國立高雄大學 101 學年度研究所碩士班招生考試試題

科目：生物化學　　系所：生物科技研究所　　是否使用計算機：是
考試時間：100 分鐘　　本科原始成績：100 分

一、選擇題（共 30 題，每題 2 分）

1. Allosteric proteins
A) display hyperbolic Michaelis-Menten kinetics.
B) display cooperativity.
C) always consist of several identical subunits.
D) a and b
E) a, b, and c

2. The simplest carbohydrates are
A) D- and L-glyceraldehyde.
B) dihydroxyacetone and D- and L-glyceraldehyde.
C) dihydroxyacetone and glycerate.
D) All of the above.
E) None of the above.

3. How many molecules thick are membranes?
A) Two
B) One
C) Infinite
D) Varying thickness, depending on structure
E) None of the above

4. Multidrug resistance in tumor cells is
A) due to the action of a membrane pump which transports small molecules out of the cells.
B) the development of resistance to several drugs following an initial resistance to a single drug.
C) caused by a mutation in the cystic fibrosis gene.
D) A and B.
E) All of the above.

5. Advantages of second messengers include
A) the signal can be amplified by making many second messengers.
B) second messengers can freely diffuse to other sites within the cell.
C) a few common second messengers can be used in multiple signaling pathways.
D) All of the above.
E) None of the above.

6. Which of the following is the electron donor used for reductive biosynthesis?

A) NADH
B) $FADH_2$
C) NADPH
D) CoASH
E) ATP

7. The primary raw materials for gluconeogenesis are

A) galactose and sucrose.
B) pyruvate and oxaloacetate.
C) lactate and alanine.
D) fructose and alanine.
E) lactose and lactate.

8. The enzymes in the glyoxylate cycle are the same as the citric acid cycle except for?

A) Malate synthase
B) Glyoxylate synthase
C) Isocitrate lyase
D) A and B
E) B and C

9. What is a cytochrome?

A) A chloroplast protein that transfers electrons, and that also contains an iron sulfur prosthetic group
B) A protein that transfers electrons, and that also contains a heme prosthetic group
C) A protein that pumps ATP, and that also contains iron
D) All of the above
E) None of the above

10. How is light used in photosynthesis?

A) The light is necessary to make the chlorophyll green, so the pigment can transmit electrons.
B) The light is used to generate high-energy electrons with great reducing potential.
C) The light provides heat energy for the chloroplasts.
D) The light is absorbed by oxygen which is converted into water.
E) None of the above.

11. In the Calvin cycle, 3-phosphoglycerate is converted into which hexose phosphate?
A) Glucose 1-phosphate
B) Glucose 6-phosphate
C) Fructose 6-phosphate
D) All of the above
E) None of the above

12. The key enzyme in glycogen degradation is
A) glycogen phosphatase.
B) glycogen phosphorylase.
C) glucose 1-phosphate synthase.
D) All of the above.
E) None of the above.

13. What organs or tissues prefer to use ketone bodies such as acetoacetate as a fuel energy source instead of glucose?
A) Heart muscle
B) Renal cortex
C) Brain
D) A and B
E) A, B, and C

14. In the urea cycle, free NH_3 is coupled with carboxyphosphate to form
A) ureatic phosphate.
B) pyruvate.
C) carbamic acid.
D) All of the above.
E) None of the above.

15. Essential amino acids differ from nonessential amino acids in that:
A) nonessential amino acids are synthesized in simple reaction pathways compared to complex pathways for most essential amino acids.
B) essential amino acids are generally synthesized directly from citric acid cycle intermediates, but not nonessential amino acids.
C) microorganisms and animals cannot synthesize essential amino acids but plants can.

D) animals cannot synthesize essential amino acids because they have lost the ability to carry out transamination reactions.
E) none of the above.

16. The source(s) of NH_2 groups in synthesis of nucleotides:
A) aspartate
B) glutamine
C) glycine
D) a and b
E) a, b, and c

17. The role of lipoprotein particles is to
A) solubilize hydrophobic lipids.
B) aid in clot formation.
C) contain cell-targeting signals.
D) A and B.
E) A and C.

18. What is the primary source of energy used by the muscle during starvation?
A) Glucose
B) Lactate
C) Ketone bodies
D) Fatty acids
E) Branched chain amino acids

19. Photolyase functions to
A) repair pyrimidine dimers.
B) remove damaged bases.
C) ligate single-strand breaks.
D) All of the above.
E) None of the above.

20. A chemical commonly used to induce the lac operon in laboratory experiments is
A) lactose.
B) IPTG.

C) X-Gal.
D) All of the above.
E) None of the above.

21. Which of the following is considered a metabolite, a substance that is chemically transformed in a biochemical process?
A) deoxyribonucleic acid
B) protein
C) glycerol
D) ribonucleic acid
E) polysaccharide

22. Why is the peptide bond planar?
A) Bulky side chains prevent free rotation around the bond.
B) Hydrogen bonding between the NH and C=O groups limits movement.
C) It contains partial double-bond character, preventing rotation.
D) None of the above.
E) All of the above.

23. Two-dimensional electrophoresis is a combination of what two techniques?
A) isoelectric focusing and affinity chromatography.
B) ion-exchange chromatography and SDS-PAGE.
C) isoelectric focusing and SDS-PAGE.
D) affinity chromatography and SDS-PAGE.
E) isoelectric focusing and ion-exchange chromatography.

24. The chemical forces that contribute to the stability of the DNA due to the base stacking present in the DNA helix are
A) hydrogen bonds.
B) van der Waals.
C) disulfide bonds.
D) b and c.
E) None of the above.

25. Which of the following molecules is the most stable?

A) mRNA
B) hemoglobin
C) carbohydrates
D) rRNA
E) mitochondrial DNA

26. Hemoglobin-binding of oxygen is best described as a
A) concerted model.
B) Michaelis-Menten model.
C) sequential model.
D) combination of sequential and concerted models.
E) None of the above.

27. When substrate concentration is much greater than K_M, the rate of catalysis is almost equal to
A) K_d.
B) k_{cat}.
C) V_{max}.
D) All of the above.
E) None of the above.

28. How is specificity determined by chymotrypsin?
A) interaction of the active site amino acids with the substrate
B) binding of the N-terminus amino acid at the active site
C) covalent binding of a his residue to the substrate
D) conformational change upon binding of substrate
E) binding of the proper amino acid into a deep pocket on the enzyme

29. Histones
A) are basic.
B) constitute half the chromosome's mass.
C) serve to organize eukaryotic DNA.
D) All of the above.
E) None of the above.

30. Most odorants are

A) mixtures of ions.
B) large organic molecules.
C) complex salts.
D) small globular proteins.
E) small, volatile organic molecules.

二、解釋名詞（共 5 題，每題 4 分）

1. Cellular respiration
2. Light-harvesting complex
3. Transcriptome
4. β-oxidation pathway
5. Chemical shift

三、簡答題（共 4 題，每題 5 分）

1. What are liposomes? What are some of the current commercial applications?
2. List some of the reasons carbohydrates are considered important molecules.
3. Which enzyme is cited as the most abundant enzyme in the biosphere? Why is this so?
4. Although nitrogen is abundant in the form of atmospheric nitrogen, it presents a fundamental problem for use in biological systems. What is the problem and how is it resolved?