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UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Kedua  
Sidang Akademik 2006/2007

April 2007

**EKC 171 – Biosains Untuk Jurutera**

*[Masa : 3 jam]*

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Sila pastikan bahawa kertas peperiksaan ini mengandungi LAPAN muka surat yang bercetak sebelum anda memulakan peperiksaan ini.

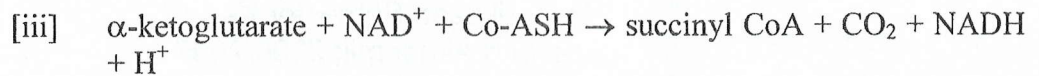
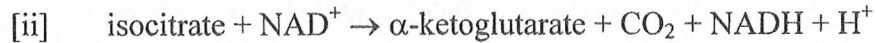
**Arahan:** Jawab EMPAT (4) soalan. Jawab mana-mana DUA (2) soalan dari Bahagian A. Jawab mana-mana DUA (2) soalan dari Bahagian B.

PELAJAR DIBENARKAN MENJAWAB SOALAN SAMA ADA DALAM BAHASA MALAYSIA ATAU BAHASA INGGERIS.

Section A : Answer any TWO questions.

Bahagian A : Jawab mana-mana DUA soalan.

1. [a] Under certain conditions, will the following reactions take place spontaneously as indicated below:-



[9 marks]

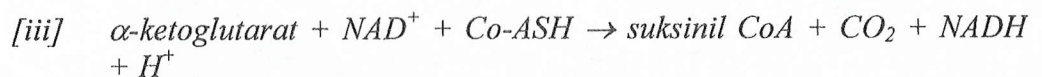
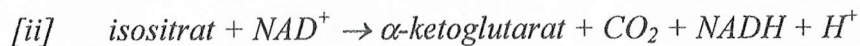
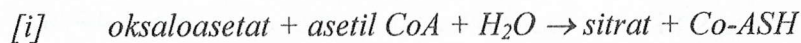
[b] What are the ATP-consuming and ATP-generating steps in glycolysis?

[6 marks]

[c] Briefly compare prokaryotes with eukaryotes in terms of internal structure and functions.

[10 marks]

1. [a] *Pada keadaan tertentu, adakah tindakbalas berikut berlaku secara spontan seperti di bawah:-*



[9 markah]

[b] *Apakah langkah-langkah yang menggunakan-ATP dan menghasilkan-ATP di dalam glikolisis?*

[6 markah]

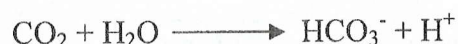
[c] *Jelaskan perbandingan di antara prokaryot dan eukaryot darisege struktur dalaman dan fungsinya.*

[10 markah]

2. [a] Discuss briefly the followings:-
- [i] Coenzymes and cytochrome
  - [ii] Lysosomes and ribosomes
  - [iii] Celluloses and glycogen
- [9 marks]
- [b] Explain how cytoplasmic NADH is recycled in malate-aspartate shuttle system?
- [8 marks]
- [c] Describe how protons move from the intermembrane space into the matrix. How is proton translocation linked to ATP synthesis?
- [8 marks]

2. [a] *Bincangkan secara ringkas yang berikut:-*
- [i] *Koenzim dan sitokrom*
  - [ii] *Lisosom dan ribosom*
  - [iii] *Celuloses dan glikogen*
- [9 markah]
- [b] *Terangkan bagaimana NADH di sitoplasma dikitar semula di dalam sistem olak-alik malat-aspartat?*
- [8 markah]
- [c] *Terangkan bagaimana proton bergerak dari ruang intermembran ke dalam matrik. Bagaimana perkaitan translokasi proton dengan sintesis ATP?*
- [8 markah]

3. [a] The hydration of CO<sub>2</sub> is catalyzed by carbonic anhydrase:



The following data were obtained for the reaction rates at pH 7.1 and an enzyme concentration of  $3.1 \times 10^{-6}$  mM.

<i>v</i> , mM/s	[CO <sub>2</sub> ], mM
27.8	1.25
50.0	2.5
83.3	5
166.7	20

*v* is the initial reaction rate at the given substrate concentration.

- [i] Based on the data given, draw a Lineweaver-Burk plot.

[5 marks]

...4/-

[ii] Calculate the  $K_M$ ,  $k_{cat}$  and  $V_{max}$

[9 marks]

[b] The presence of 4 nM of a reversible inhibitor, for an enzyme-catalyzed reaction, yields a  $V_{max}$  value that is 70% of the value in the absence of the inhibitor. The  $K_M$  value is unchanged.

[i] What is the type of inhibition that likely to occur?

[2 marks]

[ii] Find the proportion of the enzymes molecules that have bound inhibitor and compute the inhibition constant.

[5 marks]

[c] Briefly describe the reaction schemes for

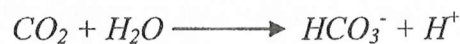
[i] competitive inhibition

[2 marks]

[ii] uncompetitive inhibition

[2 marks]

3. [a] Penghidratan  $CO_2$  dimangkin oleh anhidras karbonik:



Data yang diperolehi di bawah adalah kadar tindak balas pada pH 7.1 dan kepekatan enzim sebanyak  $3.1 \times 10^{-6}$  mM.

v, mM/s	$[CO_2]$ , mM
27.8	1.25
50.0	2.5
83.3	5
166.7	20

v ialah kadar tindakbalas mula pada kepekatan substratum yang diberi.

