

科目：生物化學

系所組：營養科學系

一、單選題：80分

1. Which statement is not true for metabolism? (1) Metabolism is an organized transformation of energy. (2) Metabolism produces and utilizes ATP. (3) Metabolism has two components: anabolism and catabolism. (4) Metabolism is characterized by single reactions with large energy releases.
2. Hydrogen bonds in ice are all EXCEPT: (1) directional; (2) weak; (3) responsible for the lower density of ice over liquid water; (4) holding water molecules in ice apart.
3. Amphiphilic (amphipathic) molecules include: (1) acidic amino acids; (2) inorganic salts; (3) salts of fatty acids; (4) water.
4. If equal amounts of Na_2HPO_4 and Na_3PO_4 are mixed in water, calculate the resulting pH. The pKas of phosphoric acid are 2.1, 7.2, 12.4. (1) 3.6; (2) 12.4; (3) 4.5; (4) 9.5.
5. Hyperventilation is a physiological mechanism to: (1) lower $[\text{CO}_2]$ in the blood and increase blood pH; (2) raise $[\text{CO}_2]$ in the blood and increase blood pH; (3) lower $[\text{CO}_2]$ in the blood and decrease blood pH; (4) raise $[\text{CO}_2]$ in the blood and decrease blood pH.
6. All of the statements about the classification of these amino acids are correct EXCEPT: (1) Aspartic acid and asparagine are acidic amino acids; (2) Alanine and valine are neutral, nonpolar amino acids; (3) Lysine and arginine are basic amino acids; (4) Tyrosine and phenylalanine are aromatic amino acids.
7. Resonance in peptide bonds results in all EXCEPT: (1) restricted rotation in the peptide backbone at the N-C α bond and C α -C β bond; (2) a C α -carbon that is out of the coplanar group of atoms; (3) the coplanar six atoms of the peptide bond group of atoms; (4) C β -N bond distance that is shorter than normal, but longer than C=N bonds.
8. Globular proteins are usually all EXCEPT: (1) Insoluble in water; (2) Roughly spherical; (3) Folded so that the hydrophobic amino acids are in the interior of the molecule; (4) Hydrophobic side chains are exposed to the water.
9. Protein isolation and purification include all of the techniques EXCEPT: (1) gas-liquid chromatography; (2) ion exchange chromatography; (3) electrophoresis; (4) solubility ("salting in" and "salting out").
10. The amino acid sequence is NOT: (1) encoded by the nucleotide sequence of DNA; (2) a form of genetic information; (3) read from N-terminal end to C-terminal end; (4) constant for proteins with the same function from different organisms.
11. All of the following statements about protein structure are correct EXCEPT: (1) Proline and hydroxyproline act as helix breakers; (2) Parallel β -sheets have all of their hydrophobic residues on one side of the sheet; (3) Glycine is the amino acid most likely to be found in a beta turn; (4) β -bulge forms between two normal β -structure hydrogen bonds and are comprised of two residues on one strand and one residue on the opposite strand.
12. All of the following are correct EXCEPT: (1) Chymotrypsinogen is the zymogen of chymotrypsin. (2) Isozymes are enzymes with slightly different subunits and various isozymes differ in terms of their affinity for substrates and sensitivity to inhibitors. (3)

