

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

一. 選擇題：(70 分，每題 2 分)

1. Which of the following organelles are involved in autophagy?

- (a) Mitochondria
- (b) Lysosomes
- (c) Chloroplasts
- (d) Golgi apparatus
- (e) Endoplasmic Reticulum

2. Which of the following eukaryotic organelles is a key regulator of apoptosis?

- (a) Mitochondria
- (b) Flagella
- (c) Chloroplasts
- (d) Cilia
- (e) Ribosomes

3. Salt bridges in proteins are an example of \_\_\_\_\_.

- (a) Hydrogen bonds
- (b) Ionic interactions
- (c) Hydrophobic interactions
- (d) van der Waals forces
- (e) London dispersion forces

4. Red blood cells are isotonic to a solution that is 0.9% sodium chloride. These same cells are \_\_\_\_\_ to a solution that is 0.9% sodium sulfate.

- (a) Isotonic
- (b) Hypertonic
- (c) Hypotonic
- (d) Tonic
- (e) Nontonic

5. The most important direct source of energy in the body is:

- (a) ATP
- (b) ADP
- (c) GTP
- (d) Glucose
- (e) Fatty acids

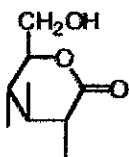
6. Which of the following compounds would liberate the most free energy on hydrolysis?

- (a) ATP
- (b) Phosphoenolpyruvate
- (c)  $PP_i$
- (d) ADP
- (e) GTP

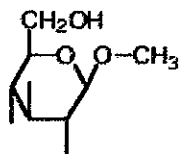
7. How many molecules of oxygen are required to completely oxidize one mole of stearic acid ( $C_{17}H_{35}COOH$ )?  
 (a) 18  
 (b) 9  
 (c) 34  
 (d) 45  
 (e) 53
8. Which of the following amino acids can participate in covalent catalysis?  
 (a) Tryptophan  
 (b) Tyrosine  
 (c) Serine  
 (d) Glycine  
 (e) Alanine
9. The lock and key model of enzyme activity proposes that each  
 (a) Enzyme can react with only a single substrate  
 (b) Enzyme has a cofactor that promotes the catalytic activity  
 (c) Substrate has a specific cofactor that binds it to the enzyme  
 (d) Enzyme binds a specific substrate because the active site and substrate have complementary structures  
 (e) Both (a) and (b) are correct
10. Alcohol dehydrogenase is an example of which of the following classes of enzymes?  
 (a) Oxidoreductases  
 (b) Transferase  
 (c) Hydrolase  
 (d) Lyase  
 (e) Isomerase

11. Which of the following is a glycoside?

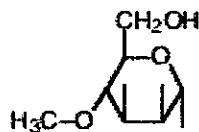
(a)



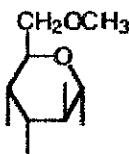
(b)



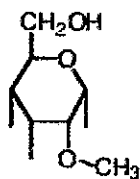
(c)



(d)



(e)



12. Carbohydrate is thought to enhance the stability of protein molecules by:
- (a) Changing the protein's shape to better resist denaturation.
  - (b) Protecting the underlying protein from the action of proteolytic enzymes
  - (c) Using hydrogen bonding to increase the stability of the protein
  - (d) Both (a) and (b) are correct
  - (e) All of the above are correct
13. The two polysaccharides used to store glucose as an energy reserve are starch and \_\_\_\_\_.
- (a) Glycogen
  - (b) Cellulose
  - (c) Fructose
  - (d) Sucrose
  - (e) Maltose
14. Both glycogenesis and glycogenolysis are controlled primarily by the interplay between the two hormones insulin and \_\_\_\_\_.
- (a) Glycogen synthetase
  - (b) Glucagon
  - (c) Fructose kinase
  - (d) Glucose hydrolyase
  - (e) Pentose kinase
15. Glucose-6-phosphate is a substrate in which of the following processes?
- (a) Gluconeogenesis
  - (b) Lipolysis
  - (c) Photosynthesis
  - (d) Glycogenolysis
  - (e) Both (a) and (b) are correct
16. Which of the following is a second messenger in glycogenolysis?
- (a) Glucagon
  - (b) Insulin
  - (c) Glucose
  - (d) ATP
  - (e) cAMP
17. A genome is
- (a) The sequence that contains the base sequence information necessary to code for a gene product
  - (b) The complete DNA base sequence in an organism
  - (c) The complementary pairing of purine and pyrimidine bases
  - (d) A base pair
  - (e) A newly synthesized RNA molecule

18. Which of the following reactions requires GDP

- (a) Fumarate  $\rightarrow$  Malate
- (b) SuccinylCoA  $\rightarrow$  Succinate
- (c) Malate  $\rightarrow$  Oxaloacetate
- (d) Citrate  $\rightarrow$  Isocitrate
- (e)  $\alpha$ -Ketoglutarate  $\rightarrow$  Succinyl CoA

