDATES</u>.

1. **Typha latifolia and Typha angustifolia** are plants that **grow** at the **margins** of **lakes and ponds. Upper** graph shows the **natural distribution** of the two species in a lake**. Lower graph** shows results of the experiment in which the two species were **planted separately in tubs,** and placed **at different depths** in water to **assess** their growth. Study the graphs **carefully** to provide **credible responses.**



(a) Compare the **dry biomass** of the two species **at the varying water depth in:**

(i) Natural distribution.

(ii) Tubs planted at different levels. **(08 marks)**

Similarities.

(In both) the dry biomass of **T. Latifolia and T. Angustifolia**:

-Peaks;

-Increases/rises;

-Falls/decreases; **03**

-Start with zero;

-Equal/Same/Equivalent at 42cm;

Differences

T. Latifolia	**T. Angustifolia.**
Peak at a lower depth/shorter distance.	Peak at a higher distance/longer distance;
lower maximum attained	Higher maximum attained;

Compare the Trends (curves) in regions where both curves exist. **01**

(ii)

Similarities.

(In both) the dry biomass of **T. Latifolia and T. Angustifolia**:

-Peaks at 47cm;

-Increases/rises;

-Falls/decreases;

-Start at the same depth; **02**

-Equal/Same/Equivalent at 65cm;

Differences

T. Latifolia	**T. Angustifolia**
Below 65cm, dry Biomass was higher	Below 65cm, dry Biomass was lower;
Higher Maximum attained (Peak)	lower maximum attained; (Peak)
Below 18cm, dry Biomass increased more rapidly	Below 18cm, dry Biomass increased less rapidly;
Compare the Trends (curves) in regions where both curves exist.**02**	

(b) **Explain** the **differences** in the **dry biomass** of the two **species in:**

(i) Natural distribution. **(06 marks)**

T. Latifolia attains maximum dry biomass at lower depth than **T. Angustifolia** because **T. Latifolia** is adapted to grow very well/more efficiently in shallow waters; out-competes **T. Angustifolia** due to **shallow roots**; which maximize **nutrient** uptake at surface layers; hence rapid growth and multiplication.

T. Angustifolia attains a higher dry biomass in deep waters/higher depth than **T. Latifolia** because is adapted to grow well in deeper waters; **out-competes T. Latifolia** due to longer/deeper root system; hence exploits nutrients at wider area/deep waters leading to rapid growth and multiplication;

(ii) In tubs at varying depth. **(07 marks)**

Tubs provide identical/Uniform environmental conditions; for optimal growth of both species; and prevent interspecific competition for resources;

Dry Biomass attained by **T. Latifolia** is higher than **T. Angustifolia** because tubs are shallow; hence favours growth of **T. Latifolia** with shallow roots which effectively obtain nutrients;

T. Angustifolia has deep and extensive roots whose growth is restricted by the tubs; by limiting nutrient uptake;

(c) Explain

(i) The types of **niches** shown in the **two graphs.** **(05 marks)**

Upper graph- Realized niche; both species compete for resources; inhibiting the growth of each other;

Lower graph- Experimental/Fundamental niche; species don't compete for resources; resulting into optimal growth;

(ii) Effect of the two types of **niches** on the **dry biomass of** the **two species.** **(07 marks)**

Realized niche- resource competition; which inhibit growth and reproduction preventing the attainment of maximum dry biomass which could occur without competition; determines the community structure by influencing the distribution of the two species;

Fundamental niche- limited the growth and reproductive potential of **T. Angustifolia**; caused maximum growth of **T. Latifolia**;

(d) Biomass is one way of measuring **abundance. Explain** the **draw backs** with the **Biomass Pyramids.** **(07 marks)**

Biomass varies with seasons; in wet season biomass is high and in dry season biomass is low;

Inverted pyramid biomass can occur; if the producer has high turnover rate/high productivity; eg algae/Phytoplanktons which are constantly harvested by consumers so their biomass at particular time is relatively small;

No indication of the rate of growth of organisms; eg grass grows fast/has high productivity but because it constantly grazed by herbivores, its biomass at any one time will be low;

Adapt to the 21st Century Pedagogical skills.

SECTION B (60 MARKS)

Answer Three Questions from this Section.

