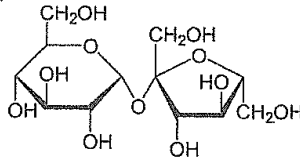


※ 注意：請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

單選題 共 50 題 (A) (B) (C) (D) (E) 5 選 1 答錯不倒扣
第 1 至 25 題 每題 1.5 分 第 26 至 50 題 每題 2.5 分

1. What type of glycosidic linkage does a sucrose molecule (as shown below) have?



- (A) β -1,3 (B) β -1,2 (C) α -1,3 (D) α -1,2 (E) α -1,4

2. Which of the following method can be used to determine protein concentration without a protein reference?
- (A) BCA (B) Beer-Lambert law (C) SDS-PAGE
(D) Bradford assay (E) Western blotting
3. An enzyme's specificity can be due to:
- (A) the ratio of catalyzed rate to the uncatalyzed rate of reaction.
(B) metabolic modulators.
(C) molecular recognition based on structural complementarity.
(D) amount of substrate available.
(E) amount of enzyme produced by the cell.
4. The dehydrogenase enzymes facilitate the direct transfer of hydride anion. Which of the following coenzymes is required for this transfer?
- (A) biotin (B) folic acid (C) lipoic acid (D) TPP (E) NAD^+
5. Which statement below about contrasting Hb and Mb is **false**?
- (A) Hb shows sigmoidal, whereas Mb shows hyperbolic oxygen saturation curves.
(B) Hb shows cooperativity, whereas Mb does not.
(C) Mb binds O_2 more tightly than Hb.
(D) Oxygen binds to a ferrous ion in both proteins.
(E) Mb-oxygen binding is dependent on physiological changes in pH, whereas Hb-oxygen binding is not.
6. In the conversion of glucose to pyruvate, how many of the actual steps involve electron transfer?
- (A) 1 (B) 2 (C) 3 (D) 4 (E) None

見背面

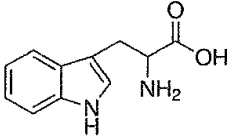
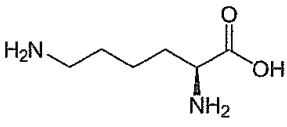
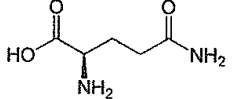
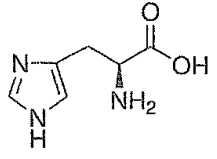
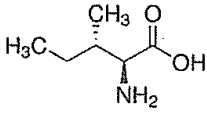
7. Which of the following statements regarding citric acid cycle is **false**?
- (A) The immediate electron acceptor for the majority of the oxidative reactions of the citric acid cycle is coenzyme A.
 - (B) Isocitrate dehydrogenase and the α -ketoglutarate dehydrogenase complex catalyze oxidative decarboxylation reactions in the citric acid cycle.
 - (C) Pantothenic acid is used by the pyruvate dehydrogenase complex as a cofactor during oxidative decarboxylation.
 - (D) Succinate dehydrogenase is the only membrane-bound enzyme in the citric acid cycle.
 - (E) None is false.
8. Which of the following statements about glycogen metabolism is **correct**?
- 1. Glycogen is mainly found in liver and muscle.
 - 2. The average chain length of the branches in glycogen is 25 glucose residues.
 - 3. Glycogen phosphorylase cleaves the $\alpha(1\rightarrow6)$ bonds in glycogen.
 - 4. Glycogen phosphorylase responds differently to allosteric effectors in its phosphorylated and dephosphorylated forms.
- (A) 1, 2 and 3 are correct. (B) 1, 3 and 4 are correct. (C) 2 and 3 are correct.
(D) 1 and 4 are correct. (E) All are correct.
9. In the citric acid cycle there are eight reactions steps. Which of the following enzymes catalyzes the release of carbon dioxide?
- (A) Malate dehydrogenase (B) Citrate synthase (C) Aconitase
(D) Isocitrate dehydrogenase (E) Succinyl-CoA synthetase
10. Cofactors usually play an important role in enzyme catalysis. Which enzyme requires lipoic acid as a coenzyme?
- (A) Isocitrate dehydrogenase (B) Malate dehydrogenase (C) Succinyl-CoA synthetase
(D) Succinate dehydrogenase (E) Aconitase
11. Compounds that generate nitrous acid (such as nitrites, nitrates, and nitrosamines) change DNA molecules by:
- (A) breakage of phosphodiester bonds. (B) deamination of bases. (C) depurination.
(D) formation of thymine dimers. (E) transformation of A \rightarrow T.
12. Which of the following is **not** used as a heterologous host for the expression of recombinant proteins?
- (A) Retroviruses (B) Bacteria such as *E. coli* (C) Eukaryotes such as *S. cerevisiae*
(D) Insect cells (E) Mammalian cells

