考生注意事項：所有考題務必在答案卷上作答。凡在問題卷上作答者無效。

一、選擇題（均為單選，每題 1 分，答錯倒扣 0.25 分）

1. The coenzyme involved in the decarboxylation of pyruvate in the pyruvate dehydrogenase complex is :

   A. Lipoamide

   B. TPP

   C. biotin

   D. coenzyme A

   E. none of the above

2. If one mole of isocitrate is oxidized to one mole of α-ketoglutarate and one mole of CO_2 in the mitochondria, $\frac{1}{2}$ mole of molecular oxygen($\frac{1}{2}O_2$) is consumed. In this reaction :

   A. 3 moles of NAD^+ are reduced.

   B. One mole of FMN is reduced.

   C. 2 moles of $NADP^+$ are reduced.

   D. 3 moles of ATP are formed from AMP.

   E. None of the above.

3. Which of the following enzymes is the main point of control of glycolysis ?

   A. hexokinase

   B. pyruvate kinase

   C. 6-phosphofructo-1-kinase

   D. 6-phosphofructo-2-kinase

   E. none of the above

4. Glycogen phosphorylase

   A. is inactivated by action of phosphorylase kinase.

   B. gives glucose-6-phosphate when the enzyme acts on glycogen.

   C. acts on the reducing end of the glycogen molecule.

   D. is activated by action of phosphorylase phosphatase.

   E. none of the above.

5. How many moles of NADPH are generated in the cytoplasm as a result of converting 1 mole of glucose-6-phosphate to ribose-5-phosphate via the pentose phosphate pathway ?

   A. 0

   B. 1

   C. 2

   D. 3

   E. none of the above

6. Type I glycogen storage disease (Von Gierke) is due to a deficiency of

   A. debranching enzyme.

   B. braching enzyme.

C. phosphorylase.

D. glucose-6-phosphatase.

E. none of the above.

7. Uric acid is

A. formed from xanthine in the presence of O_2.
B. a degradation product of cytidine.
C. deficient in the condition know as gout.
D. a competitive inhibitor of xanthine oxidase.
E. oxidized, in humans, before it is excreted in urine.

8. Nitrogen atom at position 1 of purine ring is derived in denovo synthesis from

A. glycine.
B. asparagine.
C. glutamine.
D. aspartic acid.
E. lysine.

9. Folic acid deficiency lead to megaloblastic anemia by slowing down in the folate-dependent steps in

A. pyrimidine synthesis.
B. the conversion of IMP to AMP and GMP.
C. purine synthesis and the conversion of dUMP to dTMP.
D. the reduction of ribose to deoxyribose.
E. aminates the pyrimidine ring of purines.

10. Which of the following coenzymes is not derived from nucleotides?

A. coenzyme A
B. coenzyme Q
C. FAD
D. NAD
E. none of the above

二選擇題（每題2分，答錯倒扣 0.5分）

Answer questions (11-15) according to the following key:
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.

11. The overall chemical changes that occur during one complete turn of the citric acid cycle include which of the following reactions:

1. the production of a molecule of CO_2 and the phosphorylation of one molecule of GDP.
2. the complete oxidation of one molecule of acetyl-CoA.
3. the reduction of three molecules of NAD^+ and one molecule of FAD.
4. the production of 12 molecules of ATP directly.

12. The enzymes involved in the oxidation-reduction reactions in the citric acid cycle are

1. succinyl-CoA synthetase.
2. succinate dehydrogenase.
3. aconitase.
4. isocitrate dehydrogenase.

13. A negative nitrogen balance is likely to be found in

    1. an adult on a lysine deficient diet.
    2. a healthy adult.
    3. a child on a lysine-deficient diet.
    4. a growing child.

14. The glutathione contains:

    1. threonine
    2. glycine
    3. serine
    4. cysteine

15. Which of the following conversion(s) occur(s) in humans?

    1. serine to cysteine
    2. phenylalanine to tyrosine
    3. homocysteine to methionine
    4. glutamate to proline

三、問答題

16. (3%) Write a balanced equation for the synthesis of orotate from glutamine, CO_2 and aspartate.

17. (8%) Most mammalian cells can obtain purine nucleotide and thymidylic acid in two ways. Describe these two ways briefly.

18. (4%) What are the four reactions that occur in liver cells that involve glucose-6-phosphate as a substrate?

19. (4%) What is the origin of the two phosphate groups in UDP-glucose?

20. (4%) Can the glycolytic pathway operate in the reverse direction? how can pyruvate be converted into glucose?

21. (4%) What is the molecular action of epinephrine on the glycogen degradation in a liver cell?

22. (4%) Cells which do not possess mitochondria regenerate cytoplasmic NAD^+ by the conversion of pyruvate to lactate for continued glycolysis; whereas cells that possess mitochondria can use pyruvate when oxygen is available. How do these cells regenerate the cytoplasmic NAD^+?

23. (5%) Pyridoxal phosphate is a coenzyme in amino acid decarboxylation. What is a likely mechanism of the decarboxylation?

24. (4%) What effect will high concentrations of NADPH and α-ketoglutarate have on the formation of ammonia from glutamate?

25. (2%) Predict the form in which excess ammonia be excreted in the following organisms: tadpoles, frogs, birds, and mammals.

26. (5%) What is the significance of high concentration of alanine and glutamine in normal blood circulation?

27. Methotrexate is an effective antileukemic agent. Give a short explanation. (3%)

28. (6%) Discuss the pathways which generate reducing equivalents for lipid biosynthesis.

29. (6%) Describe the role of citrate in lopid biosynthesis.

30. Describe the role of carnitine in lipid metabolism.

31. Discuss the main features of LDL pathway and their significance in regulating cholesterol metabolism.

32. (6%) Compare the activities of glycolysis and TCA cycle of a normal person with which of a diabetic patient and calculate their efficiency of energy production.