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UNIVERSITY OF RUHUNA – FACULTY OF ALLIED HEALTH SCIENCES
DEPARTMENT OF PHARMACY
FIRST BPHARM PART I EXAMINATION – DECEMBER 2023
PH 1123 BIOCHEMISTRY I – SEQ PAPER

TIME: TWO HOURS

INSTRUCTIONS

- There are **four** questions in part **A, B** and **C** in this SEQ paper.
- Answer all questions.
- No paper should be removed from the examination hall.
- Do not use any correction fluid.
- Use illustrations where necessary.

PART A

1.

1.1

1.1.1 Define the term metastasis. ***(05 marks)***

1.1.2 Describe the steps in metastasis. ***(30 marks)***

1.2 Write short notes on the following. ***(45 marks)***

1.2.1 Meiosis I

1.2.2 Exocytosis

1.2.3 Endocytosis

1.3 State two functions performed by each of the following cellular structures in the eukaryotic animal cells. ***(20 marks)***

1.3.1 Nucleus

1.3.2 Mitochondria

1.3.3 Golgi apparatus

1.3.4 Lysosomes

1.3.5 Cell membrane

2.

2.1 Define the term "Vitamins". ***(10 marks)***

2.2 Vitamin D is a fat-soluble vitamin and known as "Sunshine vitamin".

2.2.1 List two dietary forms of vitamin D. ***(04 marks)***

2.2.2 Write the biological function of Vitamin D (Calcitriol). ***(06 marks)***

2.2.3 What is the bone clinical manifestation of Vitamin D deficiency in the following populations?

2.2.3.1 Children **(*03 marks*)**

2.2.3.2 Adults **(*03 marks*)**

2.2.4 Briefly explain the reason for the administration of calcitriol supplements to patients with chronic renal failure. **(*10 marks*)**

2.3

2.3.1 What is meant by "Malabsorption syndrome"? **(*10 marks*)**

2.3.2 Write two causes of malabsorption syndrome. **(*04 marks*)**

PART B

2.4 In 1904, Franz Knoop elucidated the pathway for the biological oxidation of fatty acids. In his studies, he fed dogs fatty acid phenyl derivatives and then analyzed their urine for the resulting metabolites. Part of his results were as follows:

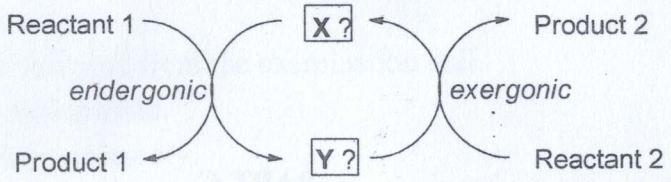
	Compound fed	Compound excreted
a	C_6H_5-COOH	C_6H_5-COOH
b	C_6H_5-CH_2-COOH	C_6H_5-CH_2-COOH
c	C_6H_5-CH(OH)-COOH	C_6H_5-CH(OH)-COOH
d	C_6H_5-CH_2-CH_2-COOH	C_6H_5-COOH
e	C_6H_5-CH(OH)-CH_2-COOH	C_6H_5-COOH
f	C_6H_5-CO-CH_2-COOH	C_6H_5-COOH
g	C_6H_5-CH_2-CH_2-CH_2-COOH	C_6H_5-CH_2-COOH
h	C_6H_5-CH_2-CH_2-CH_2-CH_2-COOH	C_6H_5-COOH

2.4.1 Explain these results in terms of the fatty acid oxidation pathway that he proposed. **(*40 marks*)**

2.4.2 How many $FADH_2$ and NADH are produced per cycle of oxidation of a fatty acid? **(*10 marks*)**

3.

3.1 The following endergonic and exergonic reactions are coupled by ATP. Indicate the positions (**X** and **Y**) that ATP and its hydrolyzed product would assume in the scheme. Give reasons for your answer. ***(15 marks)***



3.2 The conversion of glucose into glucose-6-phosphate, which must occur in the breakdown of glucose, is thermodynamically unfavorable (endergonic). How do cells overcome this problem? ***(10 marks)***

3.3 Couple the reactions given below to determine the standard free energy change for the following reaction: ***(15 marks)***

$$\text{Glucose-6-P} + \text{ATP} \rightleftharpoons \text{Fructose-1,6-bisphosphate} + \text{ADP}$$

$$\text{Fructose-6-P} \longrightarrow \text{Glucose-6-P} \qquad \Delta G_1^{0\prime} = -1.7 \text{ kJ/mol}$$

$$\text{Fructose-1,6-bisphosphate} \longrightarrow \text{Fructose-6-P} + \text{Pi} \qquad \Delta G_2^{0\prime} = -16.3 \text{ kJ/mol}$$

$$\text{ADP} + \text{Pi} \longrightarrow \text{ATP} + H_2O \qquad \Delta G_3^{0\prime} = 30.5 \text{ kJ/mol}$$

3.4 According to the Michaelis-Menten model, initial velocity (v_0) of an enzyme-catalyzed reaction can be expressed as

$$v_0 = \frac{k_{cat}[E_0][S]}{K_m + [S]} \text{ ----- } (Eq\ 1)$$

where [S] is substrate concentration and other symbols have their usual meanings.

3.4.1 Define V_{max} and simplify Eq 1 using V_{max}. ***(10 marks)***

3.4.2 Rearrange this equation to obtain Lineweaver-Burk form. ***(10 marks)***

3.5 A student carried out an enzyme-catalyzed reaction with and without an inhibitor using a series of substrate concentrations from 1.0 to 10.0 mM and measured the rate in mM per minute. An enzyme concentration of 100 μM and an inhibitor concentration of 200 μM were used for the experiment. Two Lineweaver-Burk plots were drawn and the equations obtained for the two lines are given below:

$y = 0.031\ x + 0.010$ (without inhibitor)

$y = 0.104\ x + 0.010$ (with inhibitor)

3.5.1 What are the V_{max} and K_m values for the uninhibited and inhibited reaction?

(*15 marks*)

3.5.2 Identify the type of inhibition. Give the reasons. (*10 marks*)

3.5.3 What is the turnover number of the enzyme in the absence of the inhibitor?

(*10 marks*)

3.5.4 Where does this inhibitor most likely bind to the enzyme? Explain.

(*05 marks*)

PART C

4.

4.1 Name the organ where the fructolysis is mainly taking place. (*06 marks*)

4.2 Outline the key steps of triglyceride biosynthesis from fructose in the human body.

(*50 marks*)

4.3 Briefly explain the importance of pentose phosphate pathway in oxidative stress.

(*20 marks*)

4.4 Compare and contrast the key regulatory steps of glycolysis and gluconeogenesis.

(*24 marks*)

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