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. Electrons from succinate enter the mitochondrial electron transport chain at the level of
   A. NADH-Q reductase.
   B. coenzyme Q.
   C. cytochrome bC_1 complex.
   D. cytochrome C oxidase.
   E. None of the above

2. Sucrose

   A. is a reducing sugar because carbon 1 of the fructose residue is free.
   B. is a polysaccharide.
   C. can not undergo mutarotation.
   D. is not a reducing sugar because carbon 1 of the fructose residue forms a glycoside with glucose.
   E. None of the above

3. A vitamin that contains sulfur is

   A. folic acid.
   B. vitamin B_1.
   C. riboflavin.
   D. vitamin B_{12}.
   E. vitamin B_6.

4. A person taken high cholesterol diet will have high plasma LDL, because of his liver LDL receptor is

   A. saturated.
   B. down regulated.
   C. up regulated.
   D. deactivated.
   E. destroyed.

5. Which of the following compounds is a essential fatty acid?

   A. Arachidonic acid
   B. Oleic acid
   C. Stearic acid
   D. Linoleiç acid
   E. Palmitic acid

6. Lipoprotein lipase is

   A. for the mobilization of triacylglycerols from adipos tissue.
   B. for the uptake of fatty acids from lipoprotein.
   C. for the synthesis of lipoprotein.
   D. to remove cholesterol from the blood.
   E. to redistribute lipoproteins.

7. Which of the following membrane has the highest fluidity?

   A. A membrane with high contents of unsaturated fatty acids.
   B. A membrane with low contents of unsaturated fatty acids.
   C. A membrane with high contents of saturated fatty acids.
   D. A membrane with low contents of saturated fatty acids.
   E. A membrane with high contents of cholesterol.

8. Adipose tissue responds to low insulin: glucagon by

   A. dephosphorylating the interconvertible enzymes.
   B. stimulating the deposition of fat.
   C. increasing the amount of pyruvate kinase.
   D. stimulating hormone-sensitive lipase.
   E. stimulating phenylalanine hydroxylase.

9. Peptide hormones

A. are synthesized as large precursors.
B. are free of carbohydrate.
C. may have structural homologies with one another.
D. consist of a single polypeptide chain.
E. none of the above

10. Plasma membrane receptors for peptide hormones

A. generally mediate the effect of the hormone by mechanisms independent of adenylate cyclase.
B. determine the specificity of cell responses to hormones.
C. must be fully saturated by the appropriate hormone to produce a maximal physiological response.
D. are generally easy to isolate and purify.
E. none of the above

11. Hormones may act

A. by phosphonylating or dephosphonylating enzymes.
B. by binding to enzymes and causing subunit association or dissociation.
C. indirectly by second messenger.
D. as enzyme cofactors.
E. none of the above

12. The mediation of a hormonal signal by CAMP is an example of

A. exocytosis.
B. endocytosis.
C. transduction.
D. negative feedback.
E. none of the above

13. Glucagon and insulin are similar in that both

A. act by direct stimulation of adenylate cyclase.
B. are not produced by the pancreas.
C. affect liver and adipose tissue metabolism.
D. have cytosolic receptors.
E. none of the above

14. Steroid hormones

A. are all synthesized in most tissues of the body.
B. have long half-lives and so are stored in endocrine tissues until needed.
C. in blood, circulate in both the free form and bound to protein.
D. are converted to excretory forms in the tissues that synthesize them.
E. none of the above

15. Various steroids are required for various physiological function. If only the estrogen formation is considered to block, what enzyme in steroidogenic pathways should be inhibited?

A. cholesterol side chain cleavage enzyme.
B. 17α-hydroxylase.
C. 21-hydroxylase.
D. aromatase.
E. none of the above

16. Which of the following is common to the synthesis of all steroid hormones?

A. Cholesterol side chain cleavage.
B. Conversion of pregnenolone to progesterone.
C. 17α-hydroxylation.
D. 21-hydroxylation.
E. None of the above

17. Metabolites of steroid hormones

A. are frequently conjugated with either sulfate or glucuronate.
B. no longer have an intact steroid ring system.
C. are not present in the enterohepatic circulation.
D. must circulate in the blood bound to 17β-globulin.
E. none of the above

18. Estrogen

A. effects are confined to sexual maturation and sexual characteristics.
B. production is not related to LH and FSH levels.
C. is inactivated by conversion to estrone.
D. is synthesized from endrogen by the action of an aromatase.
E. none of the above

19. Crude DNA extract can be purified by centrifugation in the

A. cesium chloride solution.
B. phenol/chloroform solution.
C. 70% ethanol solution.
D. sodium-chloride solution.
E. distillated water.

20. An intervening sequence is

A. that part of a protein that is removed by limited proteolysis.
B. that part of a protein between sites of attachment of carbohydrate.
C. that part of a tRNA molecule that is not double stranded.
D. the DNA sequence that separates one gene from another.
E. the nontranslated DNA sequences that interrupted the translated sequence.

21. Which of the following statements concerning DNA gyrase is INCORRECT? DNA gyrase

A. is a type II topoisomerase.
B. is one of several enzymes required for DNA replication.
C. requires ATP to generate supercoiling.
D. is inhibited by novobiocin.
E. is able to produce negative superhelicity but doesn't have a DNA-breaking-sealing activity.

22. Diphtheria toxin inhibits translation by

A. activating a protein kinase, which phosphorylates the initiation factor IF-2.
B. inhibiting the initiation factor IF-2.
C. covalently modifying the elongation factor EF-2.
D. promoting the dissociation of 40S and 60S ribosomal subunits.
E. transferring the nicofinamide moiety of NAD^+ to the elongation factor EF-2.

