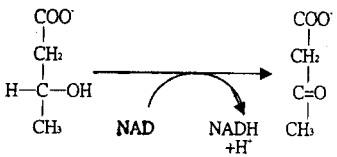
國立屏東科技大學九十學年度博士班招生考試 食 品 科 學 試題

（含生物化學、微生物、食品工程、食品檢驗分析、食品加工等五領域，請任選三領域作答）

生物化學

1. Freshly prepared mitochondria were incubated with β-hydroxybutyrate, oxidized cytochrome *c*, ADP, Pi, and cyanide. β-hydroxybutyrate is oxidized by an NAD^+--dependent dehydrogenase. (50%) (Refer attached illustrations)



The experimenter measured the rate of oxidation of β-hydroxybutyrate and the rate of formation of ATP.

(a) Indicate the probable flow of electrons in this system.
(b) How many moles of ATP would you expect to be formed per mole of β-hydroxybutyrate oxidized in this system?
(c) Why is β-hydroxybutyrate added rather than NADH?
(d) What is the function of cyanide?
(e) Write a balanced equation for the overall reaction occurring in this system.

2. A new-developed lipase, CK4, is used in some laundry detergents to help remove lipid-type stains. (20%)
(a) What unusual kind of stability does this suggest for CK4?
(b) CK4 does have a problem, in that it becomes inactivated by oxidation of a methionine close to the active site. Suggest a way to make a better CK4.

3. Design a radiotracer experiment that would allow you to determine which proportion of glucose catabolism in a given tissue preparation occurs through the pentose phosphate pathway and which proportion through glycolysis and the citric acid cycle. Describe your rationales. (30%) (Refer attached illustrations)

(Assume that you can synthesize glucose labeled with ^{14}C in any desired position or combination of positions. Assume also that you can trap CO_2 after administration of labeled glucose and determine its radioactivity.)

微生物

1.請寫出製造下列製品的微生物學名。(25%)
①Penicillin，②Citric acid，③Tempe，④清酒，⑤下面發酵啤酒，⑥納豆，⑦養樂多，⑧食醋，⑨麵包，⑩味精。

2.試述酒精發酵之型式有那幾種。(25%)

3.試述在突變育種法中，要如何取得大量生產代謝系中之代謝中間体及最終代謝物的突變株。(25%)

4.試述在微生物之緊密代謝連系中，要如何才能使其代謝生產物大量生產。(25%)

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食品工程

1. 一食品之比熱 (specific heat capacity) 爲溫度之函數，即 $Cp = a + bT + cT^2$ ，其中 Cp 爲比熱[J/kg.°K]、T 爲溫度[°K]，a, b, c 爲非零常數。在溫度爲 25℃至 95℃之範圍內，a, b, c 之值分別爲 a=3,850, b=1.5x10^{4}, c=-2.5x10^{7}。(1) 試求在此溫度範圍內之平均比熱爲多少？(2) 5[kg]之此食品自 30℃被加熱至 80℃，共需供給多少熱量？(50%)

2. 一平板式熱交換器 (plate heat exchanger) 之材質爲鎳鉻合金鋼，其熱交換面積 A=10[m^2]爲，厚度爲 x=5[mm]，熱傳導係數 (thermal conductivity) 爲 k=30[W/m°K]。若此熱交換器因長期使用，致使其兩側各有結垢物 (scale)，此結垢物之厚度爲 x=0.1[mm]，熱傳導係數爲 k=2.0[W/m°K]。熱交換器之熱側 (hot side) 流體爲熱水，其對流熱傳係數(convective heat transfer coefficient) 爲 h=1,500[W/m2°K]；熱交換器之冷側 (cold side) 流體爲果汁，其對流熱傳係數爲 h=800[W/m2°K]。(1) 根據題目所給之符號，試導出本題平板式熱交換器之總包熱傳係數 U (overall heat transfer coefficient)。(2) 若熱側及冷側流體之溫度分別爲 100℃及 20℃，試求在穩定狀態下單位時間之熱傳量爲多少？(50%)

食品檢驗分析

1.舉例說明 Immunoassay（免疫分析檢驗法）之原理及其在食品分析上之應用。(25%)

2.舉例說明 Bioassay（生物檢測法）之原理及其在食品分析上之應用。(25%)

3.在進行成分定量測定時，需先製作標準品之標準曲線。在不同的情況下，常用「內部標準法」(Internal standard)、「外部標準法」(External standard)、或「標準品加入法」(Standard addition)等不同方法，請簡述上列各方法之適用性並比較各方法之相異處。(25%)

4.以儀器分析之觀點，說明分光光度計及層析儀在食品分析上之原理及應用，並列舉上述二類之儀器種類有哪些？(25%)

