

SHEEMA GIRLS' SCHOOL

UACE BIOLOGY PAPER 1 TEST-2026

Time: 2 hours

Attempt all items

1. Following a major earthquake, a regional hospital treated several patients with severe muscle and skin injuries. Doctors noticed significant differences in recovery among three groups of patients.

Group	Observation
A	Rapid wound closure, high energy levels and normal tissue regeneration
B	Delayed wound healing, fatigue and reduced cell division in damaged tissues
C	Severe dehydration, muscle weakness, poor protein production and extensive tissue damage

Further laboratory investigations revealed that Group B patients had reduced oxygen delivery to damaged tissues, while Group C patients had low concentrations of proteins and impaired DNA-directed protein synthesis. The doctors concluded that successful recovery depends on interactions among cellular structures, biomolecules, ATP production, protein synthesis and cell division.

Tasks

- (a) Using evidence from the scenario, analyze why Group A patients recovered faster than Groups B and C.
- (b) Assess how the deficiencies observed in Group C could have affected the functions of water, proteins and nucleic acids during tissue repair.
- (c) Using evidence from the scenario, evaluate the validity of doctor's conclusion.

2. A pharmaceutical company is testing a new nutritional supplement intended to improve recovery in patients suffering from severe malnutrition. Three groups of patients were monitored for six weeks.

Group	Observation
X	Received a balanced diet containing adequate water, proteins, lipids and carbohydrates. Patients gained weight, showed increased muscle mass and recovered quickly from infections.
Y	Received adequate food but had a genetic mutation that reduced the production of a key enzyme involved in cellular respiration. Patients remained weak and recovered slowly despite eating well.
Z	Received sufficient energy-rich food but had a mutation affecting ribosome function. Patients showed poor growth, reduced tissue repair and persistent muscle wasting.

Further investigations revealed that:

- Cells from Group X had high rates of ATP production and normal cell division.
- Cells from Group Y accumulated glucose but produced less ATP than normal.
- Cells from Group Z had normal ATP levels but produced significantly fewer proteins.

The researchers concluded that recovery from malnutrition depends on coordinated interactions among biomolecules, cell structures, ATP production, protein synthesis and cell division.

Tasks

(a) Using evidence from the scenario, analyse why Group X patients recovered more successfully than Groups Y and Z.

(b) Evaluate how the enzyme deficiency could have affected ATP production and the overall recovery of group Y patients.

(c) Group Z patients produced significantly fewer proteins despite having normal ATP levels. Assess how impaired ribosome function could explain the poor growth and reduced tissue repair observed in this group.

3. A study was conducted to investigate the decline of fish populations in a river receiving industrial discharge. Three sections of the river were selected for monitoring over a period of two years. The results obtained are shown below.

Observation	Section A (Upstream)	Section B (Midstream)	Section C (Downstream)
Fish population (fish km ⁻¹)	1,240	760	290
Oxygen uptake by gill tissue (cm ³ O ₂ g ⁻¹ h ⁻¹)	4.8	3.1	1.4
ATP concentration in muscle cells (μmol g ⁻¹ tissue)	8.6	5.2	2.0
Protein production rate (arbitrary units day ⁻¹)	96	63	28
Dividing cells in gill tissue (%)	18	11	4
DNA abnormalities (% of cells affected)	2	14	43
Embryo survival (%)	91	68	24

Environmental managers were concerned that continued industrial discharge could result in the collapse of fish populations in the river. They therefore sought scientific evidence to determine whether changes occurring within fish cells and tissues could explain the observed decline in population size.

Tasks

- (a) Using the data provided, analyze the relationship between oxygen uptake, ATP concentration and fish population size in the three sections of the river.
- (b) Evaluate the extent to which differences in ATP concentration could account for the variation in fish population size observed among the three sections.

(c) Using evidence from the investigation, assess how the changes in protein production rate, frequency of cell division and DNA abnormalities could have influenced embryo survival.

(d) Environmental managers concluded that the decline in fish populations was largely a consequence of disruptions in cellular processes. Evaluate the validity of this conclusion using evidence from the investigation and your biological knowledge.

END