

單一選擇題：25 題，每題 2 分，答錯到扣 0.5 分；簡答題：5 題，每題 10 分。

A: 單一選擇題：(務必使用電腦答案卡作答，否則不與計分)

- Which of the following is correct concerning the dissociation constant, K_d , of a drug X?
 - Larger K_d implies tighter target to drug binding.
 - The K_d corresponds to the concentration of drug that binds to 90% of the target.
 - The K_d will appear to increase in higher concentrations of the true substrate of the target.
 - The apparent K_d increases as the K_m of the true substrate increases.
 - None of the above.
- Which of the following is a powerful animal model used for drug development?
 - fruit fly models with specific genes "knocked out"
 - bovine models with specific genes "knocked out"
 - E. coli* models with specific plasmids added
 - mouse strains with specific genes "knocked out"
 - None of the above.
- Which of the following *E. coli* proteins is responsible for translocation of the mRNA as a result of a conformation change due to the hydrolysis of GTP?
 - RRF
 - EF-Tu
 - EF-G
 - Shine-Delgarno
 - None of the above.
- Which of the following components of the tRNA is (are) important for the binding specificity of the tRNA synthetase?
 - acceptor stem
 - anticodon loop
 - TΨC loop
 - a and b
 - a, b, and c
- The mechanism by which type II topoisomerase relaxes DNA includes which of the following?
 - The OH of tyr 723 attacks a phosphate group on one DNA strand.
 - When the backbone of one strand is cleaved, the DNA rotates.
 - ATP binds, leading to a conformation change.
 - a and b.
 - a, b, and c.
- The starting materials necessary to synthesize sphingosine are
 - palmitoyl CoA and serine.
 - acetyl CoA and glycine.
 - palmitoyl CoA and aspartate.
 - acetyl CoA and glutamine.
 - none of the above.

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7. Respiratory distress syndrome is caused by a failure in the biosynthetic pathway of
 - A) sphingosine.
 - B) gangliosides.
 - C) dipalmitoyl phosphatidyl choline.
 - D) cholesterol.
 - E) bile salts.
8. Chorismate is a precursor to the amino acids
 - A) tryptophan, tyrosine, and phenylalanine.
 - B) tryptophan and phenylalanine.
 - C) tyrosine and phenylalanine.
 - D) tryptophan, tyrosine, phenylalanine, and serine.
 - E) none of the above.
9. Tyrosine is a precursor to the molecule(s)
 - A) melanin.
 - B) epinephrine.
 - C) serotonin.
 - D) a and b.
 - E) a and c.
10. What types of reactions do cobalamin enzymes catalyze?
 - A) intramolecular rearrangements
 - B) methylations
 - C) reduction of ribonucleotides to deoxyribonucleotides
 - D) a and c
 - E) a, b, and c
11. How does β oxidation differ in peroxisomes?
 - A) The final product is not acetyl CoA but is succinyl CoA.
 - B) NAD^+ does not participate in the reaction.
 - C) The initial dehydrogenation reaction is different in that electrons are transferred to O_2 to yield H_2O_2 .
 - D) All of the above.
 - E) None of the above.
12. Which sugar(s) is (are) converted into ribulose 5-phosphate by a single enzymatic step?
 - A) ribose 5-phosphate
 - B) xyulose 5-phosphate
 - C) erythrose 4-phosphate
 - D) a and b
 - E) b and c

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13. What is the energy cost of the C_4 pathway?
- 30 molecules of ATP are used per hexose molecule made.
 - 18 molecules of ATP are used per hexose molecule made.
 - 30 molecules of NADPH are used per hexose molecule made.
 - 18 molecules of ATP and 12 of NADPH are used per hexose molecule made.
 - None of the above.
14. A compound is known to have a free amino group with a pK_a of 8.8, and one other ionizable group with a pK_a between 5 and 7. To 100 mL of a 0.2 M solution of this compound at pH 8.2 was added 40 mL of a solution of 0.2 M hydrochloric acid. The pH changed to 6.2. The pK_a of the second ionizable group is:
- The pH cannot be determined from this information.
 - 5.4
 - 5.6
 - 6.0
 - 6.2
15. The uncommon amino acid selenocysteine has an R group with the structure $-\text{CH}_2-\text{SeH}$ ($pK_a \approx 5$). In an aqueous solution, $\text{pH} = 7.0$, selenocysteine would:
- be a fully ionized zwitterion with no net charge.
 - be found in proteins as d-selenocysteine.
 - never be found in a protein.
 - be nonionic.
 - not be optically active.
16. What is the approximate charge difference between glutamic acid and α -ketoglutarate at pH 9.5?
- 0
 - $\frac{1}{2}$
 - 1
 - $1\frac{1}{2}$
 - 2
17. An α helix of a protein would be destabilized most by:
- an electric dipole spanning several peptide bonds throughout the α helix.
 - interactions between neighboring Asp and Arg residues.
 - interactions between two adjacent hydrophobic Val residues.
 - the presence of an Arg residue near the carboxyl terminus of the α helix.
 - the presence of two Lys residues near the amino terminus of the α helix.