13. Lipoate is one of the cofactors of the pyruvate dehydrogenase complex. It can undergo reversible oxidation with its two:
(A) thiol groups. (B) amino groups. (C) hydroxyl groups.
(D) amide groups. (E) carboxyl groups.
14. Mammals produce heat by using the endogenous uncoupling agent:
(A) the small molecule 2-4-dinitrophenol synthesized by the cell.
(B) the protein thermogenin.
(C) the protein thioredoxin.
(D) the protein cytochrome *c*.
(E) a modified form of the F_0F_1 ATPase.
15. Serine can be converted directly into pyruvate. The reaction, catalyzed by serine dehydratase, requires the coenzyme:
(A) pyridoxal phosphate (PLP). (B) biotin. (C) B_{12} .
(D) tetrahydrofolate. (E) nicotinamide adenine dinucleotide (NAD).
16. The enzyme involved in the synthesis of asparagine from aspartate is a(n):
(A) aspartate aminotransferase. (B) glutamine amidotransferase.
(C) glutamate dehydrogenase. (D) decarboxylase. (E) hydroxylase.
17. Hexokinase and glucokinase belong to the kinase subclass of what class of enzymes?
(A) Oxidoreductase (B) Isomerase (C) Transferase (D) Hydrolase (E) Lyase
18. Which of the following molecules is **least likely** to be transported across the inner mitochondrial membrane?
(A) Citrate (B) NADH (C) Pyruvate (D) Phosphate (E) Malate
19. Which of the following statements about hydropathy plot is **false**?
(A) A hydropathy plot for a protein is a graphical representation of the average "hydropathy" values of contiguous groups of amino acid R-groups in a protein.
(B) A hydropathy plot can be used to deduce the quaternary structure of a membrane protein.
(C) Integral membrane proteins usually contain one or more regions with a high hydropathy index.
(D) A hydropathy plot can be used to predict whether a given protein sequence contains membrane-spanning segments.
(E) It is possible to get hydrophobic areas for proteins that are not membrane associated in a hydropathy plot, as water soluble proteins have hydrophobic interiors.

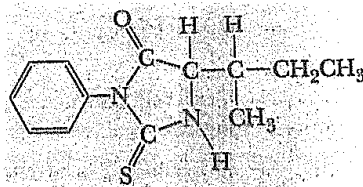
20. Which statement is **correct**?
- (A) The leading site of synthesis ketone bodies is kidney mitochondria.
 - (B) Synthesis of ketone bodies occurs in the cytosol.
 - (C) The ketones bodies can be an energy source for the brain.
 - (D) The ketone bodies include acetic acid.
 - (E) All of the above.
21. There are differences between lipid catabolism and anabolism in biology. Which statement is **correct**?
- (A) Anabolism occurs in the cytosol, catabolism in mitochondria.
 - (B) Anabolism uses NADH/NAD⁺; catabolism uses NADPH/NADP⁺.
 - (C) Anabolism requires CoA; catabolism requires acyl carrier protein.
 - (D) Anabolism and catabolism require no enzyme.
 - (E) All of the above.
22. To metabolize a fatty acid, what is the necessary step to activate it?
- (A) To form a thioester bond with coenzyme A.
 - (B) To form a glycosidic bond with coenzyme B.
 - (C) To form an ester bond with coenzyme A.
 - (D) To form a phosphodiester bond with coenzyme B.
 - (E) It requires no activation.
23. In higher plants, nitrite reductase is in ____.
- (A) nucleus
 - (B) cytoplasm
 - (C) chloroplast
 - (D) mitochondria
 - (E) endoplasmic reticulum
24. Urea cycle is used for the synthesis of ____.
- (A) lysine
 - (B) arginine
 - (C) tryptophan
 - (D) phenylalanine
 - (E) purine
25. Asparaginase, catalyzing the conversion asparagine to aspartic acid, is used to treat childhood leukemia acute lymphoblastic leukemia (ALL), acute myeloid leukemia (AML), and non-Hodgkin's lymphoma because:
- (A) asparagine is an essential amino acid.
 - (B) lymphocyte cannot synthesize asparagine.
 - (C) asparaginase is toxic to all rapidly dividing cells
 - (D) asparaginase in lymphocytes generates reactive oxygen species.
 - (E) None of the above descriptions is correct.

