【單選題】每題 2 分 (Single choice questions: 2% for each question)，共 40 分

※ 注意：請於試卷內之「選擇題作答區」依序作答。

1. 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 salt ion concentration and pH conditions.
   (C) The larger the K_a (association constant), the weaker the affinity.
   (D) The larger the K_a, the smaller the K_d (dissociation constant).
   (E) The larger the K_a, the faster the binding efficiency.

2. Which of the following is ***not*** correct concerning 2,3-bisphosphoglycerate (BPG)?
   (A) It increases the affinity of hemoglobin for oxygen.
   (B) It binds with lower affinity to fetal hemoglobin than to adult hemoglobin.
   (C) It binds at a distance from the heme groups of hemoglobin.
   (D) It is an allosteric modulator.
   (E) It is normally found associated with the hemoglobin extracted from red blood cells.

3. The amino acids contain two chiral carbons.
   (A) Serine, Threonine
   (B) Leucine, Isoleucine
   (C) Tyrosine, Phenylalanine
   (D) Threonine, Isoleucine
   (E) Methionine, Cysteine

4. If Mr. Pi carried out site-directed mutagenesis of subtilisin, changing serine 221 to leucine, what would he expect the change of kinetic parameters?
   (A) a large change in K_m and a large change in k_{cat}
   (B) a large change in K_m and a small change in k_{cat}
   (C) a small change in K_m and a large change in k_{cat}
   (D) a small change in K_m and a small change in k_{cat}
   (E) a small change in k_{cat} and a small change in k_{cat}/K_m

5. Changes in ATCase conformation were determined by co-crystallizing the enzyme with N-(phosphonacetyl)-L-aspartate (PALA). What is PALA?
   (A) a radioactive tag that binds to the subunits
   (B) a fluorescent substrate analog
   (C) a cofactor of ATCase
   (D) a sugar analog of aspartame
   (E) a bisubstrate analog that resembles the catalytic transition-state intermediate

6. Enzyme Q exhibits maximum activity at pH = 6.9. Enzyme Q performs a sharp decrease in its activity when the pH goes much lower than 6.4. One likely interpretation of this pH-dependent activity is that:
   (A) the enzyme is found in gastric secretions.
   (B) a histidine residue on the enzyme is involved in the reaction.
   (C) a glycine residue on the enzyme is involved in the reaction.
   (D) a glutamate residue on the enzyme is involved in the reaction.
   (E) the enzyme has a metallic cofactor.

7. The first four bases of the eight-base recognition cleavage site of *Not*I are GCGG. What is the complete sequence of this eight bp site?
   (A) GCGGGCGG
   (B) GCGGCGCC
   (C) GCGGCCGC
   (D) CGCCGCGG
   (E) CGCCCGCC

8. Genes can be inserted into eukaryotic cells by

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(A) a gene gun device
(B) chemical treatment
(C) microinjection
(D) viruses
(E) all of the above

9. What is the advantage of adding SDS to gel electrophoresis?
(A) SDS allows proteins to be stained by Coomassie Brilliant Blue.
(B) SDS reduces disulfide bonds.
(C) SDS allows proteins to be separated on the basis of approximate mass.
(D) SDS allows protein to remain native while heating at 100 degree.
(E) All of the above.

10. Inhibitors against which viral enzyme have potential as anti-influenza agents.
(A) Neuramidase
(B) Tetrahydrofolate reductase
(C) Phosphoribosyl pyrophosphate
(D) Phage T4 ligase
(E) Ribonuclease H

11. Examples of second messengers that relay signals received at receptors on the cell surface include
(A) calcium ions
(B) inositol trisphosphate (IP3) and diacylglycerol (DAG)
(C) cyclic nucleotides (e.g., cAMP and cGMP)
(D) a, b & c
(E) a & c