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18. A monoclonal antibody differs from a polyclonal antibody in that monoclonal antibodies:
- are labeled with chemicals that can be visualized.
 - are produced by cells from the same organism that produced the antigen.
 - are synthesized by a population of identical, or "cloned," cells.
 - are synthesized only in living organisms.
 - have only a single polypeptide chain that can recognize an antigen.
19. Which of the following statements about a plot of V_0 vs. $[S]$ for an enzyme that follows Michaelis-Menten kinetics is *false*?
- As $[S]$ increases, the initial velocity of reaction V_0 also increases.
 - At very high $[S]$, the velocity curve becomes a horizontal line that intersects the y-axis at K_m .
 - K_m is the $[S]$ at which $V_0 = 1/2 V_{max}$.
 - The shape of the curve is a hyperbola.
 - The y-axis is a rate term with units of $\mu\text{m}/\text{min}$.
20. An enzyme-catalyzed reaction was carried out with the substrate concentration initially a thousand times greater than the K_m for that substrate. After 9 minutes, 1% of the substrate had been converted to product, and the amount of product formed in the reaction mixture was $12 \mu\text{mol}$. If, in a separate experiment, one-third as much enzyme and twice as much substrate had been combined, how long would it take for the same amount ($12 \mu\text{mol}$) of product to be formed?
- 1.5 min
 - 13.5 min
 - 27 min
 - 3 min
 - 6 min
21. From the abbreviated name of the compound Gal($\beta 1 \rightarrow 4$)Glc, we know that:
- C-4 of glucose is joined to C-1 of galactose by a glycosidic bond.
 - the compound is a D-enantiomer.
 - the galactose residue is at the reducing end.
 - the glucose is in its pyranose form.
 - the glucose residue is the β anomer.
22. In glycoproteins, the carbohydrate moiety is always attached through the amino acid residues:
- asparagine, serine, or threonine.
 - aspartate or glutamate.
 - glutamine or arginine.
 - glycine, alanine, or aspartate.
 - tryptophan, aspartate, or cysteine

國立清華大學 命題紙

96 學年度 生醫工程與環境科學 系(所) 甲組(分子生醫光電組) 碩士班入學考試

科目 生物化學 科目代碼 2502 共 6 頁第 5 頁 *請在【答案卷卡】內作答

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23. The biochemical property of lectins that is the basis for most of their biological effects is their ability to bind to:
- A) amphipathic molecules.
 - B) hydrophobic molecules.
 - C) specific lipids.
 - D) specific oligosaccharides.
 - E) specific peptides.
24. 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')
25. Which of the following does *not* apply to the construction or use of a DNA library?
- A) Determining the location of a particular DNA sequence in a DNA library requires a suitable hybridization probe.
 - B) Genomic libraries are better for expressing gene products than cDNA libraries.
 - C) Many segments of DNA from a cellular genome are cloned.
 - D) Specialized DNA libraries can be made by cloning DNA copies of mRNAs.
 - E) The DNA copies of mRNA found in a cDNA library are made by reverse transcriptase.

國立清華大學 生命題紙

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B: 簡答題:

1. What chemical features distinguish a plasmalogen from a common glycerophospholipid?
2. Reagents A and B both react covalently with primary amino groups such as those of phosphatidylethanolamine. Reagent A permeates erythrocytes, but reagent B is impermeant. Both A and B are available in radioisotopically labeled form. Describe a simple experiment by which you might determine whether the phosphatidylethanolamine of erythrocyte membranes is located in the outside face of the lipid bilayer, the inside face, or in both. Be brief and use diagrams to support your answer.
3. Explain how amplification occurs in signal transductions, with examples from two of these systems: the β -adrenergic receptor, the insulin receptor, or the vasopressin system via inositol-1,4,5-trisphosphate (IP_3).
4. What is the theory for how palindromic RNA polymerase transcription termination signals function?
5. Show how the metabolism of the liver with skeletal muscle is interconnected by blood glucose and alanine during strenuous exercise.