

※ 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 ABCDE 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

- Please choose the correct answer from the following descriptions:
  - Every turn of  $\alpha$ -helix is 10.4 Å in length.
  - The side-chain of Histidine is an indole group and has important role in maintaining pH in blood.
  - Frederick Sanger developed a method for DNA sequencing and won Nobel prize.
  - Dextrin is homopolysaccharide.
  - Trehalose is the major constituent in circulating fluid of insects as energy-storage compound.

(A) Only 2 and 5 are incorrect. (B) 3, 4, and 5 are correct. (C) 2 and 5 are correct.  
(D) All descriptions are incorrect. (E) Only 1 and 4 are incorrect.
- Please choose the correct answer from the following descriptions:
  - Dextran is homopolysaccharide and the material for beads in gel filtration.
  - Agarose is the material for making SDS gel.
  - Heparin is sulfated heteropolysaccharide.
  - The strength of  $\alpha$ -keratin depends on its Cys content.
  - Hydrogen bond in  $\alpha$ -helix formed between residue  $i$  and  $i+4$ .

(A) 1 and 3 are incorrect. (B) 2 and 5 are incorrect. (C) Only 1, 4, and 5 are correct.  
(D) Only 2 is incorrect. (E) Only 3, 4, and 5 are correct.
- Please choose the correct answer(s) from the following descriptions:
  - Lectin are proteins that bind carbohydrate with high specificity.
  - The antiviral drug Tamiflu block the infection cycle of virus by inhibiting viral sialidase.
  - An oligosaccharide containing sialic acid marks newly synthesized protein in Golgi for transfer to lysosome.
  - The synthesis sequence in solid state peptide synthesis is from N-terminal to C-terminal.
  - Eukaryotes are more close to eubacteria than to archaeobacteria in evolution.

(A) 2, 3, and 5 are incorrect. (B) 2, 3, and 4 are correct. (C) 1 and 2 are correct.  
(D) Only 3 is incorrect. (E) 1 and 5 are correct.
- If the  $\Delta G^\circ$  of the reaction  $A \rightarrow B$  is  $-40$  kJ/mol, under standard conditions the reaction:

(A) is at equilibrium. (B) will never reach equilibrium.  
(C) will not occur spontaneously. (D) will proceed spontaneously from left to right.  
(E) will proceed spontaneously from right to left.
- In hemoglobin, the transition from T state to R state (low to high affinity) is triggered by:

(A)  $Fe^{2+}$  binding. (B) heme binding. (C) oxygen binding.  
(D) subunit association. (E) subunit dissociation.

見背面

6. Which one of the following statements about Pentose Phosphate Pathway (PPP) is false?
1. The enzyme transaldolase is used twice and the enzyme transketolase is used once in PPP.
  2. The enzyme phosphopentose isomerase is characterized by it converts an aldose to a ketose.
  3. Two-carbon shift reactions is catalyzed by transketolase.
  4. NADPH and xylulose-5-phosphate are products in the oxidative reaction.
  5. Glucose-6-phosphate will be channeled into the PPP if NADPH is needed.
- (A) 1, 2, and 3 are false.      (B) 1, 4, and 5 are false.      (C) 1 and 2 are false.  
(D) 2, 3, and 4 are false.      (E) None is false.
7. Which one is an  $\omega$ -6 fatty acid?
- (A) EPA (20:5( $\Delta^{5,8,11,14,17}$ ))      (B) DHA (22:6( $\Delta^{4,7,10,13,16,19}$ ))  
(C) Arachidonic acid (20:4( $\Delta^{5,8,11,14}$ ))      (D)  $\alpha$ -Linolenic acid (18:3( $\Delta^{9,12,15}$ ))  
(E) Tetracosahexaenoic (24:6( $\Delta^{6,9,12,15,18,21}$ ))
8. Which one is the basic unit for lipid synthesis?
- (A) Malonyl Co-A      (B) Choline      (C) Phosphatic acid  
(D) Glycerophospholipid      (E) Squalene
9. Which one regarding the compartmentalization of lipid metabolism is **incorrect**?
- (A) Fatty acid oxidation occurs in the mitochondria.  
(B) Ketone body synthesis takes place in the mitochondria.  
(C) Late stages of sterol synthesis take place in the ER.  
(D) Fatty acid synthesis occurs in the cytosol.  
(E) Acetyl-CoA is produced in the cytosol.
10. Which one is a secondary active transporter?
- (A) GLUT1      (B) SERCA pump      (C) Acetylcholine receptor  
(D) Lactose H<sup>+</sup> transporter      (E) Caveolin
11. Which one is involved in HDL-mediated reverse cholesterol transport to the liver?
- (A) ABCA1      (B) Acyl-CoA cholesterol acyl transferase (ACAT)  
(C) Sterol regulatory element-binding proteins      (D) HMG-CoA reductase  
(E) Acetyl-CoA Carboxylase
12. Starch is a high molecular weight polymer of D-glucose in  $\alpha$ 1 $\rightarrow$ 4 linkage. It is synthesized by starch synthase, which transfers glucose residues from \_\_\_\_\_ to preexisting starch molecules.
- (A) glucose 6-phosphate      (B) ATP-glucose      (C) ADP-glucose  
(D) sucrose      (E) glucose 1-phosphate

