

A LEVEL CBC BIOLOGY SCENARIOS STANDARD SET SERIES

Item 1. In a Southeast coast village, illegal cyanide fishing is practiced. Fishermen capture line fish for aquarium. This has led to significant die-off of non-target coral reef species. A marine biologist Dr. Inn collects tissue samples from affected damselfish. Cyanide is a potent inhibitor of cytochrome c oxidase

Table; Metabolic analysis of Damselfish Gill Tissue.

Sample	Cytochrome c oxidase activity % of normal	Gel cell membrane integrity (% of cells damaged)	Gill ATP concentration (mM)	Oxygen uptake(mg o /g/h)
Unaffected fish	100	5	4.8	9.5
Cyanide exposed fish	3	60	0.8	1.2

Tasks

- Explain in simple steps how cyanide inhibition of cytochrome c oxidase leads to the changes shown in the table.
- Using the information provided, propose strategies to solve the challenges.

Item 2. In a school, greenhouse, maize (C4 plant) developed yellow patches and stunted growth under prolonged temperature fluctuated widely and carbon dioxide concentration was low. Microscopy revealed partial loss of Kranz anatomy and reduced PEP carboxylase activity .

Condition	Light (hrs/day s)	Temperature range	Carbon dioxide (ppm)	PEPC (mol CO /mg/hrs)	Rubisco (mol)	Starch(mg/g)	Lipid(%dry mas)	Chlorophyll(mg/g)	Guard cell aperture
Optimal	12	25-28	400	7.5	5.4	25	8	2.8	4.2
Observed	20		220	2.3	1.9	10	3	1.2	1.2

Task

- Analyze how light duration, temperature fluctuation and carbon dioxide concentration affect C4 enzyme activities and chloroplast structures. Explain how changes in these variables influence micromolecules synthesis (starch, proteins, lipids) and stomatal regulation. Propose integrated strategies to optimize each factor and restore healthy photosynthesis and growth.

Item 3. In a busy Kampala hospital, patients in the COVID-19 recovery ward were monitored for oxygen levels and immune response. Three patients (Inno, Sam Fiona) were studied. Sam developed mild dehydration symptoms and elevated heart rate.

Parameter	Inno	Sam	Fiona
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Vaccination status	Fully vaccinated	Not vaccinated	Fully vaccinated
Blood O (%)	96	87	90
Antibody titre(AU/mM)	1000	40	620
WBC count (10 /L)	7.5	10.0	5.5
Temperature (c)	36.9	38.4	37.2
ADH level (pg/mL)	7	15	6

Task

- a) Explain how immunity and homeostasis account for the differences in recovery and physiological data among the patients.
- b) Describe how antibodies an ADH helped Inno and Fiona maintained stability compared to Sam.
- c) Propose safe management strategies to enhance recovery in similar patients.

Item 4. At kisubi high school, the biology teacher organized a health awareness week. Students learnt about the importance of vaccination, good nutrition, personal hygiene and physical fitness .During one session, a demonstration was done to compare immune responses between vaccinated and unvaccinated students after exposure to harmless simulated pathogen. After the activity, teachers encouraged students to maintain healthy habits such as eating well, keeping dormitory clean, getting enough rest and taking part in morning exercise to boost their general body immunity

Observation	Vaccinated students	Unvaccinated students
Body temp(C)	37.0	38.2
WBC count(relative)	High	Moderate
Presence of antibodies	Present	Absent
Reaction time to infections(days)	1	5

Task

- a) Explain the difference between innate and adaptive immunity shown in this demonstration.
- b) Describe how vaccination prepares the body to respond quickly during infections.
- c) Suggest school-level health measurers that support immunity among students.