[i] Berdasarkan data yang diberi, lukiskan satu lengkuk Lineweaver-Burk.

[5 markah]

[ii] Kirakan  $K_M$ ,  $k_{mangkin}$  dan  $V_{mak}$

[9 markah]

...5/-



[b] Kehadiran 4 nM perencat boleh balik bagi satu tindakbalas bermangkin enzim menghasilkan satu nilai  $V_{max}$  iaitu 70% daripada nilai dalam keadaan ketiadaan perencat. Nilai  $K_M$  tidak berubah.

[i] Apakah jenis perencatan yang mungkin berlaku?

[2 markah]

[ii] Carikan kadaran molekul-molekul enzim yang ada perencat ikatan dan kirakan pemalar perencatan.

[5 markah]

[c] Perihalkan skema tindak balas bagi

[i] perencatan bersaing

[2 markah]

[ii] perencatan tidak bersaing

[2 markah]

Section B : Answer any TWO questions.

Bahagian B : Jawab mana-mana DUA soalan.

4. [a] [i] Discuss the major features of 'Watson-Crick model' of DNA.

[5 marks]

[ii] Explain how protein is synthesized through transcription and translation processes.

[5 marks]

[b] Show that for an amino acid at isoelectric pH,  $pI = (pK_1 + pK_2)/2$

[5 marks]

[c] Write notes on:

[i] Biological function of lipid.

[2 marks]

[ii] Vitamin A.

[2 marks]

[iii] Vitamin E.

[2 marks]

[iv] Lipid bilayers.

[4 marks]

...6/-

4. [a] [i] Bincangkan ciri-ciri utama model DNA 'Watson-Crick'.  
[5 markah]
- [ii] Terangkan bagaimana protein disintesis melalui proses-proses transkripsi dan peralihan.  
[5 markah]
- [b] Bagi suatu asid amino pada pH seelektrik, tunjukkan  $pI = (pK_1 + pK_2)/2$   
[5 markah]
- [c] Tuliskan nota mengenai:
- [i] Fungsi biologi lipid.  
[2 markah]
- [ii] Vitamin A.  
[2 markah]
- [iii] Vitamin E.  
[2 markah]
- [iv] Dwilapisan lipid.  
[4 markah]
5. [a] Write down the factors which are to be controlled to protect proteins from being irreversibly damaged during purification process.  
[5 marks]
- [b] Discuss on secondary and tertiary structure of protein.  
[8 marks]
- [c] Write on the various forces which are responsible for stability of a protein structure.  
[4 marks]
- [d] Discuss on :
- [i] Gel filtration
- [ii] Affinity chromatography.  
[8 marks]
- ...7/-

5. [a] *Senaraikan faktor-faktor yang perlu dikawal bagi melindungi protein dari kerosakan tak berbalik semasa proses penulenan.*

[5 markah]

- [b] *Bincangkan struktur sekunder dan tertier protein.*

[8 markah]

- [c] *Tuliskan daya-daya yang bertanggungjawab bagi kestabilan struktur protein.*

[4 markah]

- [d] *Bincangkan :*

[i] *Penurasan gel*

[ii] *Kromatografi keafinan.*

[8 markah]

6. [a] *Derive an expression for the condition of maximum flow rate which will prevent washout of cells for a continuous fermentation process using sterile medium as a feed.*

[7 marks]

- [b] *In a continuous fermentation process the medium flow rate was varied and steady state concentration of cells and substrate were measured and recorded as shown in Table Q.6 [b]. The inlet concentration of substrate was 60 g/l. The volume of the fermenter was 500 ml. The inlet stream was sterile.*

Table Q. 6 [b].

Flow rate (ml/hr)	Cell concentration (g/l)	Substrate concentration (g/l)
20	4.9	0.2
35	4.88	0.4
60	4.80	1.2
80	4.70	2.4
140	0	60.0

- [i] *Find the rate equation for cell growth.*

- [ii] *What should be the range of flow rate to prevent washout of the cells.*

[9 marks]

- [c] *Discuss the steps of industrial production of citric acid and its recovery starting from molasses as the raw material.*

[9 marks]

...8/-

6. [a] Terbitkan ungkapan bagi keadaan kadar aliran maksimum yang akan menghalang sel dari dibasuh-habis untuk suatu proses penapaian selanjar yang menggunakan bahantara steril sebagai suapan.

[7 markah]

- [b] Dalam suatu proses penapaian selanjar kadar aliran bahantara telah diubah-ubah dan kepekatan keadaan mantap bagi sel dan substratum telah diukur dan direkod seperti yang ditunjukkan dalam Jadual S.6 [b]. Kepekatan substratum di salur masuk ialah 60 g/l. Isipadu penapai ialah 500 ml. Aliran di salur masuk adalah steril.

Jadual S. 6 [b].

Kadar aliran (ml/jam)	Kepekatan sel (g/l)	Kepekatan substratum (g/l)
20	4.9	0.2
35	4.88	0.4
60	4.80	1.2
80	4.70	2.4
140	0	60.0

- [i] Carikan persamaan kadar bagi pertumbuhan sel.
- [ii] Apakah julat kadar aliran yang sepatutnya digunakan bagi menghalang sel dari dibasuh-habis.

[9 markah]

- [c] Bincangkan langkah-langkah penghasilan dan perolehan asid sitrik di industri bermula dari molas sebagai bahan mentah.

[9 markah]