13. Which of the following descriptions about the melting temperatures of the fatty acids are correct?
1.  $18:1^{\Delta 9} < 18:2^{\Delta 9,12}$       2.  $18:0 < 16:0$       3.  $18:1^{\Delta 9} > 16:1^{\Delta 9}$   
4.  $18:0 > 18:1^{\Delta 9}$       5.  $20:0 < 16:0$       6.  $24:0 > 18:0$
- (A) 1, 3, and 4 only      (B) 3, 4, and 6 only      (C) 2, 3, and 5 only  
(D) 3 and 6 only      (E) 1 and 4 only
14. Oxidative stress results when the superoxide anion ( $O_2^-$ ) is formed as a side reaction of mitochondrial electron transport. This oxygen anion radical is made nontoxic by the action of enzymes in the mitochondrial matrix. Which of the following enzymes acts on two  $O_2^-$ , converting them to one molecule of water and one of  $H_2O_2$ ?
- (A) Glutathione reductase.      (B) Superoxide hydroxylase.  
(C) Glutathione peroxidase.      (D) Glutathione.      (E) Superoxide dismutase.
15. The relative concentrations of ATP and ADP control the cellular rates of:
- (A) glycolysis.      (B) oxidative phosphorylation.      (C) pyruvate oxidation.  
(D) the citric acid cycle.      (E) All of the above.
16. Some hormones are derived from amino acids; for example, catecholamines are derived from \_\_\_\_\_ while serotonin is derived from \_\_\_\_\_.
- (A) tyrosine; tryptophan      (B) tryptophan; lysine      (C) tyrosine; histidine  
(D) tryptophan; arginine      (E) histidine; lysine
17. Which of the following is **not true** during fasting?
- (A) During fasting, the liver maintains blood glucose levels.  
(B) Amino acids from muscle protein are a major carbon source for the production of glucose by the pathway of gluconeogenesis.  
(C) As amino acid carbons are converted to glucose, the nitrogens are converted to urea. Thus, the urinary excretion of urea is high during fasting.  
(D) As fasting progresses, however, the brain begins to use ketone bodies, sparing blood glucose.  
(E) Only muscle proteins are mobilized for energy requirement.
18. Which of the following is **not** involved in triggering insulin from beta-cells release in response to glucose?
- (A) Reduced efflux through ATP-gated  $K^+$ -channels      (B) Increased concentrations of ATP  
(C) cAMP-dependent phosphorylation of lipase  
(D) Phosphorylation of glucose to glucose-6-phosphate      (E) Increased  $Ca^{2+}$  levels
19. Which contain(s) a phosphoanhydride bond?
- (A) DNA      (B) RNA      (C) protein      (D) ATP      (E) Both DNA and RNA
20. Supercoiling of DNA:
- (A) is not observed in prokaryotes.      (B) requires the action of topoisomerase enzymes.  
(C) does not require ATP.      (D) is not observed in eukaryotes.  
(E) None of the above is true.

