

國立高雄大學一百學年度研究所碩士班招生考試試題

科目：生物化學
考試時間：100 分鐘

系所：生物科技研究所
本科原始成績：100 分

是否使用計算機：是

A: Choose the one best response to each following questions. (50 points)

1. What significant roles does water play in biochemistry?

- a) Water is a participant in many reactions, all biomolecules are soluble in water, and water helps regulate pH and temperature. b) Water is a participant in many reactions, water is an important solvent, and water helps regulate pH and temperature. c) Water is a participant in many reactions, water is an important solvent, and water helps regulate pressure and temperature. d) Water is a participant in all reactions, all biomolecules are soluble in water, and water helps regulate pressure and temperature. e) None of the above are true

2. Molecules with dual properties, possessing regions of both nonpolar and ionic character, are called:

- a) amphiphilic b) hydrophobic c) nonpolar d) lipids e) liposomes

3. Which of the following molecules is the strongest acid?

- a) formic acid, $K_a = 1.78 \times 10^{-4}$ b) lactic acid $K_a = 1.38 \times 10^{-4}$ c) carbonic acid $K_a = 5.62 \times 10^{-11}$ d) ammonium ion $K_a = 5.62 \times 10^{-10}$ e) phosphoric acid $K_a = 7.25 \times 10^{-3}$

4. The amino acids with charged side chains include:

- a) aspartate, glutamate, lysine and arginine. b) aspartate, glutamate and glycine. c) aspartate, lysine and arginine. d) aspartate, glutamate, lysine, glycine and arginine. e) none of the above

5. In some individuals, ethanol catabolism is accompanied by facial flushing and dilation of blood vessels, as well as other symptoms. What causes these effects?

- a) Under active alcohol dehydrogenase results in formation of high levels of blood acetaldehyde.
b) Overly active alcohol dehydrogenase results in formation of high levels of blood acetaldehyde.
c) Overly active alcohol dehydrogenase results in formation of high levels of methanol in the blood.
d) Under active alcohol dehydrogenase results in high levels of ethanol that circulate with a longer than normal half-life. e) none of the above

6. The X-axis and the Y-axis on a Lineweaver-Burk Plot correlate to:

- a) $1/V_{max}$; $1/[S]$ b) $1/v_0$; $1/[S]$ c) $1/K_M$; $1/[S]$ d) $1/V_0$; $[S]$ e) none of the above

7. If the data from an enzyme experiment is plotted as a Lineweaver-Burk plot, and the V_{max} is 0.02 sec/mol, and x-intercept is -2.5 mM^{-1} , then what is the K_M value?

- a) 2.5 μM b) 0.4 mM c) .008 mM d) 125 uM e) none of the above

8. Serine proteases demonstrate _____ catalysis when the serine oxygen binds to the carbonyl in the peptide bond.

- a) allosteric catalysis b) covalent catalysis c) metal ion catalysis d) induced fit e) none of the above

9. In noncompetitive inhibition, the inhibitor can bind to:

- a) enzyme (E) b) the enzyme-substrate complex (ES) c) the product (P) d) a and b e) b and c

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10. What is the principle underlying the concept of allosteric regulation?
a) All enzymes can be negatively inhibited by product formation. b) All enzymes can be described by the Michaelis-Menten equation. c) A binding or catalytic event occurring at one site influences the binding or catalytic event at another site. d) all of the above e) none of the above
11. Functions of the carbohydrates on glycoproteins include:
a) cell surface identification markers. b) viral growth. c) protein turnover. d) a and c e) a, b and c
12. Which of the following is (are) found in a glycerophospholipid?
a) glycerol backbone b) esterified fatty acid group c) phosphate derivative as the head group d) all of the above e) a and c
13. Which of the following RNA sequences could form a hairpin loop?
a) ACGUUUCGUAUCGUACACACGU b) GCATCGAUCGUCUCGAUCGUGC
c) ACAGACAGACAGUCUGUCUGUC d) AAUUAACCAAGGAACCGGUUCC e) none of the above
14. The steps in glycolysis that are different than those in gluconeogenesis are catalyzed by these enzymes.
a) pyruvate kinase, phosphofructokinase, glucokinase b) pyruvate kinase, glucokinase, hexokinase
c) pyruvate kinase, phosphofructokinase, triose phosphate isomerase d) pyruvate kinase, phosphofructokinase, hexokinase e) none of the above
15. Which of the following statements is false?
a) In skeletal muscle glucose is broken down into lactate via glycolysis. b) In liver lactate is converted to glucose via gluconeogenesis. c) In skeletal muscle glucose is broken down into lactate via gluconeogenesis. d) a and b are both false e) a and c are both false
16. Which of the following molecules affect the activity of phosphofructokinase?
a) ATP and AMP b) TTP and biotin c) citrate and fructose-2,6-bisphosphate d) a and b e) a and c
17. Pyruvate carboxylase is only active if the metabolite _____ is present.
a) glucose-1-phosphate b) acetyl-CoA c) DHAP d) citric acid e) none of the above
18. In the pyruvate dehydrogenase complex reactions, the FADH_2 is reoxidized by:
a) NAD^+ b) FAD c) lipoamide d) TPP e) none of the above
19. How does NAD^+ accept the electrons transferred to it, when it is reduced to $\text{NADH} + \text{H}^+$?
a) in a two-step reaction, forming a radical intermediate b) direct transfer of H_2 c) transfer of H_2O , followed by loss of oxygen d) transfer of a hydride ion (H^-) and a proton (H^+) e) none of the above
20. Succinate dehydrogenase requires the prosthetic group:
a) TPP b) FAD c) NADH d) all of the above e) none of the above
21. In photosynthesis, the water molecule is oxidized by the metalloprotein water-splitting complex also

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known as the:

a) Photosystem I b) Cytochrome *bf* c) oxygen evolving center (OEC) d) a and b e) none of the above

22. What reaction is carried out by rubisco?

a) The enzyme adds CO₂ to a five-carbon sugar and then cleaves it into two three-carbon units. b) The enzyme adds CO₂ to a five-carbon sugar and converts it to fructose. c) The enzyme fixes nitrogen and CO₂ as the initial step in amino acid synthesis. d) all of the above e) none of the above

23. Triacylglycerol lipase in adipocytes is stimulated by the direct or indirect action of:

a) β -oxidation. b) the second messenger cAMP. c) receptor binding of glucagon. d) none of the above e) a, b and c

24. Which steps occur in β -oxidation?

a) The acyl-CoA is shortened by two carbons, which are removed at the CoA end of the molecule. b) Oxidation occurs at the β position. c) The acetyl-CoA molecules are transported into the mitochondria from the cytosol. d) a and b e) a, b and c

25. What are the ketone bodies formed during certain metabolic conditions such as diabetes?

a) acetoacetate, butanone, and acetone b) acetoacetate, D-3-hydroxybutyrate, and acetone
c) glutathione, D-3-hydroxybutyrate, and acetone d) acetoacetate, glutathione and acetone e) none of the above

B: Simply explain the following terms (20points)

1. Isoelectric focusing 2. RNA editing 3. Apoenzyme 4. Hydrogen bonds 5. Allosteric site

C: Please answer the following questions (30 points)

1. It is already known the XXYYZZ signal peptide leads protein target into chloroplasts. Please design an experiment to identify the docking protein of XXYYZZ that locates in the membrane of chloroplasts and proof its function. (10 points)

2. Please explain the process that using the ion-exchange chromatography (DEAE or CM) to identify proteins. (10 points)

3. Please draw a simple diagram to describe how a cell uptake low-density lipoproteins from serum. (10 points)