

科目：生物化學

系所組：基礎醫學研究所

一、單選題 (每題 2 分，共 60 分)

1. Which of the following statements about aromatic amino acids is correct?
- (A) The presence of a ring structure in its R group determines whether or not an amino acid is aromatic.
- (B) Histidine's ring structure results in its being categorized as aromatic or basic, depending on pH.
- (C) On a molar basis, tryptophan absorbs more ultraviolet light than tyrosine.
- (D) The major contribution to the characteristic absorption of light at 280 nm by proteins is the phenylalanine R group.
2. If the pI of a peptide is 4.6, ___ might be present while ___ would probably be absent.
- (A) Glu / Lys
- (B) His / Ser
- (C) Arg / His
- (D) Asp / Gly
3. Which one of these characteristics is not true for the α helix?
- (A) There are 3.6 amino acids per turn.
- (B) There is a requirement for glycine every third amino acid residue.
- (C) A hydrogen bond forms between the carbonyl oxygen of the n th amino acid residue and the —NH group of the $(n + 4)$ th amino acid residue.
- (D) Proline is typically not found in the α helix
4. Insulin is a polypeptide hormone that contains two short polypeptide chains linked by two interstrand disulfide bonds. The most logical order of events to perform in order to sequence this protein would be:
- A: The peptides are reduced with mercaptoethanol.
- B: The peptides are sequenced using Edman chemistry.
- C: The peptides are separated by chromatography techniques.
- D: The peptides are alkylated with iodoacetamide.
- (A) A, D, C, B
- (B) C, A, D, B
- (C) C, B, A, D
- (D) A, B, C, D

※ 注意：1. 考生須在「彌封答案卷」上作答。

2. 本試題紙空白部份可當稿紙使用。

3. 考生於作答時可否使用計算機、法典、字典或其他資料或工具，以簡章之規定為準。

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5. Conditions in the tissues which enhance the delivery of oxygen by hemoglobin are the presence of

- (A) carbon dioxide.
- (B) 2,3 BPG.
- (C) protons.
- (D) All of the above.

6. Which of the following statements is NOT characteristic of k_{cat}/K_m ?

- (A) It corresponds to a second-order rate constant.
- (B) It provides an excellent parameter for comparison of the catalytic efficiency of enzymes.
- (C) It reflects the property of the enzyme when substrate concentration is at saturation.
- (D) The upper limit for the k_{cat}/K_m value is fixed by the diffusion-controlled limit for reactions, which is $10^9 \text{ M}^{-1} \text{ s}^{-1}$.

7. Active trypsin formation by the action of enteropeptidase can be viewed as the master activation step because

- (A) enteropeptidase can activate its own zymogen.
- (B) it is allosterically controlled.
- (C) trypsin activates other pancreatic zymogens.
- (D) All of the above

8. Which of the following explains why the disaccharide sucrose is not a reducing sugar?

- (A) the primary hydroxyl groups are oxidized to carboxylic acids
- (B) both anomeric carbons are involved in formation of the glycosidic bond
- (C) the glycosidic bond is in the α configuration
- (D) it is composed of a furanose and a pyranose

9. All of the following characterize phosphofructokinase-1 (PFK-1) EXCEPT:

- (A) the most important regulatory site in glycolysis.
- (B) ATP increases the affinity of the enzyme for fructose-6-phosphate.
- (C) PFK-1 activity is a function of the energy charge of the cell.
- (D) AMP decreases the K_m of PFK-1 for fructose-6-phosphate.

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10. In humans, gluconeogenesis:

- (A) is essential in the conversion of fatty acids to glucose.
- (B) helps to reduce blood glucose after a carbohydrate-rich meal.
- (C) is activated by the hormone insulin
- (D) can result in the conversion of protein into blood glucose.

11. The anaplerotic reactions associated with the TCA cycle are a result of the:

- (A) use of many of the TCA cycle intermediates in biosynthesis.
- (B) oxidative nature of the TCA cycle.
- (C) production of GTP and reduced coenzymes.
- (D) irreversible nature of some of the TCA cycle reactions.

12. Which one of the following best describes the role of mitochondria in apoptosis?

- (A) Escape of cytochrome *c* into the cytoplasm.
- (B) Uncoupling of oxidative phosphorylation.
- (C) Increase in permeability of outer membrane.
- (D) Both A and C are correct.

13. All are characteristics of eicosanoids EXCEPT:

- (A) all derived from 20-carbon fatty acids that are acylated to membrane triacylglycerol and released by the enzyme phospholipase A₂.
- (B) exert their effects at very low concentrations.
- (C) usually act as local hormones functioning through G-protein-linked receptors to elicit their biochemical effects.
- (D) include prostaglandins, thromboxanes and leukotrienes.

14. Which one of the following directly results in the activation of glycogen synthase?

- (A) Dephosphorylation of multiple residues by phosphoprotein phosphorylase-1 (PP1)
- (B) Phosphorylation of specific residues by casein kinase II (CKII)
- (C) Phosphorylation of specific residues by glycogen synthase kinase-3 (GSK-3)
- (D) The presence of insulin

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15. A function of the glyoxylate cycle, in conjunction with the citric acid cycle, is to accomplish the:

- (A) complete oxidation of acetyl-CoA to CO₂ plus reduced coenzymes.
- (B) net conversion of carbohydrate to lipid.
- (C) net synthesis of four-carbon dicarboxylic acids from acetyl-CoA.
- (D) net synthesis of long-chain fatty acids from citric acid cycle intermediates.

16. In most cases, glycerol phosphatides have _____ fatty acid at *sn*-1 carbon and _____ fatty acid at *sn*-2 carbon of the glycerol.

