

考生注意事項：所有考題務必在答案卷上作答，在問題卷上作答者不計分。

I. 選擇題（每題二分，答錯倒扣 0.5 分，均為單選）

1. Lipoprotein lipase, pancreatic lipase and hormone sensitive lipase are important enzymes involved in lipid metabolism, but they play different roles in lipid metabolism due to:
 - A. they act on different substrates.
 - B. they locate in different tissues.
 - C. they need different cofactors.
 - D. they are sensitive to different temperatures.
 - E. other reasons.
2. Fatty acids are activated to acyl-CoAs in cytosol and the acyl group is transferred to mitochondria by acyl-carnitine, because:
 - A. acyl-CoAs easily cross the mitochondrial membrane, but the fatty acids themselves will not.
 - B. fatty acids cannot be oxidized by FAD unless they are in the acyl-carnitine form.
 - C. carnitine is required to oxidized NAD⁺ to NADH.
 - D. acyl-carnitines readily cross the mitochondrial inner membrane, but acyl-CoAs do not.
 - E. none of the above is true.
3. If lauric acid is oxidized completely to carbon dioxide and water via the β -oxidation pathway and the citric acid cycle, and all of the energy conserving products are used to drive ATP synthesis in the mitochondrion, the net yield of ATP per molecule of laurate is:
 - A. 3.
 - B. 10.
 - C. 95.
 - D. 150.
 - E. 300.

（背面仍有題目，請繼續作答）

4. The hormone sensitive lipase is to hydrolyze:
- lipids stored in the liver.
 - lipids stored in the adipose tissue.
 - lipids in serum.
 - membrane phospholipids in hormone-producing cells.
 - none of the above.
5. Which of the following compounds is an intermediate of the β -oxidation of fatty acids?
- $\text{CH}_3\text{-CH}_2\text{-CO-CH}_2\text{OH}$.
 - $\text{CH}_3\text{-CH}_2\text{-CO-CH}_2\text{-CO-OPO}_3^{2-}$.
 - $\text{CH}_3\text{-(CH}_2\text{)}_{20}\text{-CO-COOH}$.
 - $\text{CH}_3\text{-CO-CH}_2\text{-CO-S-CoA}$.
 - $\text{CH}_3\text{-CH}_2\text{-CO-CO-S-CoA}$.
6. If an aerobic organism were fed each of the following four compounds as a source of energy, the energy yield from these substrates, in terms of ATP/mole, would be in the order:
- glucose>alanine>succinate>palmitate.
 - palmitate>glucose>alanine>succinate.
 - palmitate>succinate>glucose>alanine.
 - glucose>palmitate>succinate>alanine.
 - succinate>glucose>alanine>palmitate.
7. In the β -oxidation, every acetyl-CoA removed from a saturated fatty acid would produce:
- 1 mole of FADH_2 and 1 mole of NADPH.
 - 1 mole of FADH_2 and 2 moles of NADH.
 - 2 moles of FADH_2 and 2 moles of NADH.
 - 1 mole of FADH_2 and 1 mole of NADH.
 - 2 moles of FADH_2 and 1 mole of NADH.

8. The following fatty acid, in which the indicated carbon is labeled with ^{14}C , is fed to an animal:



After allowing 30 minutes for fatty acid β -oxidation, the label would most likely be recovered in:

- A. acetyl-CoA.
B. propionyl-CoA.
C. both acetyl-CoA and propionyl-CoA.
D. butyl-CoA.
E. none of the above.
9. A 30-carbon precursor of the steroid nucleus is:
- A. isopentenyl pyrophosphate.
B. geranylpyrophosphate.
C. squalene.
D. farnesylpyrophosphate.
E. none of the above.
10. Fatty acid is synthesized by the addition of two carbon units to the growing fatty acid chain, which is driven by:
- A. hydrolysis of ATP.
B. oxidation of NADPH.
C. reduction of NADP^+ .
D. decarboxylation of malonyl-CoA.
E. none of the above.

