

Note: All questions are mandatory. Please attempt part A and part B separately - DO NOT jumble Parts A and B. Please be precise in writing answers. You will only be graded for your written answers. Please leave a 0.5" margin on one of the sides of answer sheet.

Part-A

Q1. In the post mortem samples of Alzheimer's Disease patients, it has been found that there is an accumulation of Amyloid protein fibers. Small aromatic compounds such as phenol red have been shown to inhibit formation of Amyloid fibers in the laboratory. Propose a mechanism to explain this observation. **(4M)**

Q2. A soldier takes a long awaited off from the duty and excitedly plans to enjoy vacations on a beach, but during the vacation, a war is declared at the mountain borders. This soldier has to fly immediately to hills to battle front. Explain how the body will adjust to concentration differences of Oxygen with respect to oxygen carrying capacity of Hemoglobin and associated metabolites, such as BPG. Draw necessary graphical representations. **(4+2=6M)**

Q3. We have learned that fats are class of molecules which are involved in producing double the energy compared to carbohydrates. Despite this understanding, if someone is dizzy, or weak, glucose solution/ some sweet foods are first choice for feeding not a slice of cheese, or egg yolk, dollop of butter or spoonful of oil mixture. On this premise, answer following:

a) Justify this practice highlighting the properties of glucose and its advantage as an energy source that makes it a better immediate rejuvenation molecule than fats. **(2M)**

b) As you are aware, in the first step of glycolytic pathway, glucose will get converted to glucose 6-phosphate which is an ATP utilizing step. Under clinical conditions, can an intravenous injection of glucose 6-phosphate be made to conserve this one ATP? Why or why not? Justify. **(3M)**

Q4. In a hypothetical condition, if a person is clinically diagnosed with problems in carbohydrate metabolism, will the protein metabolism be affected too? Why or why not? Explain your answer with relevant biochemical/molecular justifications we had during classes. **(5M)**

Q5. For the following, provide biochemical justifications, structures are not necessary, but reactions are and marks will be deducted for not showing reactions. **(5M each)**

(A) If someone has lack of appetite, has puffy and yellowish skin goes to doctor and gets diagnosed with liver dysfunction and prescribes an almost zero protein and zero fat diet. Explain the biochemistry involved and prescribed treatment.

(B) Folic acid deficiency, believed to be the most common vitamin deficiency, causes a type of anaemia in which hemoglobin synthesis is impaired and erythrocytes do not mature properly. What is the metabolic relationship between hemoglobin synthesis and folic acid deficiency?

(C) Although oxygen does not participate directly in the citric acid cycle, the cycle operates only when O_2 is present. Why? While drawing the cycle, highlight the steps which will be hindered in absence of O_2 .

Part-B

Q1. A 65-year old man was brought to the hospital with complaints of severe chest pain, breathlessness and vomiting. He could reach the referral hospital in a nearby town 5 hours after the onset of chest pain. His blood was immediately drawn in the casualty ward, and the results were as follows:

INVESTIGATION (IN SERUM)	RESULT	REFERENCE RANGE
Creatine kinase (CK)	400 U/L	15 – 100 U/L
Aspartate transaminase (AST)	70 U/L	8 – 20 U/L
Lactate dehydrogenase (LDH)	380 U/L	100 – 200 U/L

- (a) Based on this blood test report, what is your diagnosis of the patient’s medical condition? Justify your diagnosis with the possible mechanism, based on the symptoms and the blood report. **[3.5M]**
- (b) In this blood report, what aspect of enzyme levels have been denoted – their *concentrations* or their *activity*?

Substantiate your answer suitably. **[2M]**

- (c) Map or match the above-listed enzymes with the best option given here: **[1.5M]**
(i) protein metabolism; (ii) high-energy molecule synthesis; and (iii) carbohydrate metabolism.

Q2. A cosmetic skin cream product indicated three kinds of ceramides, in addition to cholesterol, and hyaluronic acid on its label.

- (a) Distinguish these molecules on the basis of the type of macromolecule class that they belong to. **[1.5M]**
- (b) What are the functional contributions of these specific molecules in the skin cream? **[1.5M]**
- (c) Structurally, how can ceramides be different? (e.g., three ceramides are mentioned here). *Mention the core structure of a ceramide, indicating different components of a ceramide molecule, and the possible variations that can produce its derivatives. No structure diagram is needed.* **[3M]**

Q3. Read the short write-up below, and answer the questions that follow:

“ In 2015, the U.S. Food and Drug Administration (FDA) approved a treatment called uridine triacetate (Xuriden) for hereditary orotic aciduria. This medication restores the chemical compound called uridine monophosphate (sometimes just called uridine). Because of the underlying genetic defect, affected individuals cannot create (synthesize) sufficient amounts of uridine monophosphate on their own. Clinical trials investigating this medication showed improvement in anemia and disappearance of megaloblastosis and a decrease in orotic acid levels in the urine. Affected individuals also showed improvement in or remained stable in weight or height growth. Researchers believe that affected individuals must remain on this treatment throughout their lives to assure orotic acid levels remain decreased.”

- (a) Why is the condition being referred to as hereditary? Indicate the biochemical reason. **[2M]**

(b) How do the Uridine supplements avoid orotic acid excretion in the urine? Provide the biochemical mechanism. **[2M]**

(c) Can you reason how the medication helped the patients to overcome their anemia? **[2M]**

Q4. Hibernating animals, some long-distance migratory birds, and desert animals do not eat or drink for a long periods of time. How do they survive? Describe the biochemical mechanisms of their energy source and energy storage. **[4M]**

Q5. Read these two scenarios with respect to saturated and unsaturated fats, and answer the questions that follow: **[2+3 = 5M]**

(a) In weight-reduction diet plans, unsaturated fats may be preferred over saturated fats. What is the caloric reason for this preference? Provide the biochemical basis for the same.

(b) In certain food processing, saturated fats are preferred over unsaturated fats. Why? Further, how is the production of saturated fats achieved from unsaturated fats in such food processing units? Comment on the process, and bring out the health hazard of such saturated fats.

Q6. You have come across beta-alanine and L-alanine in your classes in biochemistry. **[3*1=3M]**

(a) Identify the sources of these two molecules in our cells.

(b) Comment on their role in protein synthesis.

(c) Comment on their isomeric forms.

Q7. During the *de novo* synthesis of guanine nucleotide, due to some cellular error, a particular set of cells pick up GTP as the energy source. **[1+2+1 = 4M]**

(a) Why is it being considered an error to use GTP in this synthesis reaction? Indicate the normal energy source in this pathway.

(b) How will this error disrupt the *de novo* synthesis in these cells? Mention two specific points to justify the mechanism of disruption of nucleotide synthesis.

(c) What would be the metabolic consequence of this error?

***** All the Best *****