12. The reduced form of flavin adenine dinucleotide is
(A) FADH
(B) $FADH_2$
(C) FADH++
(D) FAD+
(E) NADH

13. What is the additional metabolite that is required for the conversion of 3-phosphoglycerate to 2-phosphoglycerate in the glycolysis pathway?
(A) 2,3-bisphosphoglycerate
(B) 1,3-bisphosphoglycerate
(C) Phosphoenolpyruvate
(D) Glyceraldehyde-3-phosphate
(E) Pyruvate

14. Fructose can enter glycolysis at two distinct points, depending on the tissue. How is fructose metabolized in live and in adipose tissue, respectively?
(A) Fructose is converted to fructose-1,6-phosphate in liver.
(B) Fructose is converted to fructose-6-phosphate in adipose tissue.
(C) Fructose is converted to glucose to enter the pathway in liver.
(D) Fructose is converted to glucose-6-phosphate to enter the pathway in adipose tissue.
(E) All of the above

15. Which enzyme is responsible for catalyzing the following reaction?
Pyruvate + CoA + NAD^+ → acetyl CoA + NADH + H^+ + CO_2
(A) Acetyl CoA synthetase
(B) Pyruvate decarboxylase
(C) Acetyl CoA synthase
(D) Pyruvate dehydrogenase complex
(E) a & d

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16. In which reaction is NADH directly formed in the citric acid cycle?
(A) Conversion of succinyl CoA to succinate
(B) Conversion of succinate to fumarate
(C) Decarboxylation of alpha-ketoglutarate to form succinyl CoA
(D) Conversion of oxaloacetate to citrate
(E) All of the above

17. Why is the T state of glycogen phosphorylase (GP) less active?
(A) The T state of GP has greater affinity for glycogen
(B) ATP cannot be bound by the T state.
(C) The T state of GP cannot be phosphorylated, and thus its catalytic activity cannot be induced.
(D) The T state of GP is a monomer.
(E) The active site is partially blocked.

18. The beta-oxidation of palmitoyl-CoA (C-16:0) yields
(A) 8 Acetyl-CoA + 7 $FADH_2$ + 7 NADH + 7 H^+.
(B) 8 Acetyl-CoA + 8 $FADH_2$ + 8 NADH + 8 H+.
(C) 7 Acetyl-CoA + 6 $FADH_2$ + 6 NADH + 6 H+.
(D) 16 Acetyl-CoA + 8 $FADH_2$ + 8 NADH + 16 H+.
(E) 8 Acetyl-CoA + 7 FAD + 7 NAD^+.

19. In the urea cycle, the second nitrogen of urea enters the cycle in the form of which of the following metabolites?
(A) Glutamine
(B) Asparagine
(C) Citrulline
(D) Arginine
(E) Aspartate

20. Which amino acid is added to indole to form tryptophan?
(A) Glycine
(B) Serine
(C) Alanine
(D) Tyrosine
(E) Phenylalanine

【簡答題】每題 6 分 (Short-Answer Questions: 6% for each question)，共 30 分

21. Please draw a tetrapeptide composed of Lysine-Methionine-Aspartate-Leucine (K-M-D-L).

22. What is the approximate pI of Leu-Pro-Gly-Glu-Ala-Arg-Ile-His-Ala. (pK_2 of Leu = 9.6, pK_R of Glu = 4.25, pK_R of Arg = 12.48, pK_R of His = 6.0, pK_1 of Ala = 2.34)? What is the net charge of the peptide at pH 3.2?

23. Please briefly list four important features of a plasmid/vector which is suitable for genetic engineering.

24. Where are enhancer sequences found in the gene? What is the difference between enhancer and inducer?

25. What is microRNA (miRNA) and how it functions? What the major role do miRNAs play in cells?

【詳答題】每題 10 分 (Short-Answer Questions: 10% for each question)，共 30 分

26. Please list all the possible chromatographic methodologies that can be applied in protein purification?

27. What are the main biological functions of the polysaccharide?

28. What are similarities and differences between the transcription process and the replication processes?

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