UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	PRINCIPLES OF BIOCHEMISTRY
COURSE CODE	:	BNN 20203
PROGRAMME	:	2 BNN
EXAMINATION DATE	:	JUNE 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1 (a) Explain this statement. "Chemical elements of life".

(3 marks)

(b) Differentiate **THREE (3)** major differences between prokaryotic and eukaryotic cells.

(6 marks)

(c) List **FOUR (4)** major classes of biomolecules and relate their roles for humans.

(4 marks)

(d) Water is an ideal biological solvent. Describe the behaviour of each following in water:

(i) Hydrophilic molecules.
(ii) Hydrophobic molecules.
(iii)Amphipathic molecules.

(3 marks)

(e) Substance such as salt is easily dissolved in water. With the aid of a diagram or structure, outline the solvent properties of water that enables such situation.

(9 marks)

Q2 (a) Proteins are composed of 20 standard amino acids. Briefly describe with simple diagram the general structure of amino acid.

(3 marks)

(b) Figure **Q2 (b)** shows the titration curve for Alanine. Titration is a useful tool in determining the reactivity of amino acid side chains.

(i) Illustrate the transformation of Alanine structure at each plateau A, B and C.

(3 marks)

(ii) Based on the Figure **Q2 (b)**, calculate the isoelectric point for Alanine.

(2 marks)

(iii)Define zwitterions and sketch the structure of zwitterions.

(2 marks)

(c) Chromatography basically involves the separation of mixtures due to differences in the distribution coefficient of sample components between two different phases. Illustrate **THREE (3)** common methods in chromatography and explain the principle of each chromatography.

(10 marks)

(d) (i) Explain briefly buffer system in biochemical studies.

(2 marks)

(ii) Estimate the ratio of lactic acid and lactate required in a buffer system of pH 5.5. The pKa of lactic acid is 3.86.

(3 marks)

Q3 (a) Describe the classification of polysaccharide.

(2 marks)

(b) Identify the following sugar molecules either reducing or non-reducing sugar molecules by referring to Figure **Q3 b(i), b(ii)** and **b(iii)**. Draw circle at the functioning group that contributes to the classification.

(3 marks)

(c) Starch is a mixture of glycans that plants synthesis as their principal energy and found in almost every kind of plant. Starch composes of α-amylose & amylopectin.

(i) Compare **TWO (2)** differences between α-amylose and amylopectin.

(4 marks)

(ii) Illustrate the structure of each α-amylose & amylopectin.

(2 marks)

(iii)List **THREE (3)** applications of starch in everyday life.

(3 marks)

(d) (i) Differentiate between *cis*-isomers and *trans*-isomers of unsaturated lipids

(3 marks)

(ii) Fats and oils are both triacylglycerols. Explain why fats are solid while oils are liquid at room temperature.

(2 marks)

(e) Summarize the term below:

(i) Simple diffusion
(ii) Facilitated diffusion

(6 marks)

Q4 (a) Name **TWO (2)** binding analogue model of enzyme and differentiate each of the model with explanation and diagram.

(5 marks)

(b) Define the following terms:

(i) Activation energy
(ii) Catalyst
(iii)Active site

(3 marks)

(c) The results in Table **Q4 (c)** describe the effect of an inhibitor on enzyme activity of an enzyme.

Table Q4 (c)

[S] (mol/L)	Without inhibitor v (mol/min)	With inhibitor v_i (mol/min)
1.0×10^{-4}	28.00	17.00
1.5×10^{-4}	36.00	23.00
2.0×10^{-4}	43.00	29.00
5.0×10^{-4}	65.00	50.00
7.5×10^{-4}	74.00	61.00

(i) Construct a graph according to Lineweaver-Burke method.

(6 marks)

(ii) Calculate Vmax in the presence and the absence of an inhibitor.

(2 marks)

(iii)Calculate Km in the presence and the absence of an inhibitor.

(2 marks)

(iv)Identify the type of inhibition that is being measured.

(1 mark)

(d) The activity of enzymes can be inhibited. Inhibitors include many drugs, antibiotics, food preservatives and poisons

(i) Name **THREE (3)** classes of inhibitors.

(3 marks)

(ii) Illustrate the graph for each class of inhibitors accordingly.

(3 marks)

Q5 (a) Glycolysis appears to be ancient metabolic pathway. Glycolysis is a series of ten enzyme-catalyzed steps in which a six-carbon glucose molecule is broken down into two three-carbon pyruvate molecules. The ten reactions are divided into two phases; where in the first phase, hexose is phosphorylated and cleaved in half. While, the three carbon molecules are converted to pyruvate in the second phase.

(i) Briefly illustrate any **THREE (3)** reactions of glycolysis in the first phase including substrates, products and enzymes corresponding to the reactions.
(9 marks)

(ii) In glycolysis, for each molecule of glucose converted to pyruvate, finally how many of ATP molecules and NADH molecules are produced.
(2 marks)

(iii)Differentiate **THREE (3)** fates of the pyruvate after glycolysis pathway.
(6 marks)

(b) The Citric Acid Cycle is given as in Table **Q5 (b)** below.

