

國立臺北科技大學 103 學年度碩士班招生考試

系所組別：3610 化學工程與生物科技系生化與生醫工程碩士班甲組

第二節 生物化學 試題

第一頁 共三頁

注意事項：

1. 本試題共五大題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、單選題，每題 2 分，共 60 分，務必將答案填寫於答案紙上。

(Single Choice Question, 2 points each, must fill the answers onto the sheets)

1. Which of the following pathways is central to virtually all living organisms?
 - (A) electron transport chain
 - (B) glycolysis
 - (C) citric acid cycle
 - (D) β -oxidation of fatty acid
2. What function do vitamins usually serve in cells?
 - (A) oxidation for generating energy
 - (B) coenzymes or precursors of coenzymes
 - (C) hormones or second messengers
 - (D) binding metal ion for enzyme
3. How many NAD^+ are reduced in the degradation of palmitoyl-CoA to form eight molecules of acetyl-CoA?
 - (A) 7
 - (B) 8
 - (C) 10
 - (D) 14
4. Which of the following best describes carnitine?
 - (A) It transports fatty acids across the inner mitochondrial membrane for breakdown.
 - (B) It transports acetyl-CoA to the cytosol for fatty acid synthesis.
 - (C) It's a side product of cholesterol.

- (D) It carries growing acyl chains during fatty acid synthesis.
5. Which of the following are all essential amino acids in humans?
- (A) threonine, histidine, proline
 - (B) valine, lysine, isoleucine
 - (C) methionine, tyrosine, tryptophan
 - (D) cysteine, phenylalanine, leucine
6. The final reduced species in the electron transport chain is:
- (A) cytochrome *b*
 - (B) cytochrome *c*
 - (C) H₂O
 - (D) O₂
7. Uncouplers are compounds that inhibit the phosphorylation of ADP
- (A) by enhancing the proton gradient across the inner mitochondrial membrane
 - (B) because they are transmembrane proteins in the outer mitochondrial membrane
 - (C) by enhancing the proton gradient across the outer mitochondrial membrane
 - (D) without affecting electron transport
8. The key element at the center of chlorophyll is:
- (A) iron
 - (B) magnesium
 - (C) copper
 - (D) chlorine
9. The carbon skeleton used to make serine is:
- (A) succinate
 - (B) phosphoenolpyruvate
 - (C) α -ketoglutarate
 - (D) 3-phosphoglycerate
10. The only membrane-bound enzyme in the citric acid cycle is:
- (A) citrate synthase
 - (B) fumarase
 - (C) succinate dehydrogenase
 - (D) aconitase

注意：背面尚有試題

11. Which of the following compounds can activate pyruvate carboxylase?

- (A) ATP
- (B) acetyl-CoA
- (C) ADP
- (D) oxaloacetate

12. Which of the following molecules is a key component to regulate glycolysis?

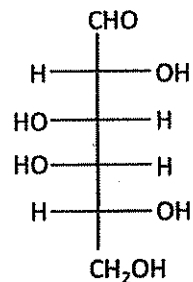
- (A) fructose-1,6-biphosphate
- (B) glyceraldehyde-3-phosphate
- (C) fructose-2,6-biphosphate
- (D) phosphoenolpyruvate

13. During anaerobic metabolism in yeast, the carbons of glucose end up in:

- (A) ethanol
- (B) CO₂
- (C) lactate
- (D) pyruvate

14. The chemical structure in right side is a:

- (A) D-glucose
- (B) D-fructose
- (C) D-ribose
- (D) D-galactose



15. Which of the following carbohydrates cannot be digested by human enzyme?

- (A) bacterial cell wall
- (B) starch
- (C) plant cell wall
- (D) glycogen

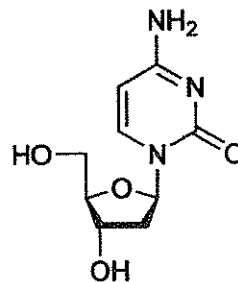
16. A tRNA was determined to have the following anticodon sequence: 3'-GAI-5' (I represents the base hypoxanthine). Please indicate which of the following codons can form base pairs with this anticodon.

