

系所組別： 口腔醫學研究所甲組

考試科目： 生物化學

考試日期：0226 · 節次：2

一、選擇題，每題 3 分，共 60 分，所有考題務必在答案卷上作答。

- The GAL4 protein activates transcription from the GAL1 promoter in yeast. To bind to DNA, the protein utilizes a
 - heme group
 - signal peptide
 - transcriptional-activating domain
 - zinc-finger domain
 - transmembrane segment
- Consider the average in vivo turnover rates for proteins, DNA, and mRNA. Which of the following orders best describes the turnover rate from fastest (shortest average lifetime) to slowest (longest average lifetime)?
 - mRNA > DNA > proteins
 - mRNA > proteins > DNA
 - Proteins > mRNA > DNA
 - Proteins > DNA > mRNA
 - DNA > mRNA > proteins
- The units of the molar extinction coefficient are
 - $L \cdot \text{mole}^{-1} \cdot \text{cm}^{-1}$
 - $L \cdot \text{mole} \cdot \text{cm}^{-1}$
 - $\text{mole}^{-1} \cdot \text{cm}^{-1}$
 - $L^{-1} \cdot \text{mole}^{-1} \cdot \text{cm}^{-1}$
- Which of the following events occurs first as a result of EGF binding to its receptor?
 - Activation of a serine/threonine kinase
 - Activation of a tyrosine phosphatase
 - Activation of a tyrosine kinase
 - Activation of a phospholipase
 - Activation of a GTPase
- Which of the following statements is true regarding the polysaccharides starch, glycogen, cellulose, and chitin?
 - All have $\alpha 1 \rightarrow 4$ linkages.
 - Starch is built from a different monomer than are the others.
 - Only chitin has a core protein.
 - Each is built from a single type of monomer.
 - Chitin and cellulose differ from each other only in the extent of their branching.
- Which of the following mRNA molecules would form the most stable stem-loop structure?
 - 5'...CCGAA.....AAGCC...3'
 - 5'...CCGAA.....AACGG...3'
 - 5'...CCGAA.....GGCUU...3'
 - 5'...CCGAA.....CCGAA...3'
 - 5'...CCGAA.....UUCGG...3'

(背面仍有題目,請繼續作答)

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7. The first metabolic intermediate that is common to the aerobic metabolism of glucose and fatty acids is
- A) acetyl CoA
 - B) pyruvate
 - C) citrate
 - D) beta-hydroxybutyrate
 - E) glyceraldehyde 3-phosphate
8. Two protein sequences are compared by BLAST and produce an e value of e^{-100} . This e value most likely signifies which of the following about the genes encoding these two proteins?
- A) They function in the same tissue.
 - B) They have unrelated functions.
 - C) They are descended from a common ancestor.
 - D) They are derived from related species.
 - E) They encode proteins that form a dimeric complex.
9. In an operon regulated only by attenuation, a mutation causing oversynthesis of the gene products is most likely to be in the part of the DNA corresponding to the
- A) operator
 - B) 5' terminal sequence of the RNA
 - C) 3' terminal sequence of the RNA
 - D) introns of the RNA
 - E) coding sequence for the *trans* activator
10. Which amino acid would interact with fatty acid tails on the membrane exposed face of an integral membrane protein?
- A) Leucine
 - B) Histidine
 - C) Tyrosine
 - D) Glutamic acid
 - E) Lysine
11. Which amino acid whose R group bearing a positive charge at pH 9?
- A) Leucine
 - B) Histidine
 - C) Tyrosine
 - D) Glutamic acid
 - E) Lysine
12. Two membranes have identical composition of phospholipid, but one contains cholesterol and the other does not. If the T_m of the membrane without cholesterol is 20°C , then which membrane would you expect to be more fluid at 37°C or 10°C ?
- A) The two membranes would exhibit some degree of fluidity.
 - B) At 37°C , the membrane without cholesterol will be more fluid
 - C) Both at 37°C and 10°C , the membrane without cholesterol will be more fluid
 - D) At 37°C , the membrane with cholesterol will be more fluid
 - E) Both at 37°C and 10°C , the membrane with cholesterol will be more fluid

