國立臺北科技大學九十八學年度碩士班招生考試

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第二節　生物化學（選考）試題

注意事項：

1. 本試題共 30 題，配分共 100 分。（選擇題 1-25 題，每題 2 分共 50 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。

1. The dimensions of living cells are limited, on the lower end by the minimum number of biomolecules necessary for function, and on the upper end by the rate of diffusion of solutes such as oxygen. Except for highly elongated cells, they usually have lengths and diameters in the range of:
   A) 0.1 μm to 10 μm.
   B) 0.3 μm to 30 μm.
   C) 0.3 μm to 100 μm.
   D) 1 μm to 100 μm.
   E) 1 μm to 300 μm.

2. The pH of a sample of blood is 7.4, while gastric juice is pH 1.4. The blood sample has:
   A) 0.189 times the $[H^+]$ as the gastric juice.
   B) 5.29 times lower $[H^+]$ than the gastric juice.
   C) 6 times lower $[H^+]$ than the gastric juice.
   D) 6,000 times lower $[H^+]$ than the gastric juice.
   E) a million times lower $[H^+]$ than the gastric juice.

3. Which of the following statements about aromatic amino acids is correct?
   A) All are strongly hydrophilic.
   B) Histidine's ring structure results in its being categorized as aromatic or basic, depending on pH.
   C) On a molar basis, tryptophan absorbs more ultraviolet light than tyrosine.
   D) The major contribution to the characteristic absorption of light at 280 nm by proteins is the phenylalanine R group.
   E) The presence of a ring structure in its R group determines whether or not an amino acid is aromatic.

4. Prosthetic groups in the class of proteins known as glycoproteins are composed of:
   A) carbohydrates.
   B) flavin nucleotides.
   C) lipids.
   D) metals .
   E) phosphates.

5. In a mixture of the five proteins listed below, which should elute second in size-exclusion (gel- filtration) chromatography?
   A) cytochrome *c* M_r = 13,000
   B) immunoglobulin G M_r = 145,000
   C) ribonuclease A M_r = 13,700
   D) RNA polymerase M_r = 450,000
   E) serum albumin M_r = 68,500

6. Two amino acids of the standard 20 contain sulfur atoms. They are:
   A) cysteine and serine.
   B) cysteine and threonine.
   C) methionine and cysteine
   D) methionine and serine
   E) threonine and serine.

7. Which of the following best represents the backbone arrangement of two peptide bonds?
   A) C_α—N—C_α—C—C_α—N—C_α—C
   B) C_α—N—C—C—N—C_α
   C) C—N—C_α—C_α—C—N
   D) C_α—C—N—C_α—C—N
   E) C_α—C_α—C—N—C_α—C_α—C

8. In an α helix, the R groups on the amino acid residues:
   A) alternate between the outside and the inside of the helix.
   B) are found on the outside of the helix spiral.
   C) cause only right-handed helices to form.
   D) generate the hydrogen bonds that form the helix.
   E) stack within the interior of the helix.

9. Which of the following statements about protein-ligand binding is correct?
   A) The K_a is equal to the concentration of ligand when all of the binding sites are occupied.
   B) The K_a is independent of such conditions as salt concentration and pH.
   C) The larger the K_a (association constant), the weaker the affinity.

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D) The larger the K_a, the faster is the binding.
E) The larger the K_a, the smaller the K_d (dissociation constant).

10. One of the enzymes involved in glycolysis, aldolase, requires Zn^{2+} for catalysis. Under conditions of zinc deficiency, when the enzyme may lack zinc, it would be referred to as the:
A) apoenzyme.
B) coenzyme.
C) holoenzyme.
D) prosthetic group.
E) substrate.

11. From the abbreviated name of the compound Gal(β1 → 4)Glc, we know that:
A) C-4 of glucose is joined to C-1 of galactose by a glycosidic bond.
B) the compound is a D-enantiomer.
C) the galactose residue is at the reducing end.
D) the glucose is in its pyranose form.
E) the glucose residue is the β anomer.