19. The main toxic effect of oxygen is due to which of the following?

- (a) Sulfate formation
- (b) ROS
- (c) Heat production during oxidation
- (d) Protons
- (e) Hydroxide ion

20. One of the mechanisms by which vitamin C protects membrane is by

- (a) Regenerating reduced  $\alpha$ -tocopherol
- (b) Reacting with proline
- (c) Reacting with glycine
- (d) Both (a) and (b) are correct
- (e) Both (a) and (c) are correct

21. The cytochromes contain which type of prosthetic group?

- (a) FADH
- (b) Heme
- (c) TPP
- (d) Zinc<sup>++</sup>
- (e) NAD<sup>+</sup>

22. The essential fatty acids are

- (a) Arachidonic acid
- (b) Linoleic acid
- (c) Palmitoleic acid
- (d) Both (a) and (b) are correct
- (e) Both (b) and (c) are correct

23. Which of the following statements is not true?

- (a) Membrane potential is an electrical gradient across a membrane.
- (b) A decrease in membrane potential is referred to as membrane depolarization.
- (c) The term repolarization is defined as the reestablishment of the original membrane potential.
- (d) The diffusion of potassium ions out of a nerve cell make the inside of the membrane negative.
- (e) The sodium channel in muscle and nerve cells is a voltage-gated channel.

24. The  $\beta$ -oxidation of fatty acids requires \_\_\_\_\_.
- (a) Coenzyme A
  - (b) NAD
  - (c) NADP<sup>+</sup>
  - (d) Both (a) and (c) are correct
  - (e) All of the above are correct
25. The conversion of acyl-CoA to acylcarnitine is inhibited by \_\_\_\_\_.
- (a) Malonyl-CoA
  - (b) Citrate
  - (c) Acetyl-CoA
  - (d) Insulin
  - (e) Both A and B are correct
26. Oxidation of the carbon farthest from the carbonyl group of a fatty acid is called
- (a)  $\alpha$  oxidation
  - (b)  $\beta$ -oxidation
  - (c)  $\omega$ -oxidation
  - (d) The reaction does not occur
  - (e) Either A or B are correct depending on the point of reference
27. Ribulose -1,5-bisphosphate carboxylase catalyzes the carboxylation of ribulose-1,5-bisphosphate to form
- (a) One molecule of sucrose
  - (b) One molecule of glucose
  - (c) Two molecules of glyceraldehyde-3-phosphate
  - (d) Two molecules of glycerate-3-phosphate
  - (e) Two molecules of dihydroxyacetone phosphate
28. The most abundant enzyme on earth is
- (a) Alcohol dehydrogenase
  - (b) Rubisco
  - (c) Sucrose synthase
  - (d) Citrate synthase
  - (e) Glucose-6-phosphate dehydrogenase
29. The most important enzyme in photosynthesis is \_\_\_\_\_.
- (a) Ribulose-1,5-bisphosphate carboxylase
  - (b) ATP synthase
  - (c) Pheophytin
  - (d) Ferredoxin- NADP oxidoreductase
  - (e) Dehydrogenase

30. Deficiency of \_\_\_\_\_ causes Lesch-Nyhan syndrome.
- (a) Folic acid
  - (b) Carbamoyl phosphate synthetase II
  - (c) UMP synthase
  - (d) HGPRT
  - (e) Mg-Protoporphyrin methylesterase
31. The most serious acute symptom of type 1 diabetes is
- (a) Anemia
  - (b) Ketoacidosis
  - (c) Hypoglycemia
  - (d) Insulin resistance
  - (e) Both (a) and (c) are correct
32. Which of the following carbohydrates is a major contributing cause of dyslipidemia non-alcoholic fatty liver disease?
- (a) Glucose
  - (b) Ribose
  - (c) Fructose
  - (d) Galactose
  - (e) Xylose
33. HIV possesses a \_\_\_\_\_ genome
- (a) ssDNA
  - (b) dsDNA
  - (c) ssRNA
  - (d) dsRNA
  - (e) None of the above are correct
34. The Greek key is associated with which of the following?
- (a)  $\alpha$ -helix
  - (b) Parallel  $\beta$ -pleated sheets
  - (c) Antiparallel  $\beta$ -pleated sheets
  - (d) Disulfide bridges
  - (e) Salt bridges
35. Schiff bases are also referred to as:
- (a) Aldimines
  - (b) Amines
  - (c) Carbinolamines
  - (d) Amino acids
  - (e) Both (a) and (c) are correct

二. 簡答題：(30 分)

1. Briefly outline the roles of molecular chaperones in protein folding (8 %)
2. Briefly describe the Pentose Phosphate Pathway (7 %)
3. Describe CRISPR-Cas9 systems for editing, regulating and targeting genomes (8 %)
4. Describe hybridoma technology for monoclonal antibody production (7 %)