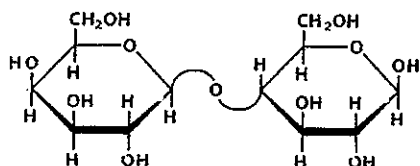
21. What is the main damaging effect of UV radiation on DNA?  
(A) Depurination (B) Deamination (C) Formation of thymine dimers  
(D) Single strand break (E) Dehydration
22. The binding of lac repressor to DNA could be considered to be analogous to:  
(A) competitive inhibition of an enzyme. (B) mixed-type inhibition of an enzyme.  
(C) uncompetitive inhibition of an enzyme. (D) allosteric effects in enzyme regulation.  
(E) None of the above
23. Protein translation begins:  
(A) at the replication fork. (B) on the lagging strand. (C) at the start codon.  
(D) in nucleus. (E) All of these
24. Eukaryotic mRNA binding to the ribosomes is facilitated by \_\_\_\_\_.  
(A) the Shine Dalgarno sequence (B) the 7-methyl guanosine cap (C) tRNA  
(D) snRNA (E) All of the above
25. Cellulose fibers resemble with the protein structure in the form of:  
(A)  $\beta$ -sheets. (B)  $\alpha$ -helices. (C)  $\beta$ -turns. (D) All of the above  
(E) both  $\beta$ -sheets and  $\alpha$ -helices.

## 第 26 至 50 題 每題 2.5 分

26. Which description is correct?  
(A) Organisms which could use light as energy source are classified as autotrophs.  
(B) Microtubules and intermediate filaments help to produce motion of organelles or of the whole cell.  
(C) Isoleucine has four stereoisomers.  
(D)  $H_2O$  in liquid water forms more hydrogen bonds than in ice.  
(E) 1 M NaCl and 1 M  $H_2SO_4$  has the same osmolarity.
27. A teacher synthesized a peptide and asked his students to describe the amino acid residues in the peptide. Student A said: "This peptide contains the amino acid residue which might be phosphorylated". Student B said: "This peptide contains the amino acid residue which has 2 chiral centers". Student C said: "This peptide does not contain the amino acid residue which could be cleaved by CNBr". Student D said: "This peptide does not contain the amino acid residue which could be modified with N-linked glycan in glycoproteins. Student E said: "The pI of this peptide is around 7". The sequence of this peptide should be:  
(A) ASQHPIMLWG (B) CVKILVGAEQNR (C) AVEFFTRDQPHK  
(D) AYKLWPiEAGQA (E) RGDSSERTVVNCA

28. Please choose the correct answer(s) from the following descriptions:

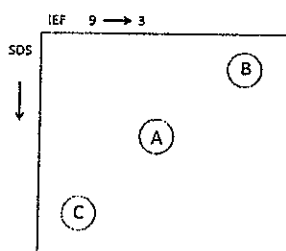
1. Fructose is not reducing sugar.
2. The  $\alpha$ -D-glucose and  $\beta$ -D-glucose interconvert in aqueous solution.
3. Glc( $\beta$ 1 $\rightarrow$ 4)Glc could be draw as the following figure.



4. The sugar drawn above is a maltose.
  5. Mannose is a C2 epimer of galactose.
- (A) Only 1 and 2 are correct.      (B) 1, 3, and 4 are correct.      (C) 1 and 5 are correct.  
 (D) 2, 3, and 4 are correct.      (E) Only 5 is incorrect.

29. A protein mixture contains proteins A, B, and C (Protein A: homodimer  $M_r = 140,000$ , pI 8; Protein B:  $M_r = 113,000$ , pI 5; Protein C:  $M_r = 13,000$ , pI 9).