12. The difference between a ribonucleotide and a deoxyribonucleotide is:
A) a deoxyribonucleotide has an —H instead of an —OH at C-2.
B) a deoxyribonucleotide has α configuration; ribonucleotide has the β configuration at C-1.
C) a ribonucleotide has an extra —OH at C-4.
D) a ribonucleotide has more structural flexibility than deoxyribonucleotide.
E) a ribonucleotide is a pyranose, deoxyribonucleotide is a furanose.

13. Which of the following deoxyoligonucleotides will hybridize with a DNA containing the sequence (5′)AGACTGGTC(3′)?
A) (5′)CTCATTGAG(3′)
B) (5′)GACCAGTCT(3′)
C) (5′)GAGTCAACT(3′)
D) (5′)TCTGACCAG(3′)
E) (5′)TCTGGATCT(3′)

14. The PCR reaction mixture does *not* include:
A) all four deoxynucleoside triphosphates.
B) DNA containing the sequence to be amplified.
C) DNA ligase.
D) heat-stable DNA polymerase.
E) oligonucleotide primer(s).

15. Current estimates indicate that humans have about _____ genes.
A) 3,000
B) 10,000
C) 30,000
D) 100,000
E) 300,000

16. An integral membrane protein can be extracted with:
A) a buffer of alkaline or acid pH.
B) a chelating agent that removes divalent cations.
C) a solution containing detergent.
D) a solution of high ionic strength.
E) hot water.

17. The biosynthesis of triacylglycerols from acetate occurs mainly in:
A) animals but not in plants.
B) humans after ingestion of excess carbohydrate.
C) humans with low carbohydrate intake.
D) plants but not in animals.
E) none of the above.

18. Glycolysis is the name given to a metabolic pathway occurring in many different cell types. It consists of 11 enzymatic steps that convert glucose to lactic acid. Glycolysis is an example of:
A) aerobic metabolism.
B) anabolic metabolism.
C) a net reductive process.
D) fermentation.
E) oxidative phosphorylation.

19. Glycogen is converted to monosaccharide units by:
A) glucokinase.
B) glucose-6-phosphatase
C) glycogen phosphorylase.
D) glycogen synthase.
E) glycogenase.

20. Malonate is a competitive inhibitor of succinate dehydrogenase. If malonate is added to a mitochondrial preparation that is oxidizing pyruvate as a substrate, which of the following compounds would you expect to decrease in concentration?
    A) Citrate
    B) Fumarate
    C) Isocitrate
    D) Pyruvate
    E) Succinate

21. Lipoprotein lipase acts in:
    A) hydrolysis of triacylglycerols of plasma lipoproteins to supply fatty acids to various tissues.
    B) intestinal uptake of dietary fat.
    C) intracellular lipid breakdown of lipoproteins.
    D) lipoprotein breakdown to supply needed amino acids.
    E) none of the above.

22. Conversion of ornithine to citrulline is a step in the synthesis of:
    A) aspartate.
    B) carnitine.
    C) pyruvate.
    D) tyrosine.
    E) urea.

23. During oxidative phosphorylation, the proton motive force that is generated by electron transport is used to:
    A) create a pore in the inner mitochondrial membrane.
    B) generate the substrates (ADP and P_i) for the ATP synthase.
    C) induce a conformational change in the ATP synthase.
    D) oxidize NADH to NAD^+.
    E) reduce O_2 to H_2O.

24. Cholesterol is synthesized from:
    A) acetyl-CoA.
    B) choline.
    C) lipoic acid.
    D) malate.
    E) oxalate.

25. Bile pigments are:
    A) formed in the degradation of heme.
    B) generated by oxidation of sterols.
    C) responsible for light reception in the vertebrate eye.
    D) secreted from the pancreas
    E) the products of purine degradation.

26. Draw the following molecular structures 劃結構式 (2.5 分/小題)
    a. glutathione
    b. arginine
    c. glucose
    d. urea

27. Define the following items 解釋名詞 (4 分/小題)
    a. nucleotide
    b. cellulose
    c. type II restriction enzymes
    d. lectin
    e. protease

28. What is the approximate length of a DNA molecule (in the B form) containing 10,000 base pairs? (5 分)

29. Proteins are constantly being synthesized in a living cell. Why doesn't the number of protein molecules become too great for the cell to contain, leading to cell destruction? (5 分)

30. Describe briefly the basic structure of an IgG protein molecule. (10 分)