- Allosteric enzymes obey Michaelis-Menten kinetics. (4) Regulatory enzymes may be stimulated by allosteric activators.
13. All are characteristics of ribozymes EXCEPT: (1) They are product specific. (2) They emerge from the reaction unchanged. (3) They enhance the reaction rate. (4) They are RNA molecules.
 14. Linkers are: (1) selectable markers incorporated into synthetic DNA. (2) short synthetic DNA duplexes consisting of a restriction site that is ligated onto DNA. (3) enzymes that link cloning sites in a sequence of nucleotides. (4) enzymes that incorporate foreign DNA into plasmids.
 15. The function of DNA topoisomerases is: (1) packaging DNA into nucleosomes. (2) forming cruciform DNA. (3) unwinding G:C rich areas in DNA. (4) breaking one or more strands of DNA, winding them tighter or looser, and rejoining the ends.
 16. Nucleotides have a nitrogenous base linked to a sugar by a: (1) α -anhydride bond; (2) β -ester bond; (3) β -N-glycosidic bond; (4) α -N-amide bond.
 17. All are characteristic of the gastric proton pump EXCEPT: (1) Gastric proton pump requires high levels of dietary K^+ to create a K^+ gradient. (2) Gastric proton pump is a H^+ , K^+ -ATPase. (3) Gastric proton pump maintains a pH gradient of about 6.6 across the mucosal cell membrane. (4) Gastric proton pump is electroneutral.
 18. Liposomes are all EXCEPT: (1) used to introduce contrast agents into the body for diagnostic imaging procedures. (2) able to fuse with cells. (3) highly unstable structures. (4) possible to prepare with different inside and outside solutions.
 19. The terpenes are all EXCEPT: (1) made up of isoprene monomers. (2) formed from two or more 2-methyl-1,3-butadiene molecules. (3) components of wool wax. (4) monomers units linked head to tail.
 20. Fatty acids are all EXCEPT: (1) either saturated or unsaturated. (2) found seldom in free form. (3) mostly found with an odd number of carbons. (4) found in linear, branched and cyclic forms.
 21. Cellulose and chitin are similar in all of the following ways EXCEPT: (1) Both are polymers of glucose. (2) Both are structural polysaccharides. (3) Both have extended ribbon conformations. (4) Both have extensive hydrogen bonding.
 22. All of the following are true EXCEPT: (1) Lactate is a homodisaccharide. (2) "Blood sugar" in hemolymph of insects is trehalose represented as $Glc\alpha\alpha Glc$. (3) Stachyose is typical of the oligosaccharide components found in beans. (4) Mucopolysaccharides such as hyaluronic acids form protective coats on animal cells.
 23. All are true for energy transduction EXCEPT: (1) includes dehydrogenase catalyzed reactions. (2) includes isomerase reactions. (3) includes oxidative phosphorylation. (4) chemical energy of carbon compounds to phosphate anhydride bonds.
 24. Which statement is NOT true? (1) In eukaryotic cells, glycolysis occurs in mitochondria and the TCA cycle reactions take place in the cytoplasm. (2) The oxidative decarboxylation of pyruvate to acetyl-CoA is catalyzed by pyruvate dehydrogenase complex. (3) Citrate synthase binds OAA and induces a conformational change which increases the binding of acetyl-CoA. (4) Aconitase catalyzes citrate isomerization to isocitrate by abstracting water from citrate to yield aconitate, then rehydration in the opposite position to produce isocitrate.

25. The correct sequence of electron transport in the succinate dehydrogenase reaction mechanism is: a. Coenzyme Q; b. FAD; c. iron-sulfur clusters; d. electron transport chain. The answer is: (1) abcd. (2) bcda. (3) bcad. (4) cbda.
26. Which is NOT true about ETS? (1) Complex II takes up two protons on the matrix side of the inner membrane and releases four protons on the intermembrane side for each pair of electrons passed through the Q cycle (2) UQH₂ is the electron donor to complex III. (3) Complex I and Complex II produce reduced coenzyme Q. (4) Complex I, III, and IV translocate protons in the inner mitochondrial membrane.
27. Which statement is NOT true? (1) The oxidation of malate to OAA is catalyzed by malate dehydrogenase. (2) The anaplerotic reactions associated with the TCA cycle are a result of the use of many of the TCA cycle intermediates in biosynthesis. (3) The reactions of the TCA cycle with large negative ΔG values include citrate synthase, isocitrate dehydrogenase, and α -ketoglutarate dehydrogenase. (4) Pyruvate dehydrogenase kinase is allosterically inhibited by high levels of NADH and acetyl-CoA.
28. The photosynthetic unit includes all EXCEPT: (1) Antenna chlorophylls. (2) The reactive center. (3) Oxidation of chlorophyll to a cationic free radical, $\text{Chl}^{\bullet+}$. (4) The cationic free radical is the Mg^{2+} ion.
29. Which statement is NOT true? (1) C-4 plants avoided photorespiration by transport of carbon dioxide from the mesophyll cells to the bundle sheath cells. (2) Glyceraldehyde-3-phosphate is used to re-synthesize ribulose-1, 5-bisphosphate in the dark reactions of photosynthesis. (3) To avoid futile cycling of carbohydrates, citric acid cycle, glycolysis and oxidative phosphorylation are off during the light. (4) ATP is hydrolyzed to ADP in the Calvin cycle.
30. Which statement is NOT true? (1) High concentrations of acetyl-CoA is absolutely essential for the activation of pyruvate carboxylase. (2) Cellular levels of fructose-2,6-bisphosphate are controlled by F-2,6-BPase and PFK-2. (3) Formation of UDP-glucose from glucose-1-phosphate requires UDP-glucose pyrophosphorylase and pyrophosphatase. (4) Glycogen synthesis and degradation must be carefully controlled at glycogen phosphorylase and glucokinase.
31. The sequence for activation of the release of fatty acids from adipose cells is: a. protein kinase activation; b. cAMP production; c. triacylglycerol lipase activation; d. fatty acid binding to serum albumin; e. hormone binding receptor; f. adenylyl cyclase activation; g. diacylglycerol lipase and monoacylglycerol lipase. The answer is: (1) efbacgd. (2) debafgc. (3) ebcgafd. (4) ebgdacf.
32. Which statement is NOT true for fatty acid catabolism? (1) Absorbed lipids are condensed with glycerol in the epithelial cells into triacylglycerols and re-packaged into chylomicrons that are transported by the lymphatic system and on into the bloodstream. (2) The majority of lipid digestion occurs in the duodenum by the enzyme pancreatic lipase. (3) Bile salts are important in the initial digestion of triacylglycerols in the intestine because they are coenzymes for pancreatic lipase. (4) Fatty acids are mobilized from adipose cells in response to glucagons, adrenaline, and ACTH.
33. Which statement is NOT true? (1) In inner mitochondrial membrane or endoplasmic reticulum, fatty acids are condensed with coenzyme A to form acyl-CoA. (2) Carnitine carries long-chain fatty acyl groups across the inner mitochondrial membrane. (3) The first

