

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. Please choose the **correct** answer from the following descriptions:

1. Protein sectors are evolutionary units of three-dimensional structure.
2. The α -D-glucose and β -D-glucose interconvert in aqueous solution.
3. Lectin is the exoskeleton of insects.
4. β -Keratin is Gly and Pro rich.
5. The pI of histidine is around 6.

(A) 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 4 and 5 are incorrect.

2. Which description is **correct**?

- (A) Lipopolysaccharide is a dominant feature of the outer membrane of the cell wall of gram-negative bacteria.
- (B) Trypsin could hydrolyze the "X-K" peptide bond.
- (C) Orthologous genes are presumed to have been derived by gene duplication followed by gradual changes in the sequences of both copies.
- (D) Collagen is full of α -helix structure and has Gly-X-Pro repeating sequence.
- (E) For naming the RS system, $-\text{CH}_2\text{OH}$ group has higher priority than $-\text{CHO}$ group.

3. Please choose the **correct** answer from the following descriptions:

- (1) Comparing amino acids "C" and "S", there is only one atom difference.
- (2) For two-dimensional gel electrophoresis, proteins were separated according to their molecular weights, then further separated according to their pI values.
- (3) Using solid state peptide synthesis to synthesize the peptide "SMART", the synthesis sequence is T-R-A-M-S.
- (4) Phenylisothiocyanate is used to do chemical fragmentation on methionine residues.
- (5) Evolutionary relatedness can be inferred from sequence homology. Lysozyme and α -lactoalbumin are identical at 48 positions but their functions are not related. It is called "convergent evolution".

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

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4. Both water and glucose share an —OH that can serve as a substrate for a reaction with the terminal phosphate of ATP catalyzed by hexokinase. Glucose, however, is about a million times more reactive as a substrate than water. The best explanation is that:
- (A) glucose has more —OH groups per molecule than does water.
 - (B) the larger glucose binds better to the enzyme; it induces a conformational change in hexokinase that brings active-site amino acids into position for catalysis.
 - (C) the —OH group of water is attached to an inhibitory H atom, while the glucose —OH group is attached to C.
 - (D) water and the second substrate, ATP, compete for the active site resulting in a competitive inhibition of the enzyme.
 - (E) water normally will not reach the active site because it is hydrophobic.
5. When O₂ binds to heme in hemoglobin, the _____ ion is drawn into the plane of the _____ causing a conformational change that is transmitted to adjacent subunits enhancing the _____ for additional O₂ binding.
- (A) Mg²⁺; globin; planarity.
 - (B) Fe²⁺; heme; folding.
 - (C) Zn²⁺; globin; attraction.
 - (D) Fe³⁺; porphyrin; affinity.
 - (E) Fe²⁺; porphyrin; affinity.
6. BPG shifts the oxygen saturation curve of Hb to the _____ because BPG binds to _____ making Hb an O₂ delivery system eminently suited for human.
- (A) right; deoxyHb.
 - (B) right; oxyHb.
 - (C) left; oxyHb.
 - (D) left; deoxyHb.
 - (E) none of the above.
7. In *E. coli*, rotation of the flagella is powered by:
- (A) phosphorylation of the motB protein by phosphoenolpyruvate.
 - (B) a proton gradient across the plasma membrane of the bacterium.
 - (C) the hydrolysis of ATP by the motB protein.
 - (D) the hydrolysis of GTP by the flagella.
 - (E) None of the above.
8. Which of the following compounds can **not** serve as the starting material for the synthesis of glucose via gluconeogenesis?
- (A) Lactate.
 - (B) Oxaloacetate.
 - (C) Acetate.
 - (D) α -Ketoglutarate.
 - (E) Glycerol.