- (A) a saturated; a saturated
- (B) a saturated; an unsaturated
- (C) an unsaturated; a saturated
- (D) an unsaturated; an unsaturated

17. All of the following are examples of nucleotide functions EXCEPT:

- (A) CTP in phospholipid synthesis.
- (B) UTP in complex carbohydrate synthesis.
- (C) ATP in energy for the cell.
- (D) TTP in protein synthesis.

18. _____ are important in the processing of eukaryotic gene transcripts into mature messenger RNAs for export from the nucleus into cytoplasm.

- (A) snRNPs
- (B) tRNAs
- (C) rRNAs
- (D) siRNAs

19. All are properties of nucleosomes EXCEPT:

- (A) protein spools neatly wrapped with DNA.
- (B) fundamental structural unit in chromatin.
- (C) protein spools made up of histones H2A, H2B, H3 and H4 tetrameric aggregates.
- (D) DNA binds histones by ionic bonds of positively charged amino acids and the negative charged phosphate groups.

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20. _____ carries long-chain fatty acyl groups across the _____ membrane.
- (A) Biotin; intestinal
 - (B) TPP; outer mitochondrial
 - (C) CoA-SH; plasma
 - (D) Carnitine; inner mitochondrial
21. The product of β -oxidation, acetyl-CoA, can be used for all EXCEPT:
- (A) synthesis of ketone bodies.
 - (B) synthesis of glucose.
 - (C) synthesis of amino acids.
 - (D) catabolism in the TCA cycle.
22. The main source(s) of NADPH for fatty acid biosynthesis is (are):
- (A) TCA cycle.
 - (B) oxidative phosphorylation.
 - (C) malic enzyme and the pentose phosphate pathway.
 - (D) the conversion of OAA to malate by malate dehydrogenase.
23. All are regulatory mechanisms of HMG-CoA reductase EXCEPT:
- (A) low [cholesterol] increases mRNA for HMG-CoA reductase.
 - (B) high [cholesterol] increases half-life for HMG-CoA reductase.
 - (C) phosphorylation by cAMP cascade inactivates HMG-CoA reductase.
 - (D) phosphatases activate HMG-CoA reductase.
24. The carbons of sphinganine are derived from:
- (A) oleate and glycerol.
 - (B) arachidonate and glycine.
 - (C) fatty alcohol and dihydroxyacetone phosphate (DHAP).
 - (D) palmitate and serine.
25. In which part of the chloroplast does reduction of CO_2 during photosynthesis primarily occur?
- (A) Grana.
 - (B) Thylakoid disks.

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(C) Stroma.

(D) Thylakoid space.

26. The conversion of α -ketoglutarate to glutamate is

(A) a transamination.

(B) a reductive amination.

(C) an amidation.

(D) an oxidation.

27. Pyridoxal phosphate is involved in which of the following reactions?

(A) transaminations

(B) decarboxylations

(C) racemizations

(D) all of the above

28. Purine salvage reactions

(A) use bases as the substrate

(B) use nucleosides as the substrate

(C) produce nucleosides as products

(D) require the hydrolysis of ATP

29. DNA replication is a challenging process because:

(A) DNA strands must be separated

(B) New DNA is always synthesized from the 5' \rightarrow 3' direction but the two template strands run in opposite directions

(C) The cell must guard against replication errors

(D) All of the above

30. At what point does the sigma (σ) subunit of RNA polymerase released from the core enzyme?

(A) Prior to the incorporation of any nucleotides into an RNA strand.

(B) After transcription begins and about 10 nucleotides have been added to the RNA chain.

(C) Just prior to chain termination.

(D) Never; it is an intrinsic part of the core enzyme.

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二、問答題 (共 40 分)

1. (A). What is the effect of pH on the binding of oxygen to hemoglobin (the Bohr Effect)? (B). Briefly describe the mechanism of this effect. (4 分)
2. What factors would make it difficult to interpret the results of a gel electrophoresis of proteins in the absence of sodium dodecyl sulfate (SDS)? (4 分)
3. Why is citrate, in addition to being a metabolic intermediate in aerobic oxidation of fuels, an important control molecule for a variety of enzymes? (4 分)
4. What is the fundamental difference between uncouplers and respiratory inhibitors? (4 分)
5. Explain why the phosphorylation of glycogen is more efficient than the hydrolysis of glycogen in mobilizing glucose for the glycolytic pathway. (4 分)
6. Please arrange the correct sequence for activation of the release of fatty acids from adipocytes. (4 分)
 - (A) protein kinase A activation
 - (B) cAMP production
 - (C) triacylglycerol lipase activation
 - (D) fatty acid binding to serum albumin
 - (E) hormone binding receptor
 - (F) adenylyl cyclase activation
 - (G) phosphorylation of perilipin
 - (H) diacylglycerol and monoacylglycerol production
7. Please arrange the correct sequence for synthesis of cholesterol (5 分)
 - (A) HMG-CoA synthase
 - (B) formation of 3-hydroxy-3-methylglutaryl-CoA
 - (C) β -ketothiolase catalyzed condensation
 - (D) HMG-CoA reductase activity
 - (E) formation of acetoacetyl-CoA
 - (F) geranyl pyrophosphate
 - (G) isopentenyl pyrophosphate

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- (H) 5-phosphomevalonate
- (I) farnesyl pyrophosphate
- (J) dimethylallyl pyrophosphate

8. How is cancer chemotherapy related to purine biosynthesis? (4分)

9. Please describe the processes and enzymes involving DNA replication. (7分)

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