

第一大題 1~15：單選題，每題 2 分，合計 30 分。※ 注意：請於試卷內之「選擇題作答區」依序作答。

1. During aerobic glycolysis, pyruvate is most likely oxidized to _____ while in anaerobic glycolysis, pyruvate is converted to _____.
(A) acetaldehyde; ethanol
(B) acetyl-CoA; glyceraldehyde
(C) acetyl-CoA; lactate
(D) acetaldehyde; lactate
(E) none of the above.
2. In photosynthesis, light energy is transformed into ATP and biosynthetic reducing power into
(A) NADPH.
(B) NADH.
(C) ADP.
(D) AMP.
(E) None of the above.
3. The oxidation of malate to oxaloacetate is not thermodynamically favored under standard conditions. It occurs because:
(A) it involves substrate-level phosphorylation.
(B) it is coupled with a strong reduction.
(C) it is coupled with ATP hydrolysis.
(D) oxaloacetate is used in the next reaction, which has a negative ΔG .
(E) the previous reaction has a large negative ΔG .
4. ATP made in glycolysis and the TCA cycle is the result of _____ phosphorylation, and NADH-dependent ATP synthesis is the result of _____ phosphorylation.
(A) oxidative; substrate-level
(B) oxidative; electron
(C) substrate-level; electron
(D) substrate-level; oxidative
(E) proton-gradient; oxidative
5. All are characteristic of the conversion of glucose to lactate EXCEPT:
(A) anaerobic pathway with no net oxidation.
(B) "primed" by ATP phosphorylation.
(C) located in the cytosol.
(D) approximately 50% efficient in erythrocytes.
(E) net production of four ATP per glucose.
6. All are important reasons to phosphorylate glucose in the first step of glycolysis EXCEPT:
(A) the large positive free energy is important in getting the pathway started.
(B) glucose-6-phosphate has a negative charge preventing transport out of the cell.
(C) the concentration of free glucose in the cell is lowered favoring influx of glucose.
(D) phosphorylation keeps the glucose in the cell.
(E) regulatory control can be imposed only at a reaction not at equilibrium.
7. Substrate-level phosphorylation occurs in glycolysis in the reaction catalyzed by _____ and belongs to _____ class of enzymes.
(A) phosphoglycerate kinase; transferase
(B) hexokinase; transferase
(C) phosphofructokinase; transferase
(D) glucokinase; transferase
(E) glyceraldehyde-3-phosphate dehydrogenase; oxidoreductase
8. The only reaction of the citric acid cycle that provides substrate-level phosphorylation is catalyzed by:
(A) malate dehydrogenase.
(B) citrate synthase.
(C) isocitrate dehydrogenase.
(D) succinyl-CoA synthetase.
(E) nucleotide triphosphate kinase.

見背面

9. The pentose phosphate pathway is an important source of _____, and for _____, an essential precursor for ATP, NAD⁺, FAD, CoA, DNA and RNA.
(A) ATP; NADH
(B) NADH; NADPH
(C) NADPH; ribose-5-phosphate
(D) ribose-5-phosphate; ATP
(E) all are true
10. Which of the following statements about the light reactions of photosynthesis is true?
(A) There are two distinct photosystems, linked together by a mechanism similar to electron transport.
(B) The source for electrons is located in the stroma of the thylakoid.
(C) The Mn complex is the primary electron acceptor and is located on photosystem I.
(D) The ultimate electron donor is molecular oxygen.
(E) Plastoquinone is a fixed electron transporter in the system located in the inner membrane.
11. The primary storage form of lipid is _____ and it is normally stored in the _____.
(A) phospholipid; liver
(B) cholesterol; muscles
(C) monoacylglycerol; adipocytes
(D) triacylglycerols; adipocytes
(E) triacylglycerols; liver
12. In the citric acid cycle, acetyl-CoA reacts with _____ to produce _____.
(A) fumarate; -ketoglutarate
(B) oxaloacetate; citrate
(C) citrate; isocitrate
(D) succinyl-CoA; oxaloacetate
(E) malate; cis-aconitate
13. What is the committed step in fatty acid biosynthesis?
(A) Binding of the fatty acyl group to the acyl carrier protein.
(B) Synthesis of malonyl CoA.
(C) Transacylase reaction.
(D) The formation of acetoacetyl-ACP.
(E) None of the above.
14. Organisms capable of atmospheric nitrogen fixation include:
(A) some bacteria and archaea.
(B) higher eukaryotic organisms, such as mammals.
(C) all plants.
(D) fungi, including yeasts and molds.
(E) None of the above.
15. The brain normally uses _____ as its source of metabolic energy, but during starvation _____ may be the major source of energy.
(A) glucose; ketone bodies
(B) ketone bodies; fatty acids
(C) fatty acids; amino acids
(D) amino acids; glucose
(E) all are true

第二大題 16~27：問答題，合計 70 分。※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

16. Please briefly describe the different and common features of the “Q cycle” in mitochondria and chloroplast. (6%)
17. What is metabolomics? What are the principle tools for metabolomics analyses? (4%)
18. How are triacylglycerols mobilized from the adipose tissues? (5%)

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19. Some researchers have proposed that photosystem II (PSII) is the most important enzyme system in the history of life. Do you agree with them? Please explain your reasoning. (5%)
20. Please answer the names of the enzymes which can be inhibited by the indicated drugs (a~e) listed below. (10%)
- (a) Lipitor
 - (b) Allopurinol
 - (c) Methotrexate
 - (d) Penicillin
 - (e) 5-Fluorouracil
21. Please draw the molecular structures of the indicated sugar derivatives (a~d) listed below. (8%)
- (a) N-acetylglucosamine
 - (b) Glucuronic acid
 - (c) Methyl- β -D-glucoside
 - (d) 2-deoxy- α -D-ribose
22. Please draw the molecular structures of the indicated fatty acids and glycerophospholipids (a~c) listed below. (6%)
- (a) Linoleic acid
 - (b) Arachidonic acid
 - (c) Phosphatidylserine
23. Please describe the structural features of the right-handed alpha-helix in proteins. (5%)
24. Chymotrypsin, trypsin, and elastase are all serine-type proteases. Why do they have different substrate specificity? (5%)
25. Please describe the single-displacement (sequential) and double-displacement (ping-pong) bi-substrate enzyme reactions. (5%)
26. Please describe the DNA sequencing method developed by Frederick Sanger. (5%)
27. Please describe the mechanism of the genome editing with CRISPR/Cas9 system. (6%)

試題隨卷繳回