國立成功大學 108 學年度碩士班招生考試試題

系　　所：生物科技與產業科學系

考試科目：生物化學　　考試日期：0224，節次：1

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

I. 單選題 (Simple Choice Questions):共 25 題, 每題 2 分 (50%)

1. Buffers have all of the following characteristics *except*:

a. they have relatively flat titration curves at the pH(s) where they buffer.

b. they resist changes in their pH as acid or base is added.

c. they are typically composed of a weak acid and its conjugate base.

d. they buffer best for polyprotic acids half-way between the two pK_a values.

e. buffer where the amounts of conjugate base are nearly equivalent to the amounts of weak acid.

2. Which of the following statements about cellulose fiber is true?

a. It is a linear polymer of β (1→4) glycosidic linked glucose and galactose residues.

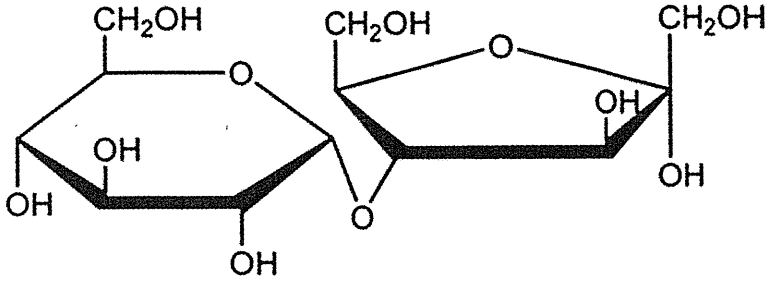
b. It is extremely susceptible to hydrolysis.

c. It is water-soluble.

d. It is made up of very weak microfibrils.

e. Intermolecular hydrogen bonds play a major role in stabilization of the microfibrils.

3. Which of the following best describes the glycosidic bond below?



a. β(2→4)

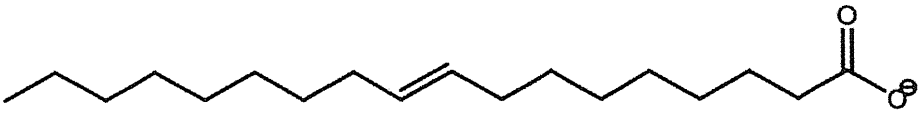
b. α(1→3)

c. α(1→4)

d. β(1→3)

e. α(2→4)

4. Of the following fatty acids, which would have physical and physiological properties most similar to elaidic acid, pictured below?



a. oleic acid ($18:1\Delta^{9}$)

b. lauric acid (12:0)

c. linoleic acid ($18:2\Delta^{9,12}$)

d. stearic acid (18:0)

e. arachidonic acid ($20:4\Delta^{5,8,11,14}$)

5. From the following types of organic molecules, the order of most reduced to most oxidized is:

A. aldehyde
B. hydrocarbon
C. CO_2
D. alcohol
E. carboxylic acid

a. A, B, C, D, E

b. B, E, A, D, C

c. C, B, E, A, D

d. B, D, A, E, C

e. C, D, E, B, A

6. Seven of the ten reactions of glycolysis are reversible (ΔG near zero) and can be used in reverse of glycolysis for gluconeogenesis. The three irreversible reactions are catalyzed by:

a. hexokinase, phosphoglycerate kinase, pyruvate kinase.

b. triose phosphate isomerase, phosphoglycerate mutase, pyruvate kinase.

c. enolase, phosphoglycerate kinase, phosphofructokinase-1.

d. hexokinase, phosphoglucoisomerase, glyceraldehyde-3-phosphate dehydrogenase.

e. hexokinase, phosphofructokinase-1, pyruvate kinase.

7. Inhibition of the citric acid cycle at isocitrate dehydrogenase increases the levels of citrate and isocitrate that may increase the production of:

a. amino acids.

b. pyruvate and oxaloacetate.

c. glyoxylate and cytosolic acetyl-CoA.

d. succinate and fumarate.

e. lactate and alanine.

8. Which of the following correctly and completely describes electron movement in electron transport?

a. NADH → complex I → complex III → coenzyme Q → Complex IV → O_2

b. [$FADH_2$] → complex II → cytochrome c → complex III → coenzyme Q → Complex IV → O_2

c. NADH → complex I → coenzyme Q → complex III → cytochrome c → Complex IV → O_2

d. [$FADH_2$] → complex I → coenzyme Q →complex III → Complex IV → O_2

e. none of the above

9. If both NADPH and ribose-5-P are needed which of the following best represents the net reaction of the pentose phosphate pathway?

a. 4 Fruc-6-P + 2 glyceraldehyde-3-P → 6 ribose-5-P

b. 3 Gluc-6-P + 6 NADP+ → 6 NADPH + 3 CO2 + 2 Fruc-6-P + 1 glyceraldehyde-3-P + 6 H+

c. Gluc-6-P + 2 NADP+ + 2 H2O → 2 NADPH + CO2 + ribose-5-P + 2 H+

d. Gluc-6-P + 12 NADP+ + 6 H2O → 1 2 NADPH + 6 CO2 + 12 H+ + Pi

e. None of the above

10. Which of the following correctly describes the sequence of events in the conversion of a triacylglycerol to acetyl-CoA?