oxidation in the β -oxidation of saturated fatty acids is catalyzed by acyl-CoA dehydrogenase. (4) The reactions for producing acyl-CoA from fatty acid involves hydrolysis of ATP produces AMP and PPI, with further hydrolysis of PPI to drive the reactions.

34. Which statement is NOT true? (1) Propionyl-CoA is a product of β -oxidation of odd-chain fatty acids and is metabolized by carboxylation to D-methylmalonyl-CoA. (2) Methylmalonyl-CoA mutase produces succinyl-CoA and is B12-dependent. (3) During β -oxidation of certain unsaturated fatty acids, *cis*- Δ^3 -fatty acyl-CoAs are formed that must be converted to *trans*- Δ^2 -fatty acyl-CoAs by enoyl-CoA dehydrogenase. (4) 2,4-dienoyl-CoA reductase involves in saturated fatty acid catabolism.
35. All of the following statements are correct EXCEPT: (1) Adipocytes lack the enzyme glycerol kinase so that the futile cycle of triacylglycerol hydrolysis and synthesis is prevented. (2) Brown fat has high levels of mitochondria rich in cytochromes. (3) In addition to carbohydrate and lipid energy metabolism, the liver serves other purposes producing insulin to regulate metabolism. (4) Ethanol metabolism in liver is characterized by decreased gluconeogenesis activity resulting in hypoglycemia.
36. All of the following statements are correct EXCEPT: (1) During fasting or starvation, the brain utilizes β -hydroxybutyrate from the blood stream. (2) Glucose is pivotal to adipocyte metabolism for providing glucose-6-phosphate for generating NADPH from the pentose phosphate pathway. (3) During strictly anaerobic exercise, muscle cells preferentially reduce pyruvate to lactate. (4) Palmitic acid is one of the fuels for contracting muscles during strictly anaerobic metabolism.
37. All of the following statements are correct EXCEPT: (1) The term ketogenic amino acids refers to amino acids degraded to yield acetyl CoA or acetoacetate. (2) The carbon skeletons of glutamate converge to pyruvate. (3) α -ketoglutarate, succinyl-CoA, fumarate, and oxaloacetate are convergent metabolic intermediates of α -amino acid carbon skeletons. (4) 5-phosphoribosyl- α -pyrophosphate (PRPP) is the limiting substance in the biosynthesis of purines.
38. All of the following are true of the urea cycle EXCEPT: (1) It helps in the excretion of excess nitrogen. (2) Stimulation of carbamoyl-phosphate synthetase I (CPS-I) decreases the activity of the urea cycle. (3) It is linked to citric acid cycle through fumarate. (4) It is mainly confined to the liver.
39. All of the following statements are correct EXCEPT: (1) Proline acts in feedback inhibition of glutamine synthetase (GS) in prokaryotes. (2) An increase in the degree of adenylation of GS would be a result of a high [Gln]/[α -KG] ratio. (3) In plants and microorganisms, amino acid biosynthesis is a matter of synthesizing the appropriate α -ketoacid followed by transamination with glutamate. (4) All of the carbons and nitrogens of ornithine come biosynthetically from glutamate
40. The correct sequence for synthesis of mevalonate from acetyl-CoA is: A. HMG-CoA synthase; B. formation of 3-hydroxy-3-methylglutaryl-CoA; C. β -ketothiolase catalyzed condensation; D. HMG-CoA reductase activity; E. Formation of acetoacetyl-CoA. The answer is: (1) E, C, D, A, B. (2) C, D, A, B, E. (3) C, E, A, B, D. (4) E, B, A, C, D.

二、簡答題：20分

1. 胺基酸可依照其代謝產物分為 glucogenic 及 ketogenic 兩大類，只屬於 ketogenic 的胺基酸其英文縮寫為何？(4分)
2. 身體進行合成作用的主要能源來自何種 nucleotides? 而生成蛋白質、磷脂質及多醣體的主要能源分別來自何種 nucleotides? (8分)
3. 請依照先後順序寫出 glycolysis 的十個步驟中，與 ATP 消耗及產生有關的步驟分別需要哪些酵素？(8分)

- ※ 注意：1. 考生須在「彌封答案卷」上作答。
2. 本試題紙空白部份可當稿紙使用。
3. 考生於作答時可否使用計算機、法典、字典或其他資料或工具，以簡章之規定為準。