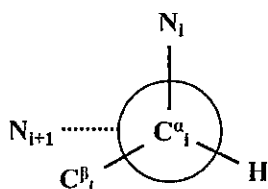
1. Sandy used SDS-PAGE to separate these three proteins. The sequence of the protein bands shown in gel from top to bottom is A-B-C.
2. Simon dissolved the protein mixture in 20 mM phosphate buffer (pH 7) and loaded to a cation exchange column equilibrated with the same buffer. Protein B could not bind to the column.
3. Samuel dissolved the protein mixture in 20 mM phosphate buffer (pH 7) and loaded to an anion exchange column equilibrated with the same buffer. Only protein A and C could bind to the column.
4. Silvia used a gel filtration column to separate them, C will be eluted first.
5. Sophie used 2-Dimensional electrophoresis to separate them. The relative positions of these three proteins is like the image below.



- (A) 1, 2, and 5 are correct.      (B) 2 and 4 are incorrect.      (C) 1, 3, and 4 are incorrect.  
 (D) Only 2 is correct.      (E) Only 1 and 3 are incorrect.

見背面

30. The following figure describes the torsion angle of the residue  $i$  in a protein. What does the figure tell you?

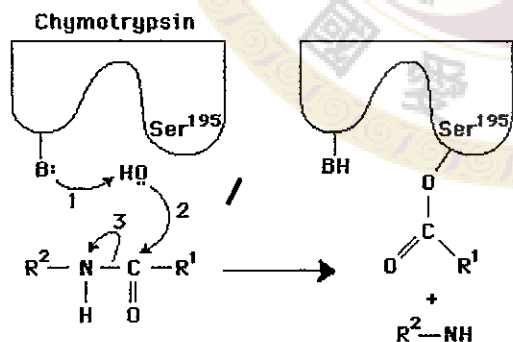


- (A) It is  $\phi$  angle  $-90$  degree. (B) It is  $\omega$  angle  $+90$  degree.  
 (C) It is  $\phi$  angle  $+90$  degree. (D) It is  $\phi$  angle  $-90$  degree.  
 (E) It is  $\phi$  angle  $+90$  degree

31. Which of the following is not correct concerning cooperative binding of a ligand to a protein?

- (A) It is usually a form of allosteric interaction.  
 (B) It is usually associated with proteins with multiple subunits.  
 (C) It results in a sigmoidal binding curve.  
 (D) It rarely occurs in enzymes.  
 (E) It results in a nonlinear Hill Plot.

32. In the following diagram of the first step in the reaction catalyzed by the protease chymotrypsin, the process of general base catalysis is illustrated by the number \_\_\_\_\_, and the process of covalent catalysis is illustrated by the number \_\_\_\_\_.



- (A) 3; 2 (B) 1; 3 (C) 2; 3 (D) 2; 1 (E) 1; 2

33. The steady state assumption, as applied to enzyme kinetics, implies:

- (A) the ES complex is formed and broken down at equivalent rates.  
 (B) the enzyme is regulated.  
 (C)  $K_m = K_s$ .  
 (D) the  $K_m$  is equivalent to the cellular substrate concentration.  
 (E) the maximum velocity occurs when the enzyme is saturated.

34. Which one of the following statements is **correct**?

1. Conversion of ethanol to acetaldehyde is a two-electron oxidation.
2. FAD is a stronger reducing reagent than  $\text{NAD}^+$ .
3. There is entropy loss when ADP is phosphorylated.
4. Creatine phosphate is a high-energy-bond containing molecule.
5.  $\text{NAD}^+$  is the electron acceptor during in the conversion of 3-phosphoglycerate to 1,3-bisphosphoglycerate.

(A) 1, 2, and 3 are correct. (B) 2, 3, and 4 are correct. (C) 1, 3, and 4 are correct.  
(D) 1, 3, 4, and 5 are correct. (E) 2, 3, 4, and 5 are correct.

35. Which of the following statements is **incorrect**?

1. The second phosphorylation reaction from the conversion of glucose to pyruvate is the conversion of fructose-6-phosphate to yield fructose-2,6-bisphosphate.
2. Conversion of glyceraldehyde-3-phosphate to 1,3-bisphosphoglycerate reduces  $\text{NAD}^+$  to NADH.
3. The second isomerization reaction in glycolysis is catalyzed by triose phosphate isomerase.
4. Conversion of pyruvate into Acetyl-CoA and  $\text{CO}_2$  by pyruvate decarboxylase is the first  $\text{CO}_2$  releasing reaction in aerobic glycolysis.
5. In glycolysis, the reaction catalyzed by phosphoglycerate kinase is the step where the use and production of ATP is balanced.