Table Q5 (b)

No	Substrates	Products	Enzyme	Reaction type
1	Oxaloacetate + Acetyl CoA + H_2O	Citrate + CoA-SH	Citrate synthase	Aldol condensation
2	Citrate	cis-Aconitate + H_2O	Aconitase	Dehydration
3	cis-Aconitate + H_2O	Isocitrate	-	Hydration
4	Isocitrate + NAD^+	Oxalosuccinate + NADH + H^+	Isocitrate dehydrogenase	Oxidation
5	Oxalosuccinate	α-Ketoglutarate + CO_2	-	Decarboxylation
6	α-Ketoglutarate + NAD^+ + CoA-SH	Succinyl-CoA + NADH + $H^+ + CO_2$	α-Ketoglutarate dehydrogenase	Oxidative decarboxylation
7	Succinyl-CoA + GDP + P_i	Succinate + CoA-SH +GTP	Succinyl-CoA synthetase	Substrate-level phosphorylation
8	Succinate + ubiquinone (Q)	Fumarate + ubiquinol (QH_2)	Succinate dehydrogenase	Oxidation
9	Fumarate + H_2O	L-Malate	Fumarase	H_2O addition (hydration)
10	L-Malate + NAD^+	Oxaloacetate + NADH + H^+	Malate dehydrogenase	Oxidation

(i) Label the item1 to 8 of Figure **Q5 (b)** based on the citric acid cycle table.
(4 marks)

(ii) Describe **TWO (2)** important roles of the tricarboxylic acid cycle in metabolism.
(4 marks)

-END OF QUESTION-

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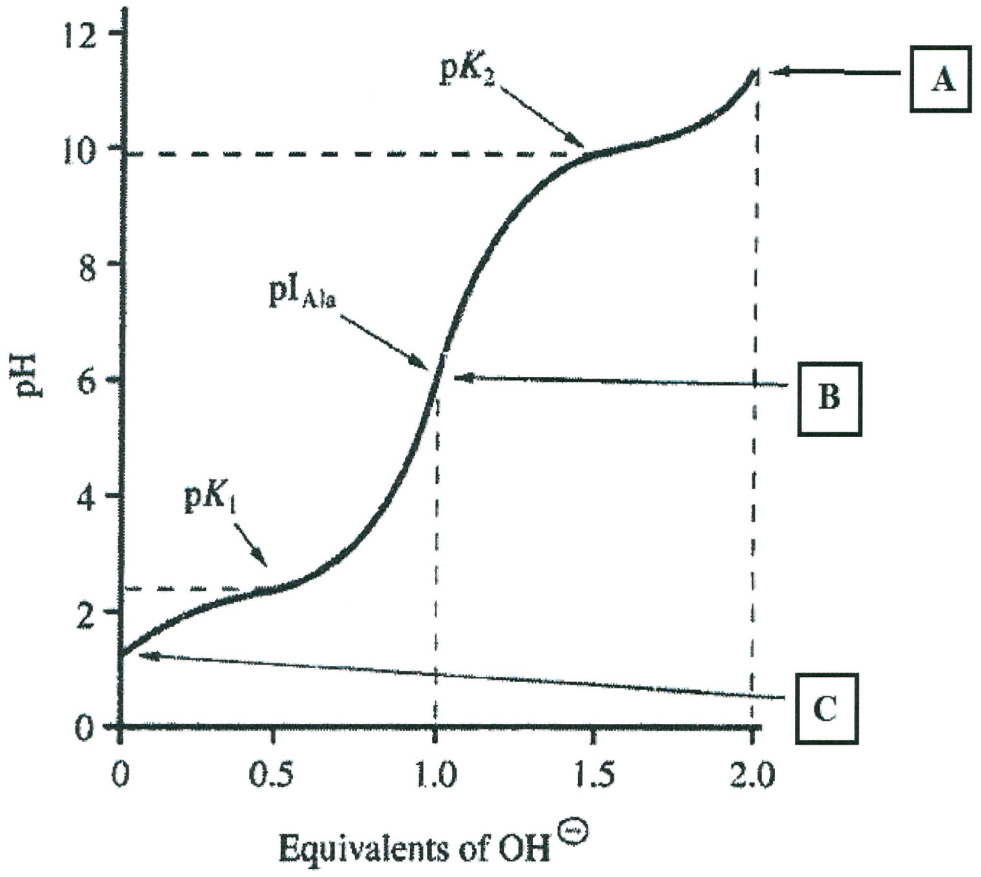

FIGURE Q2 (b)