9. Which of the following statements about citric acid cycle is **true**?
- (1) Citric acid cycle plays roles in both catabolism and anabolism.
 - (2) All enzymes of the cycle are located in the matrix, except malate dehydrogenase.
 - (3) Both oxidation and decarboxylation reactions are involved in the generation of α -ketoglutarate from isocitrate.
 - (4) The enzyme catalyzed the production of citrate is an allosteric enzyme that is inhibited by NADH, ATP, and succinyl-CoA.
 - (5) The step involves FAD in the citric acid cycle before the step that generates GTP.
- (A) 1, 2, and 4 are true. (B) 1, 3, 4 and 5 are true. (C) 1, 3, and 4 are true.
(D) 1, 2, 3, and 4 are true. (E) All are true.
10. Which one of lipid metabolites does **not** act as a biological signal?
- (A) Arachidonic acid. (B) Lysophosphatidic acid. (C) Wax.
(D) Inositol phosphates. (E) Sphingosine-1-phosphate.
11. Which one does **not** mainly distribute on the outer leaflet of the plasma membrane?
- (A) Glycoprotein. (B) Glycolipid. (C) GPI-anchored protein.
(D) Phosphatidylcholine. (E) Phosphatidylserine.
12. Which one is **not** a lipid anchored protein?
- (A) Caveolin. (B) Glycophorin. (C) Lamin A.
(D) Src. (E) GPI-anchored protein.
13. Which one is **incorrect** regarding β and ω oxidation of fatty acids?
- (A) β oxidation takes place in mitochondrial inner matrix.
(B) ω oxidation occurs in ER.
(C) Mono-unsaturated FA needs enoyl-CoA isomerase.
(D) Final products contain acetyl-CoA.
(E) The length of fatty acid > 12C utilizes ω oxidation.
14. Which one is **not** the fate of cholesterol?
- (A) Incorporated into the plasma membranes in hepatocytes.
(B) Synthesis of biliary cholesterol and bile acid.
(C) Synthesis of vitamin D.
(D) Formation of triacylglycerol in VLDL.
(E) Synthesis of hormones for extrahepatic tissues.

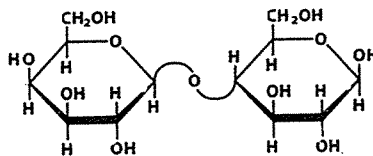
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15. Which lipoprotein contains the most abundant cholesterol?
(A) Chylomicron. (B) VLDL. (C) LDL. (D) IDL. (E) HDL.
16. Which one has a **less** relevance to cardiovascular diseases?
(A) High LDL. (B) High HDL. (C) *Trans* unsaturated fatty acid.
(D) Long Saturated fatty acid. (E) ω 6 fatty acid.
17. All are true for DNA polymerase **except**:
(A) generates dsDNA from ssDNA.
(B) synthesizes new strands by adding successive nucleotides in the 5'→3' direction.
(C) copies the sequence of nucleotides of one strand in a complementary fashion.
(D) requires a primer with a free 5'-OH end, but the 3'-end may be phosphorylated.
(E) copies the sequence of nucleotides of one strand to form a new second strand.
18. The higher the _____ content of a DNA, the _____ the melting temperature, and the _____ the ionic strength, the _____ the melting temperature.
(A) G:C; higher; lower; lower (B) G:C; lower; higher; lower
(C) G:C; higher; higher; lower (D) A:T; higher; higher; lower
(E) A:T; lower; lower; higher
19. RNA is _____ stable to alkaline hydrolysis than DNA because RNA's vicinal _____ group makes the 3'-phosphodiester bond susceptible to _____ cleavage.
(A) more; 2'-OH; nucleophilic (B) more; 2'-OH; electrophilic
(C) less; 2'-OH; nucleophilic (D) less; 3'-OH; nucleophilic
(E) more; 3'-OH; electrophilic
20. The function of DNA topoisomerases is:
(A) packaging DNA into nucleosomes.
(B) forming cruciform DNA.
(C) unwinding G:C rich areas in DNA.
(D) breaking one or more strands of DNA, winding them tighter or looser, and rejoining the ends.
(E) promoting DNA hybridization.
21. Alanine is formed from transamination of:
(A) asparagine. (B) aspartame. (C) oxaloacetate. (D) citrate. (E) pyruvate.