(A) 2, 3, and 5 are **incorrect**. (B) 1, 3, and 4 are **incorrect**.  
(C) 1, 3, and 5 are **incorrect**. (D) All are **incorrect**. (E) None is **incorrect**.

36. Which statement regarding glycogen breakdown is correct?

1. Cleavage of glycogen terminal glucose is catalyzed by glycogen phosphorylase.
2. The breakdown of glycogen to generate Glucose-6-phosphate needs no ATP.
3. Transferase activity in glycogen debranching enzyme catalyzes the transfer of shorter  $\alpha(1\rightarrow6)$  linked glucose chain to another  $\alpha(1\rightarrow6)$  linked glucose chain for further cleavage reaction.
4. Glucosidase activity in glycogen debranching enzyme catalyzes the cleavage of  $\alpha(1\rightarrow6)$  linked glucose for complete breaking down the branch in glycogen

(A) 1, 2, and 3 are correct. (B) 2, 3, and 4 are correct. (C) 1, 2, and 4 are correct.  
(D) All are correct. (E) None is correct.

37. Which one of the following statements is **incorrect**?

- (A) P-type ATPase transporter is inhibited by vanadate.
- (B) Cyanide ( $\text{CN}^-$ ) blocks the lactose transporter in *E. coli*.
- (C) Tetrodotoxin impairs voltage-gated  $\text{Na}^+$  channels.
- (D) Statin competes with acetyl Co-A.
- (E) Aspirin inhibits COX-2.

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38. Which one is **incorrect**?
- (A) Catabolism of fatty acids produces acetyl-CoA.
  - (B) Catabolism of fatty acids produces reducing power NADH.
  - (C) Anabolism of fatty acids requires acetyl-CoA and malonyl-CoA.
  - (D) Anabolism of fatty acids requires reducing power from NADPH.
  - (E) Fatty acid synthase contains a domain of acyl-CoA dehydrogenase.
39. Which one is **not** a rate-limiting step in lipid metabolism?
- (A) Carnitine acyltransferase I for fatty acid entry into mitochondria
  - (B) Acetyl-CoA carboxylase for biosynthesis of fatty acid
  - (C) PEP carboxykinase for triacylglycerol cycle
  - (D) Acyl transferase for phospholipid synthesis
  - (E) HMG reductase for cholesterol synthesis
40. Which of the following descriptions is(are) false?
1. The difference between a ribonucleotide and a deoxyribonucleotide is that a ribonucleotide has an -OH instead of an -H at C-2.
  2. The DNA copies of mRNA found in a cDNA library are made by reverse transcriptase.
  3. Type II restriction enzymes cleave DNA only at recognition sequences specific to a given restriction enzyme
  4. Deamination of the nucleotide base 5-methylcytosine yields nucleotide base thymine.
  5. Type II restriction enzymes may make staggered (off-center) cuts within their recognition sequences.
- (A) 5 only      (B) 3 only      (C) 4 only      (D) 1 and 2  
(E) None of the descriptions are false.
41. Which of the following descriptions is false?
- (A) If electron transfer in tightly coupled mitochondria is blocked (with antimycin A) between cytochrome *b* and cytochrome *c*<sub>1</sub>, O<sub>2</sub> uptake will continue.
  - (B) A drug that inhibits the ATP synthase in the mitochondrion will also inhibit the flow of electrons down the chain of carriers.
  - (C) Oxidative phosphorylation can **not** occur in the absence of an intact inner mitochondrial membrane.
  - (D) Uncoupling of mitochondrial oxidative phosphorylation halts mitochondrial ATP formation, but allows continued O<sub>2</sub> consumption.
  - (E) If electron transfer in tightly coupled mitochondria is blocked (with antimycin A) between cytochrome *b* and cytochrome *c*<sub>1</sub>, then all ATP synthesis will stop.
42. The reaction of the citric acid cycle that is most similar to the pyruvate dehydrogenase complex-catalyzed conversion of pyruvate to acetyl-CoA is the conversion of:
- (A) citrate to isocitrate.      (B) fumarate to malate.      (C) malate to oxaloacetate.
  - (D) succinyl-CoA to succinate.      (E)  $\alpha$ -ketoglutarate to succinyl-CoA.