第 26 至 50 題 每題 2.5 分

Use the five amino acids labelled as a~e in the table below to answer the questions 26~28.

a	b	c
		
d	e	
		

26. Which amino acid in the above table can be post-translationally glycosylated?
 (A) Amino acid a (B) Amino acid b (C) Amino acid c
 (D) Amino acid d (E) Amino acid e
27. Which amino acid in the above table strongly absorbs UV at 280 nm?
 (A) Amino acid a (B) Amino acid b (C) Amino acid c
 (D) Amino acid d (E) Amino acid e
28. Which amino acid in the above table is frequently used as a general base to help catalyze protease activities?
 (A) Amino acid a (B) Amino acid b (C) Amino acid c
 (D) Amino acid d (E) Amino acid e
29. Edman degradation of a polypeptide yielded a chemical structure as follows. What kind of amino acid is located at the N-terminus of this polypeptide?



- (A) Cys (B) Phe (C) Ile (D) Leu (E) Tyr

見背面

30. Protein A has an isoelectric point of 9.2 and protein B has an isoelectric point of 4.0. To keep a stable heterodimeric complex A/B in solution, which experimental condition in the following is more favorable?
- (A) 100 mM glycine (pH 9.0)
 (B) 50 mM sodium phosphate (pH 6.5), 500 mM sodium chloride
 (C) 100 mM glycine (pH 3.0)
 (D) 20 mM Tris-HCl (pH 8.0), 0.1 % SDS
 (E) 50 mM sodium phosphate (pH 6.5)

31. The following data were obtained in a study of an enzyme known to follow Michaelis-Menten kinetics:

V_0 ($\mu\text{mol}/\text{min}$)	Substrate added (mmol/L)
217	0.8
325	2
433	4
488	6
647	1,000

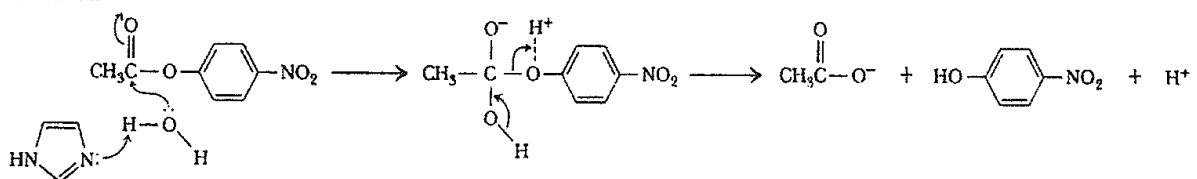
The K_m for this enzyme is approximately:

- (A) 1 mM. (B) 2 mM. (C) 1,000 mM. (D) 4 mM. (E) 6 mM.
32. Carbonic anhydrase has two substrates, carbon dioxide and bicarbonate, which are both converted to carbonic acid. Kinetic data for each is given below. While determining the kinetics of HCO_3^- as a substrate, how would the addition of CO_2 effect the reaction if the rate were measured by the disappearance of bicarbonate?