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13. A new drug to treat ulcers of the stomach has a critical amino group and a carboxyl group with pKa values of ~9 and ~4. In order to be active, both groups need to be in their acid form. Would this drug likely be effective if given orally? (The typical pH of the stomach is ~2.)
- A) Yes, both groups will be in acid form.
 - B) No, only the amino group will be in acid form.
 - C) No, only the carboxyl group will be in acid form.
 - D) No, both groups will be in the conjugate base form.
 - E) Yes, both groups will be in the conjugate base form.
14. The three-dimensional structure of an enzyme in complex with its substrate was determined by X-ray crystallography. The structure revealed that a methionine residue in the active site of the enzyme is in close proximity to an isoleucine residue on a substrate. Which of the following would be the predominant interaction between these two amino acids?
- A) covalent bond
 - B) disulfide bond
 - C) hydrogen bond
 - D) ionic interaction
 - E) hydrophobic interaction
15. The amino acid sequence of an enzyme was determined to have a genetic mutation resulting in the amino acid change cysteine → proline. The active site of this enzyme contains a zinc cofactor and can bind an inhibitor to inhibit its activity. Of the following options, what is the most likely effect of the mutation?
- A) The enzyme will no longer bind its cofactor.
 - B) The mutant amino acid will directly interfere with catalysis.
 - C) The mutant amino acid is too far away to have any effect on the active site.
 - D) The mutant amino acid will alter interactions affecting the overall 3D enzyme structure.
 - E) The mutant amino acid will change the substrate specificity of the enzyme.
16. The cancer cell's increased dependence on glycolysis for its energy needs also implies that which of the following statements must also be true in a cancer cell?
- A) Phosphofructokinase 2 will be active
 - B) Phosphoenolpyruvate carboxykinase will be active
 - C) Glucose 6-phosphatase will be active
 - D) Fructose 2,6-bisphosphate will be low in the cancer cell
 - E) Pyruvate will be turned into oxaloacetate in the matrix of the mitochondria
17. Lipitor (a statin drug) inhibits the enzyme HMG-CoA Reductase in the pathway of cholesterol biosynthesis via competitive inhibition. Normal kinetic parameters for this enzyme with HMG-CoA (without the drug) are: $K_m = 2.5 \mu\text{M}$ and $V_{max} = 130 \text{ pmol min}^{-1}$. Which of the following shows the expected changes in the kinetic parameters for HMG-CoA in the presence of the drug?
- | <u>K_m</u> | <u>V_{max}</u> |
|-------------------------|-----------------------------|
|-------------------------|-----------------------------|

(背面仍有題目,請繼續作答)

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18. Asparaginase is used to reduce the level of asparagine in the blood in one treatment for leukemia. Which isoform of asparaginase would be most useful if the patient's blood asparagine level is 0.2mM?

	<u>K_m</u>	<u>V_{max}</u>
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- | | | |
|----|--------|----------|
| A) | 0.1mM; | 0.1mM/hr |
| B) | 0.1mM; | 0.5mM/hr |
| C) | 0.2mM; | 0.1mM/hr |
| D) | 0.2mM; | 0.5mM/hr |
| E) | 0.5mM; | 0.5mM/hr |

19. Linda must use a mixture of insulin analogs to maintain her blood glucose due to the lack of production of insulin by her pancreas. Which of the following statements correctly describes native human insulin?

- A) Insulin is released from α -cells of the pancreas.
- B) Insulin binds to G-protein coupled receptors.
- C) Insulin stimulates phosphorylation of many key regulatory enzymes in metabolism.
- D) Insulin is activated by cleavage of the C-peptide from proinsulin.
- E) Insulin is an eicosanoid hormone.

20. Which one of Linda's liver enzyme activities decreases when she is treated with insulin?

- A) Fructose 1,6-bisphosphatase
- B) Pyruvate kinase
- C) Pyruvate dehydrogenase complex
- D) Phosphofructokinase 1 (PFK1)
- E) Glucokinase

二、回答下列問題，每題 10 分，共 40 分所有考題務必在答案卷上作答。

1. Describe the basic principles how it is possible to identify proteins by mass spectrometry.
2. Two DNA samples (X and Y) were isolated from two different species. Both DNA samples are found to be the same size. The G+C/A+T ratio of X-DNA sample and Y-DNA sample is 2.0 and 2.5 respectively. Which sample contains smaller number of H bonds between strands? Which DNA sample would be easier to denature?
3. What gene is unique to retroviruses? Why is the protein encoded by this gene absolutely necessary for maintaining the retroviral life cycle, but not that of other viruses? This protein plays essential roles in molecular cloning. What is the application?
4. Briefly describe the following terms.
 - a. MicroRNA
 - b. Phage display