43. Which of the following statements in the enzyme cofactors involved in one-carbon transfer reactions is false?
- (A) Tetrahydrofolate, *S*-adenosylmethionine, and biotin are important cofactors involved in the reactions of one-carbon transfers.
  - (B) *S*-Adenosylmethionine is synthesized from ATP and methionine.
  - (C) In the activated-methyl cycle for the synthesis of methionine and *S*-adenosylmethionine, homocysteine is converted to methionine through the donation of the methyl group from  $N^5, N^{10}$ -methylenetetrahydrofolate.
  - (D) Acetyl-CoA carboxylase, which catalyzes the formation of malonyl-CoA from acetyl-CoA, contains a biotin prosthetic group.
  - (E) The methyl group donated from *S*-adenosylmethionine is more reactive than that donated from  $N^5$ -methyltetrahydrofolate.
44. What are the three mammalian enzymes that can "fix" ammonia into organic molecules?
- (A) Nitrogenase complex, Carbamoyl phosphate synthetase I, and Glutamine synthetase
  - (B) Glutamate dehydrogenase, Glutamine synthetase, and Carbamoyl phosphate synthetase I
  - (C) Dinitrogenase, Carbamoyl phosphate synthetase I, and Glutamate dehydrogenase
  - (D) Dinitrogenase reductase, Dinitrogenase, and Carbamoyl phosphate synthetase I
  - (E) Glutamine amidotransferases, Glutamine synthetase, and Carbamoyl phosphate synthetase I
45. What are the major carriers of nitrogen in the blood for amino acid metabolism?
- (A) Alanine and glutamine
  - (B) Arginine and glutamine
  - (C) Lysine and arginine
  - (D) Arginine and tryptophan
  - (E) Glutamine and asparagine
46. As a physician, which of the tests do you wish to examine for type 1 diabetes patients in addition to blood glucose? With this test, you can determine if the patients have been consistently keeping the blood sugar down.
- (A) ketone bodies in the blood
  - (B) triacylglycerols in the blood
  - (C) ketone bodies in the urine
  - (D) glycosylated hemoglobin (HbA1C) in the blood
  - (E) lactate in the blood
47. Aminotransferases are enzymes that have all of the following characteristics **except** that:
- (A) they can make an  $\alpha$ -ketoacid from an  $\alpha$ -amino acid.
  - (B) they use pyridoxal phosphate as a carrier of amino groups.
  - (C) the reactions that they catalyze are highly reversible.
  - (D) they use ATP in the reactions that they catalyze.
  - (E) serum levels of certain aminotransferases are used as a clinical measure of tissue damage.
48. Which of the followings is **not** a function of DNA polymerase I from *E. coli*?
- (A) Adding nucleotides to the primer strand
  - (B) 3'→5' exonuclease activity
  - (C) 5'→3' exonuclease activity
  - (D) proofreading
  - (E) *E. coli* DNA polymerase I has **all** of the above functions.

49. A mutation in the trp binding site of the repressor would result in:

- (A) inducible trp operon expression.                      (B) constitutive trp operon expression.  
(C) no operon expression.                                      (D) All of the above                      (E) None of the above

50. The direction of amino acid transfer to the growing polypeptide chain is:

- (A) from the A (aminoacyl tRNA site) site to the P (peptidyl tRNA site) site on the small subunit of the ribosome.  
(B) from the A site to the P site on the large subunit of the ribosome.  
(C) from the A site to the E (exit tRNA site) site on the ribosome.  
(D) from the P site to the A site on the small subunit of the ribosome.  
(E) from the P site to the A site on the large subunit of the ribosome.