Substrate	K_m (mM)	K_{cat} (sec^{-1})	K_{cat}/K_m ($\text{mM}^{-1}\text{sec}^{-1}$)
CO_2	12	1×10^6	8.3×10^4
HCO_3^-	26	4×10^5	1.5×10^4

- (A) CO_2 would increase the activity of the enzyme.
 (B) CO_2 would cause an apparent decrease in the K_m for HCO_3^- .
 (C) CO_2 would act as a competitive inhibitor.
 (D) CO_2 would act as a noncompetitive inhibitor.
 (E) CO_2 would act as an uncompetitive inhibitor.
33. The catalytic mechanism below is an example of:

Mechanism



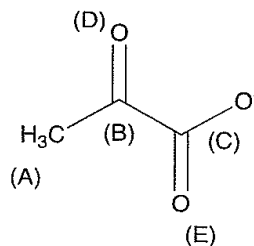
- (A) covalent nucleophilic catalysis. (B) covalent electrophilic catalysis.
 (C) specific base catalysis. (D) general base catalysis. (E) low barrier hydrogen bond catalysis.

34. All are properties of regulatory enzymes **except**:
- (A) pathway end-products may act as allosteric inhibitors.
 - (B) v vs $[S]$ plots are sigmoid- or S-shaped.
 - (C) substrate binding is cooperative.
 - (D) monomeric enzymes with a single regulated active site.
 - (E) may be stimulated by allosteric activators.
35. Which of the following statements concerning the free energy change (ΔG) is **false**?
- (A) The energy change for a reaction depends only on the initial and final states, and is independent of the path taken.
 - (B) A spontaneous reaction is one in which energy is absorbed.
 - (C) The standard state usually used in biochemistry (ΔG°) includes all concentrations at 1 M, except for $[H^+]$, which is 10^{-7} M.
 - (D) The ΔG values for glycolytic reactions at physiological conditions may be exergonic, even though the ΔG° at "standard" conditions, may be endergonic.
 - (E) None is false.
36. Which of the following statement regarding glycolysis is **true**?
1. Hexokinase undergo a distinct conformational change when it binds glucose.
 2. The phosphorylation of glucose to glucose 6-phosphate is an exergonic reaction that is coupled to the endergonic hydrolysis of ATP.
 3. The binding of glucose to hexokinase is an example of induced-fit binding of a substrate to the active site of an enzyme.
 4. The phosphorylation of fructose 6-phosphate to fructose-1,6-bisphosphate is the committed step in glycolysis because it is the most strongly exergonic step in the pathway.
- (A) 1 and 2 are correct. (B) 3 and 4 are correct. (C) 1 and 3 are correct.
(D) 2 and 4 are correct. (E) All are correct.
37. Which of the following statements regarding lipid metabolism is **true**?
1. The carrier molecule which transports fatty acids through the inner mitochondrial membrane is lipoic Acid.
 2. Release control of fatty acids from triacylglycerols in adipocytes involves cyclic AMP as a second messenger.
 3. The use of cyclic AMP to mobilize fatty acids from adipose tissue is analogous to cyclic AMPs role in mobilization of sugars from glycogen in the liver.
- (A) 1 and 2 are true. (B) 1 and 3 are true. (C) 2 and 3 are true.
(D) All are true. (E) None is true.

見背面

38. Thiamine pyrophosphate (TPP) is one of the key enzyme cofactors involved in alcohol fermentation. Which of the following statement clearly explain the cofactor's functional role?
- (A) TPP functions like FAD to be involved in electron transfer.
 - (B) TPP functions like NAD^+ to be involved in reduction/oxidation.
 - (C) TPP helps the enzyme to proceed decarboxylation.
 - (D) TPP helps the enzyme to form a double bond in the reaction of dehydrogenase.
 - (E) TPP helps the enzyme to proceed oxidation from $-\text{CH}_2\text{OH}$ to $-\text{CHO}$.

39. Thiamine pyrophosphate (TPP) also involves in the formation of acetyl-CoA, in which TPP has to be deprotonated first and then attacks one site of pyruvate. Please identify which site.