22. Which statement about ribonucleotide reductase is **not** true:
 (A) It is an enzyme that catalyzes the formation of dADP, dGDP, dCDP and dTDP.
 (B) The reaction catalyzed by ribonucleotide reductase is strictly conserved in all living organisms.
 (C) The immediate reducing power of ribonucleotide reductase is provided by thioredoxin.
 (D) Consists of two non-identical subunits.
 (E) Free radical is involved in the catalysis.
23. Which statement about thymidine kinase (TK) is **not** true:
 (A) Thymidine kinase catalyzes the reaction: deoxythymidine + ATP \rightarrow TMP + ADP.
 (B) Thymidine kinases have a key function in the synthesis of RNA.
 (C) Mammals have two isoenzymes, TK1 and TK2.
 (D) Certain viruses also carry gene for the expression of viral thymidine kinases.
 (E) None of the above.
24. Many biomolecules are derived from amino acid precursors. Serotonin and dopamine are synthesized from _____ and _____, respectively.
 (A) histidine; tyrosine. (B) phenylalanine; tryptophan. (C) tryptophan; tyrosine.
 (D) histidine; tryptophan. (E) tryptophan; histidine.
25. In humans, which of the following amino acids are essential?
 (A) Gln and Glu. (B) Lys and Cys. (C) Trp and Ser.
 (D) Arg and Ala. (E) Met and Phe.

第 26 至 50 題 每題 2.5 分

26. Choose from the answers 1~6 to describe the following figure, then pick up the **correct** descriptions.



1. Glc(β 1 \rightarrow 4)Glc 2. Gal(β 1 \rightarrow 4)Glc 3. Glc(α 1 \rightarrow 4)Glc
 4. Maltose 5. Cellobiose 6. Lactose

- (A) 2 and 6 are correct. (B) 1 and 4 are correct. (C) 3 and 4 are correct.
 (D) 1 and 5 are correct. (E) 3 and 5 are correct.

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30. A protein mixture contains protein A, B, C.

Protein A: homodimer $M_r = 180,000$, pI 5; Protein B: $M_r = 12,000$, pI 7;

Protein C: $M_r = 150,000$, pI 9

Joseph says: When I used SDS-PAGE to separate these three proteins. The sequence of the protein bands shown in gel from top to bottom is A-C-B.

Steve says: When I used SDS-PAGE to separate these three proteins. The sequence of the protein bands shown in gel from top to bottom is B-A-C

Jacky says: When I dissolved the protein mixture in 20 mM phosphate buffer (pH 7) and loaded it to a cation exchange column equilibrated with the same buffer. Only protein C could bind to the column matrix

Simon says: When I dissolved the protein mixture in 20 mM phosphate buffer (pH 8) and loaded it to an anion exchange column equilibrated with the same buffer. Only protein C could bind to the column matrix

Clarence says: When I dissolved the protein mixture in 150 mM phosphate buffer (pH 7) and used a gel filtration column to separate them, the elution sequence is B→C→A.

Rita says: When I dissolved the protein mixture in 150 mM phosphate buffer (pH 7) and used a gel filtration column to separate them, the elution sequence is A→C→B.

Lily says: When I dissolved the protein mixture in 150 mM phosphate buffer (pH 7) and used a gel filtration column to separate them, the elution sequence is C→A→B.

Who are **correct**?

- (A) Joseph, Simon, and Clarence. (B) Rita and Jacky. (C) Steve, Jacky, and Lily.
(D) Simon and Clarence. (E) Joseph, Jacky, and Rita.

31. There are three peptides, A, B, and C.

Peptide A sequence is DSQWMKLGIV. Peptide B sequence is KLHPPGTI.

Peptide C sequence is EETAIRR.

Amelia says: The pI value of peptide A should be near 9.

David says: The pI value of peptide C is higher than peptide B.

Bret says: The pI value of peptide B should be near 6.

Sandy says: The pI value of peptide B is higher than peptide A.