2. (a) Explain

(i) How the **absence of oxygen affects the Oxidative Phosphorylation** in the body. **(07 marks)**

Terminal electron acceptor in the electron transport chain (ETC) by accepting electrons and hydrogen ions forming water;
absence causes electron flow in the ETC to stop;
Reduced NAD cannot be converted back to oxidized NAD;
Supply of NAD in the mitochondria run out; hence Krebs and Links reaction cannot occur;
Glycolysis only occurs with small yield of ATP; hence Oxygen increases ATP yield per glucose molecule;

(ii) The Properties of **ATP** that makes it an **ideal cellular energy Currency.** **(04 marks)**

ATP stores or releases only a small, manageable amount of energy at a time; so no energy is wasted as heat;
It's a small, soluble molecule; so it can be easily transported around the cell;
It's easily broken down; so energy can be easily released instantaneously;
It can be quickly remade;
It can make other molecules more reactive by transferring one of its phosphate groups to them (phosphorylation);
ATP can't pass out of the cell; so the cell always has an immediate supply of energy;

(b) Describe how the **reversal of glycolysis** leads to **formation of starch** during **Photosynthesis.** **(09 marks)**

RUBP fixes carbondioxide forming GP; (Glycerate-3-phosphate) catalyzed by RUBP carboxylase enzyme;
GP is converted to TP (triose phosphate) or GALP (glyceraldehyde-3-phosphate); by ATP and reduced NADP;
TP is converted to fructose-1,6-bishosphate by an enzyme;
Fructose-1,6-bishosphate is dephosphorylated to Fructose-6-phosphate;
Fructose-6-phosphate isomerizes to glucose-6-Phosphate;
Glucose-6-phsphate is dephosphorylated to glucose;
Glucose is polymerized to starch via condensation reaction;

3. (a) Explain the **reasons** behind the **fluidity** of the **cell membrane.** **(07 marks)**

Unsaturated Fatty acids in the Bilayer; with bent/kinked hydro-carbons preventing close packing;
Shorter fatty acid tails; reduce surface area for formation of Vandarwaals forces of attraction between adjacent tails increasing fluidity;
Cholesterol that fits between hydro-carbon tails; prevents close packing of tails;
Increased temperature; causes increased kinetic energy of phospholipids hence increased fluidity;

(b) Explain the **adaptations** of the following **Macro- molecules** to their **roles** in organisms.

(i) Collagen. **(08 marks)**

Long parallel polypeptides/unbranched/straight to increase surface area for formation of hydrogen bonds for stability/strength;
Very large prevents dissolving in water/insoluble; OR support in synovial joints.
Triple helix/Tropocollagen/three polypeptide chains tightly wound around for high tensile strength;

Small size of individual molecules/polypeptides for close packing/compactness hence high strength/support in regions of high strain eg backbone;
Tropocollagens are thick and tough for high tensile strength;
Fibres formed due to interaction of fibrils via hydrogen bonds give strength;
Cross-linkages between amino-acids of polypeptides prevent each polypeptide sliding past each other hence function as a single unit;
Flexibility allows stretching/change in shape;

(ii) Haemoglobin. **(05 marks)**

Quaternary structure with polar (Hydrophilic) R-groups outside and (Hydrophobic) non-polar groups inside; polar groups form hydrogen bonds with water making it soluble;
Four haem groups with divalent iron hence higher affinity/association with oxygen for transport;
Allosteric protein to pick up oxygen rapidly at (higher partial pressures) alveoli and release rapidly to tissues (low oxygen partial pressures);
Large molecule to increase surface area for transport/carrying of oxygen;
Alpha and beta chains closely packed/fitted forming stable structure;
Divalent iron reversibly combines with oxygen as it doesnot not become oxidized;

4. (a) With **examples, explain** the **meaning** of **vacuum activity.** **(06 marks)**

Behaviour that occur when motivation is high and no releaser presents its self; response produced is not directed towards the normal situation; hence mean of reducing frustrations;
Occurs in absence of external stimuli; rewards or reinforcement;
eg showing irritation towards someone who is not the cause of irritation but acts as a substitute;

(b) State the **importance** of the following **behaviours** to the **survival** of the organisms.

