

I. 單選題 (共 50 分)

- (2%) A buffer contains 0.01 mole of lactic acid ($pK_a = 3.86$) and 0.05 mole of sodium lactate per liter. What is the pH of the buffer?
(A) 4.6 (B) 5.8 (C) 7.4 (D) 9.6 (E) 12.97
- (2%) Which of following amino acid cannot be converted to pyruvate during catabolism?
(A) Glycine (B) Serine (C) Tryptophan (D) Threonine (E) Leucine
- (2%) *Submaxillarius* protease (mouse submaxillary gland) can cleave polypeptides at specific point of _____.
(A) Glutamic acid (B) Aspartic acid (C) Tyrosine (D) Arginine (E) None of above
- (2%) What is the most abundant class of immunoglobulin?
(A) IgA (B) IgG (C) IgD (D) IgE (E) IgM
- (2%) In the first stage of protein biosynthesis, activation of amino acids is performed by enzymes of _____.
(A) N-formylmethionyl-tRNA^{Met}
(B) Peptidyl transferase
(C) Ornithine transcarbamoylase
(D) Aminoacyl-tRNA synthetases
(E) N-acetylglutamate synthase
- (2%) Which of the following description about the function of enzyme used in recombination DNA technology is correct?
(A) Alkaline phosphatase removes nucleotides from the 5' ends of a duplex to expose single-stranded 3' ends.
(B) Polynucleotide kinase adds a phosphate to the 5'-OH end of a polynucleotide to label it or permit ligation.
(C) Terminal transferase makes a DNA copy of an RNA molecule.
(D) Exonuclease III adds homopolymer tails to the 3'-OH ends of a linear duplex.
(E) Type II restriction endonucleases joins two DNA molecules or fragments.
- (2%) Which class of enzyme functions to catalyze the reaction of "addition of groups to double bonds"?
(A) Isomerases (B) Transferases (C) Ligases (D) Lyases (E) Oxidoreductases
- (2%) Please order the following procedures for the cholesterol biosynthesis in animals.
 - Activation of isoprene units
 - Formation of four rings of the steroid nucleus
 - Condensation of acetate units to form mevalonate
 - Formation the 30-carbon linear squalene

(A) III \rightarrow II \rightarrow IV \rightarrow I
(B) II \rightarrow III \rightarrow I \rightarrow IV
(C) III \rightarrow I \rightarrow IV \rightarrow II
(D) I \rightarrow II \rightarrow III \rightarrow IV
(E) IV \rightarrow II \rightarrow I \rightarrow III

參考用

注意：背面有試題

9. (2%) Which of following description regarding the DNA replication is correct?
(A) DNA replication occurs with very high fidelity and at a designated time in the cell cycle.
(B) DNA replication is carried out in three phases: initiation, elongation, and termination.
(C) The DNA replication starts at a single origin in bacteria and usually proceeds bi-directionally.
(D) DNA is synthesized in the 5' → 3' direction by DNA polymerases.
(E) All of the above.
10. (2%) Please calculate the K_i for a noncompetitive inhibitor if 2×10^{-4} M [I] yields 75% inhibition of an enzyme-catalyzed reaction?
(A) 1.86×10^{-5} M (B) 3.46×10^{-4} M (C) 7.62×10^{-4} M (D) 6.66×10^{-5} M (E) 9.45×10^{-5} M
11. (2%) Decoding of the nucleotide sequence in mRNA into the amino acid sequence of proteins depends on _____?
(A) tRNAs & Aminoacyl-tRNA synthetases
(B) rRNAs & Aminoacyl-tRNA synthetases
(C) Aminoacyl-tRNA synthetases
(D) tRNAs
(E) rRNAs
12. (2%) At the *wobble* position, a given base "A (Adenine)" in mRNA can base-pair with _____ in tRNA?
(A) U
(B) U, C
(C) U, I
(D) C, U, I
(E) C, I
13. (2%) Which of the following description regarding the nucleic acid is correct?
(A) Messenger RNA transfers genetic information from DNA to ribosomes for protein synthesis.
(B) Single RNA strands can fold into hairpins, double stranded regions, or complex loops.
(C) The primary purines are adenine and guanine in both DNA and RNA.
(D) DNA strands with appropriate sequences can form hairpin/cruciform structures or tetraplex DNA.
(E) All of the above.
14. (2%) Which of the following combination regarding the biological lipid and its example is NOT correct?
(A) Fatty acids / Oleate
(B) Glycerolipids / Triacylglycerol
(C) Sphingolipids / Palmitoylcarnitine
(D) Saccharolipids / Lipopolysaccharide
(E) Prenol lipids / Retinol

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■ For questions # 15 & 16:

The K_a of a weak acid HA is 3×10^{-4} , please calculate:

15. (2%) The OH^- ion concentration in the solution?
 (A) 3.85×10^{-12} (B) 1.49×10^{-12} (C) 7.83×10^{-12} (D) 4.47×10^{-12} (E) 9.55×10^{-12}
16. (2%) The degree of dissociation of the acid in a 0.15 M solution?
 (A) 4.46 (B) 6.21 (C) 8.92 (D) 12.42 (E) 13.38 %
17. (2%) Which of the following codons may serve as the start codon / initiator?
 I. UUG
 II. AUG
 III. GUG
 IV. UAA
 V. UGA
 VI. CUG
 (A) I, III, V (B) III, IV, VI (C) II, III, VI (D) II, IV, VI (E) I, IV, V

■ For questions # 18 - 22:

- I. Arginine
 II. Cysteine
 III. Glycine
 IV. Lysine
 V. Methionine
 VI. Asparagine
18. (2%) Which of the following combination where the amino acids are all positively charged?
 (A) I, II, III (B) I, IV (C) I, V, VI (D) I, III (E) I, VI
19. (2%) Which of the following combination where the amino acids are all hydrophobic?
 (A) I, II (B) II, VI (C) III, VI (D) I, IV (E) None of above
20. (2%) How many amino acid(s) is/are polar with uncharged R group?
 (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
21. (2%) Which of the following combination where the amino acids all contain aromatic residue(s)?
 (A) II, III (B) I, IV, V (C) II, III, VI (D) IV, V (E) None of above
22. (2%) How many amino acid(s) contain(s) sulfur atom?
 (A) 0 (B) 1 (C) 2 (D) 3 (E) 4

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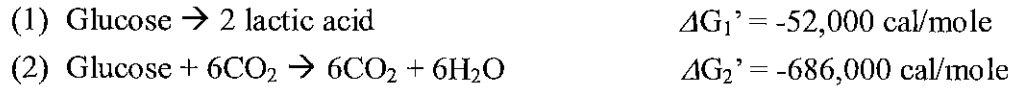
23. (2%) The double helix structure of DNA is mainly stabilized by?
- (A) Electrostatic interactions
 - (B) Hydrophobic interactions
 - (C) Ionic bonds
 - (D) Hydrogen bonds
 - (E) Phosphodiester bonds
24. (2%) Which of the following description about ATP reaction is NOT correct?
- (A) The exergonic conversion of ATP to ADP or to AMP is coupled to many endergonic reactions and processes.
 - (B) Hydrolysis of ATP provides energy for bioprocess including translocation of RNA polymerase and ribosome movement.
 - (C) To maintain its high group transfer potential, ATP concentration must be held far above the equilibrium concentration by energy-yielding reactions of catabolism.
 - (D) ATP provides the energy for anabolic reactions, including the synthesis of information macromolecules, transfer of molecules across membranes against concentration and/or electrical potential gradients.
 - (E) ATP is the chemical link between catabolism and anabolism.
25. (2%) Which of the following description regarding the Glycolysis is NOT correct?
- (A) Glycolysis is a near-universal pathway by which a glucose molecule is oxidized to three molecules of pyruvate with energy conserved as ATP and NADH.
 - (B) Glycolysis is tightly regulated in coordination with other energy-yielding pathways to assure a steady supply of ATP.
 - (C) The aim of the Preparatory phase is phosphorylation of glucose and its conversion to glyceraldehyde 3-phosphate.
 - (D) The aim of the Payoff phase is oxidative conversion of glyceraldehyde 3-phosphate to pyruvate and the coupled formation of ATP and NADH.
 - (E) All 10 glycolytic enzymes are in the cytosol, and all 10 intermediates are phosphorylated compounds of three or six carbons.

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II. 計算題 (共 50 分)

1. (a) Please calculate the $\Delta G'$ for the complete oxidation of lactic acid to CO_2 and H_2O through the given hint information below. (10%) (b) How many moles of ATP could be synthesized in the process at 40% efficiency? (5%)

<Hint>



參考用

2. Ten grams of butter were saponified; the nonsaponifiable fraction was extracted into 25 mL of chloroform. The absorbance of the chloroform solution in a 1 cm cuvette was 0.53 at 328nm and 0.48 at 458 nm. Please calculated the carotene and vitamin A content of the butter? The extinction coefficients for carotene and vitamin A at the above two wavelengths are given below. (15%)

Compound	$a^{1\text{cm}}_{1\%}$ in CHCl_3	
	328 nm	458 nm
Carotene	340	2200
Vitamin A	1550	~ 0

3. The follow data were recorded for the enzyme-catalyzed reaction $\text{S} \rightarrow \text{P}$.

[S] (M)	v (nmoles \times liter $^{-1}\times$ min $^{-1}$)
6.25×10^{-6}	15.0
7.50×10^{-5}	56.25
1.00×10^{-4}	60
1.00×10^{-3}	74.9
1.00×10^{-2}	75

- (a) Please estimate V_{max} (3%) and the K_m (Michaelis constant) (3%)
 (b) What would v be at $[\text{S}] = 2.5 \times 10^{-5}$ M? (4%)
 (c) What would v be at $[\text{S}] = 5.0 \times 10^{-5}$ M if the enzyme concentration was doubled? (10%)