Who is **correct**?

- (A) Amelia. (B) All are incorrect. (C) David. (D) Bret. (E) Sandy.

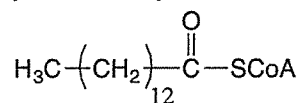
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32. A small molecule that increases the activity of an enzyme by binding to a site other than the catalytic site is termed a(n):
(A) allosteric activator. (B) alternative inhibitor. (C) competitive activator.
(D) stereospecific agent. (E) transition-state analog.
33. Which of these statements about enzyme-catalyzed reactions is **false**?
(A) At saturating levels of substrate, the rate of an enzyme-catalyzed reaction is proportional to the enzyme concentration.
(B) If enough substrate is added, the normal V_{\max} of a reaction can be attained even in the presence of a competitive inhibitor.
(C) The rate of a reaction decreases steadily with time as substrate is depleted.
(D) The activation energy for the catalyzed reaction is the same as for the uncatalyzed reaction, but the equilibrium constant is more favorable in the enzyme-catalyzed reaction.
(E) The Michaelis-Menten constant K_m equals the $[S]$ at which $V = 1/2 V_{\max}$.
34. When every enzyme molecule in the reaction mixture has its substrate-binding site occupied by substrate, the kinetics become _____-order, and the velocity is _____.
(A) first; $V_{\max}/2$. (B) first; V_{\max} . (C) second; $V_{\max}/2$.
(D) zero; $V_{\max}/2$. (E) zero; V_{\max} .
35. 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) monomeric enzymes with a single regulated active site.
(D) substrate binding is cooperative.
(E) may be stimulated by allosteric activators.
36. Which of the following cofactors is required for the conversion of succinate to fumarate in the citric acid cycle?
(A) ATP. (B) Biotin. (C) $NADP^+$. (D) NAD^+ . (E) FAD.
37. Which one of the following enzymatic activities would be decreased by thiamine deficiency?
(A) Fumarase. (B) Isocitrate dehydrogenase. (C) Malate dehydrogenase.
(D) Succinate dehydrogenase. (E) α -Ketoglutarate dehydrogenase complex.

38. The conversion of 1 mole of fructose 1,6-bisphosphate to 2 mole of pyruvate by the glycolytic pathway results in a net formation of:
- (A) 1 mole of NADH and 1 mole of ATP. (B) 2 mole of NAD⁺ and 4 mole of ATP.
(C) 1 mole of NAD⁺ and 2 mole of ATP. (D) 2 mole of NADH and 4 mole of ATP.
(E) 2 mole of NADH and 2 mole of ATP.
39. Which one of the following statements is **true**?
1. In glycolysis, ATP is synthesized by both substrate-level and oxidative phosphorylation.
 2. Fructose-1,6-bisphosphate is an allosteric factor for controlling by phosphofructokinase.
 3. In the glyceraldehyde-3-phosphate dehydrogenase reaction, the amino acid cysteine is important in adding a second phosphate to glyceraldehyde phosphate.
 4. During anaerobic metabolism in red blood cells, the carbons of glucose end up in lactic acid.
 5. Phosphofructokinase and pyruvate kinase both are tetrameric.
- (A) All are true. (B) 1 and 4 are **not** true. (C) 5 is **not** true.
(D) 1, 3 and 5 are **not** true. (E) 2 and 4 are **not** true.
40. Which one is **incorrect** regarding the rate limiting steps of lipid metabolism?
- (A) Carnitine acyltransferase I in β oxidation.
(B) Acetyl-CoA carboxylase in fatty acid synthesis.
(C) HMG reductase in phosphatidylcholine synthesis.
(D) Phosphatidic acid phosphatase in phospholipid synthesis.
(E) Serine palmitoyltransferase in sphingolipid synthesis.
41. Which one is **incorrect** regarding the intermediates and precursors in lipid metabolism?
- (A) *Cis*- Δ^2 enoyl CoA in β oxidation.
(B) Mevalonate in cholesterol synthesis.
(C) Phosphatidic acid in glycerolphospholipid synthesis.
(D) Serine and palmitoyl-CoA in sphingolipid synthesis.
(E) Δ^3 -Isopentenyl pyrophosphate is the precursor of vitamin A, E, K.
42. Which molecule contains an phosphoanhydride bond?
- (A) DNA. (B) RNA. (C) UMP. (D) ADP. (E) cAMP.