- (A) Site A (B) Site B (C) Site C (D) Site D (E) Site E

40. Which of the following statements **correctly** describes the process of DNA sequencing by chain termination?
- (A) The enzyme DNA polymerase is used to form a primer that binds to the template DNA.
 - (B) In order to effectively sequence the DNA, the dideoxynucleotides must be present at a higher concentration than the deoxynucleotides.
 - (C) The use of 4 unique fluorescent labels attached to the dideoxynucleotides allows for a single reaction to be run.
 - (D) The dideoxynucleotides lack a 5'-OH and therefore can not serve as acceptors in nucleotide addition
 - (E) Both B and C are correct
41. The correct sequence of procedures in the Southern blotting (hybridization) technique is:
- a. Hybridization with radioactive probe
 - b. Agarose gel electrophoresis and visualize bands
 - c. Transfer (blot) to nitrocellulose filter
 - d. Digest DNA with restriction nucleases
 - e. Expose filter to X-ray film, develop and observe
- (A) b, a, c, e, d (B) d, c, b, a, e (C) c, d, b, e, a
 (D) d, b, c, a, e (E) a, b, c, d, e

42. Which of the following conversions require more than one step?
1. Alanine \rightarrow pyruvate
 2. Phenylalanine \rightarrow hydroxyphenylpyruvate
 3. Aspartate \rightarrow oxaloacetate
 4. Glutamate \rightarrow ketoglutarate
 5. Proline \rightarrow glutamate
- (A) 2 and 3. (B) 1, 2, and 4. (C) 1, 3, and 5. (D) 2 and 5. (E) 2, 3, and 5.
43. Which molecule contains an phosphoanhydride bond?
- (A) DNA (B) AMP (C) UDP (D) RNA (E) cAMP
44. All are properties of glycerol-3-phosphate dehydrogenases **except**:
- (A) one is located in the cytosol.
(B) works to carry electrons into mitochondria.
(C) one is located in the inner mitochondrial membrane.
(D) mitochondrial enzyme has bound coenzyme Q.
(E) FAD-dependent mitochondrial enzyme.
45. Which of these statements about the membrane proteins is **true**?
- (A) An integral membrane protein can be extracted with a chelating agent that removes divalent cations.
(B) Peripheral membrane proteins are generally noncovalently bound to membrane lipids.
(C) Carbohydrate moieties of membrane glycoproteins are linked to the intracellular domain of the proteins.
(D) Peripheral membrane proteins may have functional units on both sides of the membrane.
(E) Glycosylphosphatidylinositols, abbreviated GPI, are complex glycolipids that attach some proteins to the cytosolic surface of the plasma membrane.
46. Besides β -oxidation for lipid metabolism, there are other ways to catabolize lipid. Which statement is **correct**?
- (A) There is NAD-dependent β -oxidation for lipid metabolism in peroxisomes.
(B) The β -oxidation in peroxisomes uses O_2 to oxidize lipid and produces H_2O_2 .
(C) Branched-chain lipids are degraded via ω -oxidation.
(D) α -Oxidation is the main route to produce dicarboxylic acids.
(E) None of the above.
47. Purine is a heterocyclic aromatic organic compound that consists of a pyrimidine ring fused to _____ ring.
- (A) benzene (B) ribose (C) imidazole (D) furan (E) pyrazole
48. Thymidylate synthase methylates dUMP at 5 position to make dTMP. The methyl donor is _____.
- (A) S-adenosylmethionine (B) N^5, N^{10} methylene-THF (C) 5-methyl-THF
(D) taurine (E) creatine.

見背面

題號： 460

國立臺灣大學 110 學年度碩士班招生考試試題

科目： 生物化學(A)

題號： 460

節次： 8

共 10 頁之第 10 頁

49. Synthesis of triacylglycerol in adipocytes requires high level of glucose in the blood, because:
- (A) glycolysis of glucose provides high level of acetyl CoA for fatty acid synthesis.
 - (B) glycolysis of glucose provides high level of ATP.
 - (C) glycolysis of glucose provides dihydroxyacetone phosphate for glycerol phosphate synthesis.
 - (D) glycolysis of glucose provides high level of NADH for fatty acid synthesis.
 - (E) pentose phosphate pathway provides high level of NADPH for fatty acid synthesis.
50. Nitrifying bacteria obtain their chemical energy from:
- (A) the reduction of NO_3^- to NH_4^+ .
 - (B) the formation of NH_4^+ from N_2 gas.
 - (C) the oxidation of NH_4^+ to N_2 .
 - (D) the oxidation of NH_4^+ to NO_3^- .
 - (E) the formation of NO_2^- from NO_3^- .

試題隨卷繳回