a. lipolysis, albumin transport, carnitine shuttle, activation to acyl CoA, β-oxidation

b. albumin transport, carnitine shuttle, lipolysis, activation to acyl CoA, β-oxidation

c. lipolysis, albumin transport, activation to acyl CoA, carnitine shuttle, β-oxidation

d. albumin transport, activation to acyl CoA, carnitine shuttle, lipolysis, β-oxidation

e. none of the above are correct

11. The appropriate sequence of intermediates between mevalonate and squalene are:

A. geranyl pyrophosphate

B. isopentenyl pyrophosphate

C. 5-phosphomevalonate

D. farnesyl pyrophosphate

E. dimethylallyl pyrophosphate

a. A, C, D, B, E

b. C, B, E, A, D

c. C, E, A, D, B

d. E, C, B, D, A

e. B, C, D, A, E

12. Herbicides (e.g., "Roundup") that inhibit biosynthesis of "essential" amino acids are supposedly safe for animal exposure because animals do not have enzymes for:

a. synthesis of the members of the 3-phosphoglycerate family

b. the glyoxylate cycle.

c. the glutamine synthesis pathway.

d. Phe, Val, Leu, and Ile biosynthetic pathways.

e. none are correct.

13. Which of the following serves as one of the nitrogen sources for the pyrimidine ring?

a. glutamate

b. carbamoyl phosphate

c. asparagine

d. glycine

e. none of the above

14. Proline is referred to as the "helix breaker" because

a. its only found in the L form, which is incompatible with helical protein structure.

b. it is hydrophobic.

c. it lacks a charged functional groups for ionic bonding.

d. it lacks the hydrogen atom needed for hydrogen bonding.

e. it has a polar functional group.

15. DNA and RNA differ

a. in that RNA contains ribose and DNA contains deoxyribose.

b. in that RNA contains nucleosides and DNA contains nucleotides.

c. in that RNA contains uracil and DNA contains thymine.

d. both A and C.

e. All of these are correct.

16. Lipid rafts are

a. regions of the membrane that are high in sphingolipids, which facilitate communication with the external environment of the cell.

b. important regions of membrane structure comprised of phospholipids.

c. rafts of lipids inside of the cell that serve to store energy.

d. regions not typically associated with signal transduction.

e. regions where greater concentrations of sphingolipids are on the inner side of the membrane.

17. The equation A − PO4 + B → A + B − PO4 would be catalyzed by which of the following classes of enzymes?
a. oxidoreductases
b. transferases
c. hydrolases
d. ligases
e. isomerases

18. Enzyme regulation may occur by several methods. Which of the following is not a means of enzyme regulation?
a. substrate-level phosphorylation
b. feedback inhibition
c. saturation
d. covalent modification
e. allosteric regulation

19. The base composition in DNA isolated from cow liver cells is 28% adenine; what percent of the bases are cytosine?
a. 14%
b. 22%
c. 28%
d. 36%
e. 56%

20. Which of the following is involved in proofreading during DNA replication?
a. 5' to 3' exonuclease activity of DNA polymerase
b. 5' to 3' endonuclease activity of DNA polymerase
c. 3' to 5' exonuclease activity of DNA polymerase
d. 3' to 5' endonuclease activity of DNA polymerase
e. RNA polymerase

21. Which of the following most accurately describes the flow of information for retroviruses?
a. RNA → protein
b. DNA → protein
c. DNA → RNA → protein
d. protein → RNA → DNA → protein
e. RNA → DNA → RNA → protein

22. You wish to use mRNA profiles to examine gene expression in cells during times of stress. You are investigating the cell's
a. proteome.
b. genome.
c. spliceosome.
d. transcriptome.
e. BLAST (Basic Local Alignment Search Tool).

23. What new field combines computer science and biology to understand sequence data?
a. bioinformatics
b. genome editing
c. transcriptomics
d. recombinant DNA technology
e. genetic engineering.

24. Each of the following is a second messenger *except*
a. cyclic adenosine monophosphate.
b. inositol trisphosphate.
c. calcium ions.
d. epinephrine.
e. diacylglycerol.

25. You are interested in studying the expression of a gene associated with human cancer during fetal development. Which of the following might be useful to study the expression of this gene over time?
a. DNA microarrays
b. genome-wide association studies
c. Southern blot analysis
d. in situ hybridization
e. DNA microarrays and in situ hybridization

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II. 簡答題 (Short essay questions): 共 10 題, 每題 5 分 (50%)

1. Please describe the principle of a biochemical method used to measure the blood sugar level?

2. Please describe the characteristics of the enzyme, ribulose-1, 5-*bis* phosphate carboxylase/oxygenase (RUBISCO) which it is involved in the photosynthesis?

3. Please describe the binding change mechanism to illustrate the ATP synthesis.

4. Please define the "coenzyme" versus the "vitamins". In addition, please discuss the relationship between them.

5. Please describe the major steps to generate transgenic plants which it conferred the resistance to insects.

6. Please briefly describe how Oswald Avery was able to show that DNA is the genetic material in cells.

7. Please describe four basic components of a PCR reaction and draw a temperature profile of a PCR cycle.

8. Please describe two methods you know to study protein-DNA interactions.

9. Please describe three different methods that can be used to detect protein-protein interaction *in vitro* or *in vivo*.

10. Please describe the molecular mechanism of ubiquitin-proteasome mediated protein degradation.