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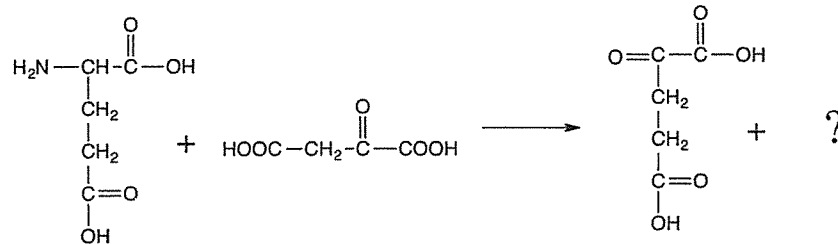
43. In the TCA cycle, carbon enters the cycle as _____ and exits as _____ with metabolic energy captured as _____, _____ and _____.
- (A) malonyl-CoA; water; NADH; [FADH₂]; ATP
 (B) acetyl-CoA; CO₂; ATP; NADH; [FADH₂]
 (C) succinyl-CoA; CO₂; ATP; NADH; NADPH
 (D) malonate; water; NADH; ATP; NADPH
 (E) acetyl-CoA; CO₂; NADH; ATP; NADPH
44. Uncoupling of mitochondrial oxidative phosphorylation:
- (A) slows the conversion of glucose to pyruvate by glycolysis.
 (B) allows continued mitochondrial ATP formation but halts O₂ consumption.
 (C) halts all mitochondrial metabolism.
 (D) slows down the citric acid cycle.
 (E) halts mitochondrial ATP formation but allows continued O₂ consumption.
45. Glutamine synthetase plays an important role in the incorporation of ammonia into glutamine. Which of the following post-translational modification controls the activity of glutamine synthetase?
- (A) Phosphorylation/dephosphorylation. (B) Adenylation/deadenylation.
 (C) Acetylation/deacetylation. (D) Methylation/demethylation. (E) None of the above.
46. Chorismate is an important precursor in the synthesis of all of the following **except**:
- (A) vitamin K. (B) folic acid. (C) arginine. (D) tyrosine. (E) tryptophan.
47. Which of the following statement about homocysteine is **not** true:
- (A) It is a homologue of cysteine, differing by addition of methylene bridge (-CH₂-).
 (B) It is found in some proteins.
 (C) It is biosynthesized from methionine by the removal of its terminal Cε methyl group.
 (D) It can be recycled into methionine or converted into cysteine with the aid of certain B-vitamins.
 (E) It is a possible risk factor for coronary artery disease.
48. Considered the following saturated fatty acid, how many β-oxidation cycle does it need to completely metabolize the above fatty acid to acetyl-CoA?



- (A) 2. (B) 3. (C) 4. (D) 6. (E) 12.

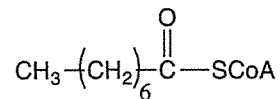
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49. Considered the following transamination reaction in amino acid biosynthesis, what amino acid would be produced?



- (A) Glu. (B) Asp. (C) Gln. (D) Thr. (E) Arg.

50. Given the saturated fatty acid shown below, how many ATPs can be produced when it is completely metabolized?



Some useful info:

- i. In the TCA cycle, one Acetyl-CoA gives 3 moles of NADH, 1 mole of FADH₂, and 1 mole of GTP.
- ii. One mole of NADH produces 2.5 mole of ATP.
- iii. One mole of FADH₂ produces 1.5 mole of ATP.

- (A) 30. (B) 34. (C) 36. (D) 50. (E) 52.

試題隨卷繳回