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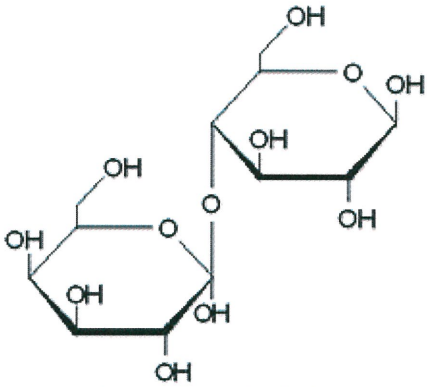

FIGURE Q3 b(i)

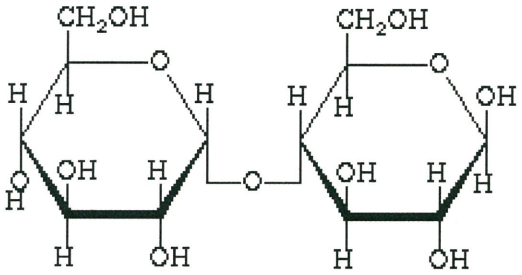

FIGURE Q3 b(ii)

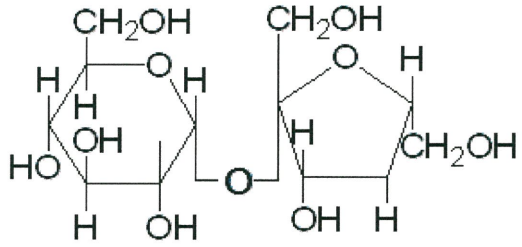

FIGURE Q3 b(iii)

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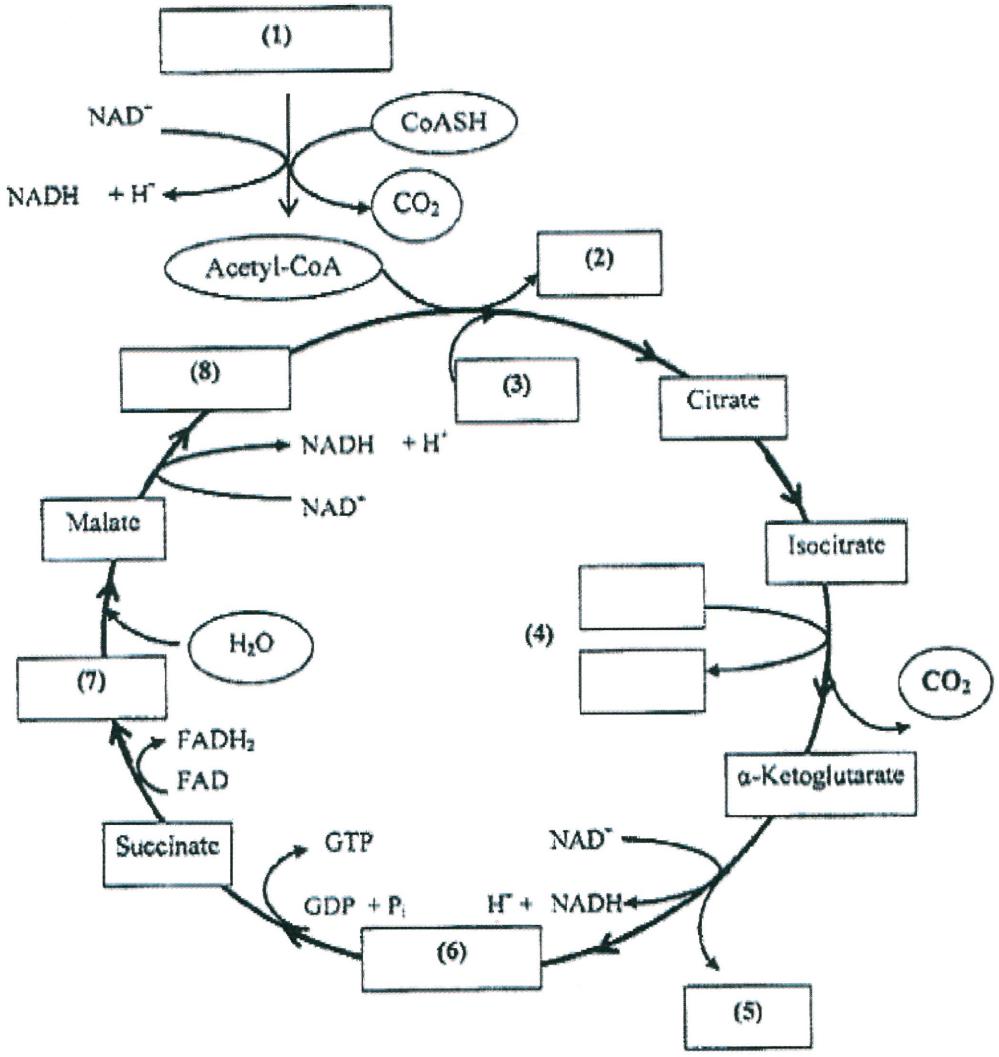

FIGURE Q5 (b)