- (A) 5'-CUC-3'
- (B) 5'-CUA-3'
- (C) 5'-CUU-3'
- (D) all of the above

17. The promoter site is:
- (A) the general region of DNA downstream from the start site
 - (B) the site on DNA at which RNA polymerase binds to initiate transcription
 - (C) the start site for transcription in DNA
 - (D) the binding site for regulatory proteins that stimulate transcription
18. Which of the following methods was used to prove the semiconservative replication of DNA?
- (A) density-gradient centrifugation
 - (B) column chromatography
 - (C) ultraviolet spectroscopy
 - (D) gel electrophoresis
19. The T_m of the double stranded-DNA is:
- (A) The energy needed to melt the DNA
 - (B) The midpoint of the range over which the helix denatures
 - (C) The temperature at which the helix is completely open
 - (D) The temperature at which the helix starts to precipitate together
20. Which of the following vitamins is derived from β -carotene?
- (A) vitamin K
 - (B) vitamin E
 - (C) vitamin A
 - (D) vitamin C
21. The rate of a reaction depends on:
- (A) the enthalpy change
 - (B) the activation energy
 - (C) the free energy change
 - (D) the entropy change

22. The chemical structure in right side is a:

- (A) deoxycytidine
- (B) deoxyguanosine
- (C) deoxyadenosine
- (D) none of above



23. The dissociation constant for an acid is 1×10^{-5} . What is its pK_a ?
- (A) -0.5
 - (B) 0.5
 - (C) 5
 - (D) -5
24. Which of the following amino acid residues interrupts an α -helix structure?
- (A) proline
 - (B) lysine
 - (C) methionine
 - (D) histidine
25. What happens when a protein is denatured?
- (A) It is completely hydrolyzed to amino acids
 - (B) It breaks apart into several peptides
 - (C) All of its hydrogen bonds are formed
 - (D) Its secondary structure is disrupted but its primary structure remains intact
26. Protein precipitated by ammonium sulfate is based upon proteins interacting with other proteins via:
- (A) hydrogen bonds
 - (B) disulfide bonds
 - (C) hydrophobic interactions
 - (D) ionic bonds
27. Which of the following methods would be best to separate a protein that binds strongly to its substrate?
- (A) affinity chromatography
 - (B) gel filtration chromatography
 - (C) cation exchange chromatography
 - (D) anion exchange chromatography
28. The active site of an enzyme is the place where the following happens:
- (A) The enzyme substrate complex forms here
 - (B) Allosteric regulation of enzyme rate occurs here
 - (C) The catalytic reaction happens here
 - (D) The enzyme-substrate complex forms and the reaction occurs at the active site

29. A velocity curve (V vs. [S]) for a typical allosteric enzyme will be:

- (A) a straight line
- (B) a sigmoid curve
- (C) a parabola
- (D) a rectangular hyperbola

30. Kinase reactions describe enzymes which:

- (A) transfer groups from one part of a molecule to another
- (B) add phosphate groups to another molecule
- (C) use NAD^+/NADH in their reactions
- (D) add or remove double bonds in molecules

二、請說明 synthetase 和 synthase 這兩個酵素所催化的化學反應作用過程有何異同? (10 分)

三、化學鍵有強鍵及弱鍵的分別，請至少舉 3 例說明弱鍵在生物化學裡的重要性。(10 分)

四、攝食過多的醣類及蛋白質，在體內終究都會轉成脂肪儲存，但人類為何無法只靠攝食脂肪存活下來? (10 分)

五、一個固態的 X 酵素，其分子量為 100 kDa，由 900 個胺基酸分子所組成，現在需要進行其酵素反應以將應物 A 催化反為 B，希望的反應濃度為每毫升(ml)反應溶液中含有 10^{10} 個 X 酵素，而反應總體積需求為 50 毫升，請問你應該取多少克的 X 酵素進行反應? (10 分)