11. For acetyl-CoA to be available in the cytoplasm for use in fatty acid biosynthesis, it must be transported from the mitochondria to cytoplasm. What shuttle system is responsible for this transport?
- A. Citrate-malate-oxaloacetate.
 - B. Oxaloacetate-pyruvate.
 - C. Citrate-malate-pyruvate.
 - D. Carnitine acyltransferase.
 - E. None of the above.
12. In the acetyl-CoA carboxylase catalyzed reaction, palmitoyl-CoA acts as a(n):
- A. effector of the energy charge.
 - B. allosteric activator.
 - C. competitive inhibitor.
 - D. feed back inhibitor.
 - E. cofactor.
13. Which of the following molecules is not transported in the blood by lipoprotein?
- A. Fatty acid.
 - B. Triacylglycerol.
 - C. Cholesterol esters.
 - D. Phospholipids.
 - E. None of the above.
14. Which of the following metabolic pathways is responsible for the generation of reducing power for biosynthetic reactions?
- A. Gluconeogenesis.
 - B. Oxidative phosphorylation.
 - C. β -oxidation of fatty acids.
 - D. Pentose phosphate pathway.
 - E. None of the above.

15. In intermediary metabolism, the stoichiometry for which of the following molecules is determined by a evolutionary design?
- A. NADPH.
 - B. ATP.
 - C. NADH.
 - D. $FADH_2$.
 - E. None of the above.
16. The uptake of cholesterol via low density lipoprotein receptor would :
- A. down regulate the LDL receptor.
 - B. enhance the ACAT activity.
 - C. inhibit the HMGCoA reductase.
 - D. cause A, B, and C to occur.
 - E. cause nothing to happen.
17. Which of the following steroid hormones is C-21?
- A. Aldosterone.
 - B. Dehydroepiandrosterone.
 - C. Estradiol.
 - D. Testosterone.
 - E. Vitamin D.
18. Receptors for steroid hormones are found in:
- A. cell membranes.
 - B. cytoplasm.
 - C. ribosomes.
 - D. mitochondria.
 - E. Golgi apparatus.

19. The direct effect of cAMP in the protein kinase A pathway is to:
- A. activate adenylate cyclase.
 - B. dissociate regulatory subunits from protein kinase.
 - C. phosphorylate certain cellular proteins.
 - D. phosphorylate protein kinase A.
 - E. release hormones from a target tissue.
20. Activation of phospholipase C initiates a sequence of events including all of the following except:
- A. release of inositol 4,5-bisphosphate from a phospholipid.
 - B. increase in intracellular Ca^{2+} concentration.
 - C. release of diacylglycerol from a phospholipid.
 - D. activation of protein kinase C.
 - E. phosphorylation of certain cytoplasmic proteins.
21. Which of the following statements about phosphofructokinase-1 is **INCORRECT**?
- A. ATP is a substrate of the enzyme.
 - B. ATP is a negative modulator of the enzyme.
 - C. It is a major regulatory enzyme in glycolysis.
 - D. It is inhibited by NAD^+ .
 - E. Fructose-2,6-bisphosphate is a positive modulator of the enzyme.
22. Which of the following enzymes catalyzes the formation of the first energy-rich compound in glycolysis?
- A. Pyruvate kinase
 - B. Glyceraldehyde-3-phosphate dehydrogenase
 - C. Enolase
 - D. Hexokinase
 - E. Phosphoglycerate kinase

23. How many ATP molecules are produced from each glucose unit in glycogen molecule converted to pyruvate?
- A. one
 - B. two
 - C. three
 - D. four
 - E. none of the above
24. Drug induced hemolytic anemia is a genetic disorder involving a deficiency of
- A. pyruvate kinase.
 - B. pyruvate dehydrogenase.
 - C. glucose-6-P dehydrogenase.
 - D. lactase.
 - E. galactokinase.
25. The reaction Fructose-1,6-bisphosphate \rightleftharpoons dihydroxyacetone phosphate + glyceraldehyde-3-phosphate has a ΔG° of +23.9 kJ/mol at 25°C. One can predict that
- A. the reaction as written cannot occur in a cell.
 - B. the reaction is always at equilibrium.
 - C. the reaction as written can occur in a cell, if non-equilibrium intracellular concentrations make such reactions exergonic.
 - D. Fructose-1,6-bisphosphate will rapidly convert to dihydroxyacetone phosphate + glyceraldehyde-3-phosphate.
 - E. none of the above.
26. The operation of malate-aspartate shuttle does **NOT** require the existence of
- A. aspartate aminotransferase.
 - B. malate dehydrogenase.
 - C. malate- α -ketoglutarate transporter.
 - D. acetyl CoA.
 - E. glutamate-aspartate transporter.