食品加工

1. 超臨界氣體萃取(Supercritical gas extraction)是以超臨界氣體爲溶劑的萃取法，其和一般溶劑萃取法相較之優點爲何？(40%)

2. 請說明利用擠壓技術(Extrusion)來製造食品之優點與好處.(60%)

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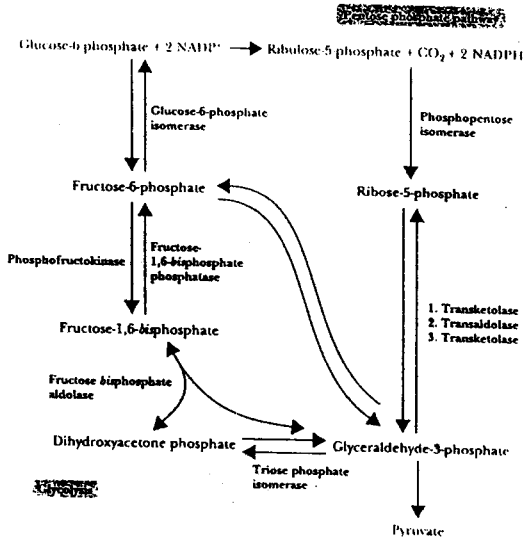

FIGURE
Relationships between the pentose phosphate pathway and glycolysis. If the organism needs NADPH more than ribose-5-phosphate, the entire pentose phosphate pathway is operative. If the organism needs ribose-5-phosphate more than NADPH, the nonoxidative reactions of the pentose phosphate pathway, operating in reverse, produce ribose-5-phosphate (see text).

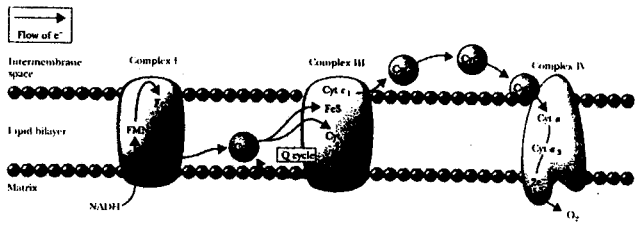

FIGURE
The compositions and locations of respiratory complexes in the inner mitochondrial membrane, showing the flow of electrons from NADH to O_2. Complex II is not involved and not shown. NADH has accepted electrons from substrates such as pyruvate, isocitrate, α-ketoglutarate, and malate. Note that the binding site for NADH is on the matrix side of the membrane. Coenzyme Q is soluble in the lipid bilayer. Complex III contains two *b*-type cytochromes, which are involved in the Q cycle (see text). Cytochrome *c* is loosely bound to the membrane, facing the intermembrane space. In Complex IV, the binding site for oxygen lies on the side toward the matrix.

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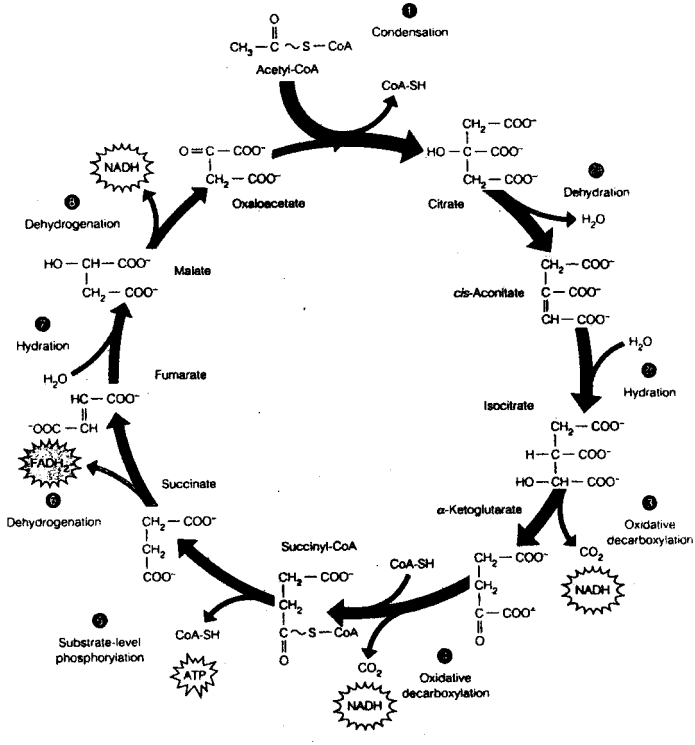

The fate of carbon in the citric acid cycle. Acetyl-CoA entering the citric acid cycle is highlighted (in blue) to show the fate of its two carbons as far as malate. Carboxyl groups that leave the cycle as CO_2 are shown in green. Note that these departing groups contain carbons incorporated as acetyl-CoA in earlier turns of the cycle.