23. The "Wobble" hypothesis refers to the less stringent base-pairing specificity of the

A. 5'-end base of the codon.
B. 3'-end base of the anticodon.
C. middle base of the anticodon.
D. 5'-end base of the anticodon.
E. middle base of the codon.

24. Which of the following statements about the B-form structure of DNA is INCORRECT?

A. The bases of the pairs are almost perpendicular to the helical axis.
B. The strands of the double helix are antiparellel.
C. When the relative humidity of the fiber is increased to 150% B-form structure will collapse and become to A form structure.
D. The most typical form of DNA occurring in the cell.
E. The centers of the bases are 3.4Å apart and produce a complete turn of a helix with a pitch of 34Å.

二選擇題（每題 2 分，答錯倒扣 0.5 分）

Answer questions 25-30 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 are correct

25. Galactose

1. is an epimer of glucose.
2. results from the hydrolysis of lactose.
3. is a reducing sugar.
4. is an anomer of glucose.

26. Hyaluronic acid

1. is a proteoglycan.
2. is a high molecular weight, positively charged polysaccharide.
3. contains large segments of a repeating disaccharide unit consisting of a hexosamine and a uronic acid.
4. is a polymer which contains sulfate.

27. The symptoms of scurvy are due to

1. a failure to incorporate ascorbic acid into the procollagen molecule.
2. a failure to remove the N-terminal fragments from procollagen molecules.
3. inadequate cross-linking of the α-chains in tropocollagen.
4. inadequate formation of hydroxyproline and hydroxylysine.

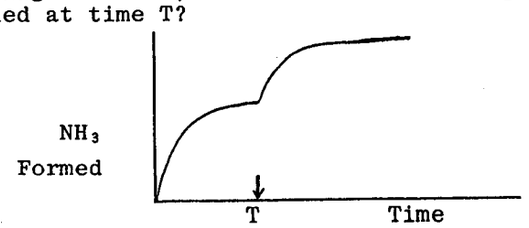
28. Vitamin D_3

1. increases the absorption of calcium from the intestine.
2. deficiency in children leads to rickets.
3. requires the activity of both liver and kidney enzymes to be converted to its biologically active form.
4. has the same ring structure as cholesterol.

29. Urease is an enzyme following Michaelis-Menten kinetics
It catalyzes the reaction

$$\text{urea} + 2H_2O \rightleftharpoons 2NH_3 + H_2CO_3$$

and is inhibited by glycine.
In the diagram below, which of the following materials could have been added at time T?



1. More glycine
2. More urease
3. More ammonia
4. More urea

30. The effect of pH on an enzyme catalyzed reaction reflects

    1. ionization of the enzyme-substrate complex.
    2. ionization of the enzyme.
    3. ionization of the catalytic site of the enzyme.
    4. conformational change of the enzyme.

三簡答題

31. (3%) Explain how land animals can cool themselves by surface evaporation with minimum expenditure of body fluid.

32. (3%) The pKa values of arginine are as follows:

    pKa_1 (α-carboxyl)=2.2
    pKa_2 (α-amino)=9.0
    pKa_3 (side chain)=12.5

    (a) What is the pI of arginine?
    (b) What is the net charge of arginine at pH=6.0?

33. (3%) The amino group of alanine, which has a pK of 9.7, can exist in either the protonated form or the free base.

    (a) In what pH zone can alanine be used as an effective buffer due to its amino group?
    (b) In order to have 99% of the amino group of alanine in the protonated form, what must the pH of the solution?

34. (2%) List four characteristic properties of globular proteins which can be used for protein separations.

35. (4%) Describe briefly two methods which can be used for the cleavage of disulfide bonds in proteins. What are the cleavage products?

36. (2%) What are the two most prevalent secondary structures in native proteins?

37. (5%) What is the physiological significance of the Bohr effect in oxygen-hemoglobin equilibrium?

38. (3%) Name two bile pigments. What is their precursor?

39. (4%) If you assume that the Eo' for 2 Cyta(Fe^{+++})+$2e^-$ ⟶ 2 Cyta(Fe^{++}) is 0.29 volts, the Eo' for $\frac{1}{2}O_2+2H^+ + 2e^-$ ⟶ H_2O is 0.82 volts, and the formation of ATP from ADP and Pi under the conditions in question requires a free energy change of 7.3 kcal/mol; calculate the ΔGo' that can be obtained and the percentage efficiency of energy conservation in ATP as Cyta is oxidized by oxygen. (F=23.062 kcal/V.mol)

40. (8%) What is the effect of each of the following inhibitors on electron transport and ATP formation by the respiratory chain?

    A. Atractyloside
    B. Oligomycin
    C. DNP
    D. Antimycin A

41. (2%) Describe the term "Respiratory contorl".

42. (3%) Describe the possible roles of metal ions in enzymic catalysis.

43. (4%) Describe the factors contributing to the decrease in activation energy.

44. (4%) What are the possible types of physiological regulation of enzyme activity?

45. (5%) Describe the basic model for DNA replication in E coli (summarize the proposed events that occur in or near a replication fork in E. coli.)

46. (5%)
(A) Give possible explanations why a simply cloned eukaryotic gene will not usually yield functional mRNA in a bacterial host.
(B) Assuming the problem in (A) is solved, give possible reasons why a desired protein may not be made by a eukaryotic gene cloned in a bacterium.

47. (4%) A DNA fragment containing 19 base pair is sequenced by the Maxam-Gilbert procedure. The figure below show the data; panels 1 and 2 correspond to the two complementary strands. What are the complete sequence of the two complementary strands.