27. The E_o' for the redox pair NAD^+/NADH is -0.32 V , and the E_o' for oxaloacetate/malate is -0.17 V . What is the standard free-energy change of the following reaction? ($F = 96.5\text{ kJ/V}\cdot\text{mol}$)



- A. -14.46 kJ/mol
 - B. $+14.46\text{ kJ/mol}$
 - C. -28.95 kJ/mol
 - D. $+28.95\text{ kJ/mol}$
 - E. -0.15 kJ/mol
28. According to chemiosmotic coupling hypothesis the driving force for ATP synthesis during oxidative phosphorylation is
- A. electrons.
 - B. the proton gradient.
 - C. oxygen.
 - D. high energy compounds.
 - E. none of the above.
29. How many moles of high-energy phosphates are consumed per mole of glucose synthesized from pyruvate by gluconeogenesis?
- A. two
 - B. four
 - C. six
 - D. ten
 - E. twelve
30. The coenzyme of transketolase is
- A. thiamine pyrophosphate.
 - B. FMN.
 - C. FAD.
 - D. NAD^+ .
 - E. pyridoxal phosphate.

II. 選擇題 (每題二分, 答錯倒扣 0.5 分, 均為單選)

Answer the following questions using the key outlined below

- (A) if 1, 2, and 3 are correct
- (B) if 1 and 3 are correct
- (C) if 2 and 4 are correct
- (D) if only 4 is correct
- (E) if all four are correct

31. Glucokinase

- 1. is found in the liver.
- 2. catalyzes a reversible reaction in glycolysis.
- 3. requires ATP for reaction.
- 4. has a low K_M for glucose.

32. Which of the following enzymes catalyzes a reaction that produces both CO_2 and NADH?

- 1. Succinate dehydrogenase
- 2. α -Ketoglutarate dehydrogenase
- 3. Fumarate hydratase
- 4. Isocitrate dehydrogenase

33. The citric acid cycle is stimulated by

- 1. high concentration of oxaloacetate.
- 2. high ratio of $[\text{NAD}^+]/[\text{NADH}]$.
- 3. high ratio of $[\text{ADP}]/[\text{ATP}]$.
- 4. high concentration of succinyl-CoA.

34. The rate of mitochondrial respiration is inhibited by a deficiency of

- 1. DNP.
- 2. ATP.
- 3. ionophore.
- 4. ADP.

(背面仍有題目, 請繼續作答)

35. Glycogen synthase

1. uses UDP-glucose as the activated substrate.
2. is regulated by phosphoprotein phosphatase.
3. is activated by dephosphorylation.
4. catalyzes addition of glucose residues to the reducing end of a glycogen chain.

36. Glucagon triggers an increased rate of glycogen breakdown in liver by causing:

1. the allosterical activation of glycogen phosphorylase.
2. the dephosphorylation of phosphorylase kinase.
3. the dephosphorylation of glycogen phosphorylase a.
4. the conversion of glycogen phosphorylase b to glycogen phosphorylase a.

37. The addition of 2,4-dinitrophenol to a suspension of mitochondria carrying out active respiration, which of the following events will occur?

1. oxygen consumption increases.
2. oxygen consumption decreases.
3. the P/O ratio drops to zero.
4. do none of the above.

38. The gluconeogenesis enzyme glucose-6-phosphatase is regulated

1. allosterically.
2. by phosphorylation.
3. by feedback inhibition.
4. by availability of substrate.

39. Which of the following statements concerning Cori cycle is correct?

1. The Cori cycle is active when muscle is involved in anaerobic glycolysis.
2. Lactate dehydrogenase is one of the enzymes that form the Cori cycle.
3. During the Cori cycle, muscle produces lactate and liver produces glucose.
4. NH_3 is the by-product of the Cori cycle.

40. Glycogen degradation is stimulated by the active forms of the enzymes

1. phosphorylase kinase.
2. debranching enzyme.
3. phosphorylase.
4. phosphoprotein phosphatase.

III 問答題 (20%)

41. 單株抗體(monoclonal antibody), 近年來常被運用在生物醫學研究及臨床診斷上。其製備常通用融合瘤(hybridoma)技術, 常用之骨髓瘤細胞(myeloma cells)通常可分為 thymidine kinase 及 hypoxanthine phosphoribosyl transferase 缺失兩種。請分別敘述其原理、篩選機制、及操作程序去取得單株抗體。