(i) Territoriality. **(07 marks)**

Ensures that organisms and offspring are adequately spaced;
Ensures organism receives share of the available resources such as food and breeding space;
Ensures only the fittest breed and pass on their genes to next generation;
Associated with intraspecific competition which regulate population of organisms;
Species achieves maximum utilization of habitat;
Leaves animal free from disturbances during pair formation;
Reduces risks of diseases/Infections;
Prevents direct conflicts;

(ii) Courtship. **(07 marks)**

Attracts partners; by use of sounds; which are species specific;
Ensures mating between members of the same species;
Mating occurs among sexually mature individuals;
Males determine whether females are sexually receptive or not;
Females respond to correct behavior leading to fertilization;
Suppresses aggressive behaviour;

5. (a) Explain why the **Loop of Henle** is described as **hair pin counter-current Multiplier system.** **(05 marks)**

Counter-current- Loop of Henle has descending and ascending limbs; with tubular fluid flowing in opposite direction;
Hair pin- Loop of Henle arranged in a hair pin shape/U-shape; with descending limbs inserted deep in the medulla; then bends to become ascending limb in the renal cortex;
Multiplier system- loop of Henle maintains a steep concentration/osmotic gradient in the medulla; ascending limb actively pumps sodium chloride into the interstitium; and water leaves the descending limb and collecting ducts by osmosis;
concentration of renal fluid in the descending limb always

higher than ascending limb at any level; with the U-bend/deepest part more concentrated than the rest;

b(i) Explain the **role** of the **hypothalamus** as a **thermostat** in the body. **(10 marks)**

Hypothalamus **thermo-receptors** have a set point/norm; which is a reference for monitoring body temperature; receives impulses from thermo-receptors in the skin and deep body tissues; and senses the temperature of blood flowing through the brain; when tissues temperatures are lower than normal; cold-centre/posterior hypothalamus triggers heat production; and inhibits activity of the hot centre in order to conserve heat in the body; When tissue temperatures are higher than normal, hot centre/anterior hypothalamus triggers responses that decrease heat production; increasing heat loss by inhibiting the activity of the cold centre;

(ii) Explain how the **ectothermic behaviour** of the **camel** allows its survival in **hot areas**. **(05 marks)**

During hot sunny day, Camel tissues store much heat to prevent loss of large amounts of water by evaporation; much heat is lost at night and the following day temperature climbs from abnormally low point; which prevents reaching lethal value by the end of the day;

Reduces heat gain during the day; by maintaining a low thermal gradient between the surrounding air and its body;

6. a)(i) Distinguish between **natural selection** and **artificial selection.** **(07 marks)**

Natural selection	**Artificial selection**
environmental factors exert selection pressure	Humans exert selection pressure;
Better variations adapt to the environment	Better variations are desirable to man;
Individuals with unfavourable features die	Individuals with unfavourable features are isolated/exterminated/sterilized;
Non-selective	Selective;
Increases genetic diversity	lowers genetic diversity;

Increases heterozygosity	decreases heterozygosity;
Genetic isolation methods operate	Genetic isolation mechanisms don't operate;
Out-breeding is common leading to increased vigour	Inbreeding is common leading to loss of Vigour;
occurs in the wild	occurs in domesticated animals;

(ii)**How** has **Man positively** used the **knowledge** of **selection in agriculture**? **(07 marks)**

Artificial selection; **involving Inbreeding**; and **Out-breeding**; Inbreeding which is used to retain desirable characteristics; risen due to mutations; by breeding individuals with close relatives;
Out-breeding-breeding unrelated individuals; increasing heterozygosity; and size of the gene pool; Hybrid vigour results; into progenies with excellent yields, resistance to diseases, hardiness and increased flavour;
Natural selection; by understanding how environmental pressures can lead to survival and reproduction of individuals; with advantageous traits;

(b) Describe the **deviations** from the **classical Mendelian inheritance.** **(05 marks)**

Linked genes; genes found on the same chromosomes/inherited together hence independent assortment doesn't occur;
Incomplete dominance; when one gene doesn't completely mask the effect of the other resulting into blended phenotype;
Co-dominance; where both alleles have effect on the Phenotype;
Polygenic inheritance; where multiple genes influence a single trait;
Epistasis; interaction between different genes affecting phenotype;
Pleitropy; one gene affects multiple traits;
Environmental factors; eg temperature and light affect the expression of genes;
Lethal genes; causing death of some individuals;
Mutations; leading to non-disjunctions affecting the ratios obtained;
Haploidy; organisms have one set of chromosomes/one copy of genes hence no dominance/masking;