

國立中山大學 101 學年度轉學生招生考試試題

科目：生物化學【生科系學士班三年級】

題號：7019
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單選題 (60 分，每題 1.5 分)

1. Proteins are linear polymers of amino acids linked by covalent _____ bonds.
(A) ester (B) anhydride (C) peptide (D) hydrogen
2. The peptide _____ would absorb light at 280 nm.
(A) Ala-Lys-His (B) Ser-Gly-Asn (C) Ala-Ala-Trp (D) Val-Pro-Leu
3. Proteins destined for an extracellular location are characteristically _____.
(A) phosphoproteins (B) glycoproteins
(C) lipoproteins (D) flavoproteins
4. An electrostatic interaction might occur within a protein between the amino acid pair _____ at typical physiological pH.
(A) Ser/Asn (B) Asp/Glu (C) Arg/Cys (D) Lys/Asp
5. α -Helices are stabilized primarily by _____.
(A) H bonds between the main chain peptide bond component atoms
(B) electrostatic interactions between R-groups
(C) hydrophobic interactions between the α -carbons of the main chain
(D) H bonding between the R-groups
6. The amino acid residue most likely to be found in a β -turn is _____.
(A) glycine (B) alanine (C) valine (D) leucine
7. All of the following disaccharides are reducing sugars EXCEPT _____.
(A) lactose (B) maltose (C) sucrose (D) cellulose
8. All are true for the DNA double helix EXCEPT _____.
(A) the two strands are parallel
(B) the two strands are held together by interchain H bonds
(C) the two strands have complementary base pairing
(D) they are easily sheared into shorter fragments during isolation procedures
9. In a sample of double-stranded DNA containing 32% cytosine, the percentage of adenine would be _____.
(A) 32% (B) 68% (C) 18% (D) 16%
10. The higher the _____ content of a DNA, the _____ the melting temperature is.
(A) GC; higher (B) GC; lower (C) AT; higher (D) AT; lower
11. All are the distinctive features of enzymes EXCEPT _____.
(A) regulation (B) catalytic activity
(C) ability to change ΔG (D) specificity
12. The _____ site is the specific site on enzyme where _____ binds and catalysis occurs.
(A) substrate; coenzyme (B) active; substrate

- (C) regulatory; coenzyme (D) active; regulatory
13. The trivial term for an enzyme that catalyzes the ATP-dependent phosphorylation is _____.
- (A) an isomerase (B) a protease (C) a kinase (D) a catalase
14. Catalysts accelerate a chemical reaction by _____.
- (A) raising the average energy of the reactants
(B) providing a means of acceleration by being completely consumed in the reaction
(C) lowering the energy of activation
(D) lowering the overall free energy change of the reaction
15. Malonate inhibition of succinate dehydrogenase is an example of _____.
- (A) noncompetitive inhibition (B) competitive inhibition
(C) irreversible inhibition (D) uncompetitive inhibition.
16. Enzymes have active sites which have the greatest complementarity to the _____.
- (A) substrate (B) transition state
(C) product (D) both substrate and product
17. Because the pK_a is near 7, _____ side-chains are often involved in general acid-base catalysis.
- (A) cysteine (B) aspartate (C) lysine (D) histidine
18. All are characteristic of allosteric enzymes EXCEPT:
- (A) Effectors may show stimulatory or inhibitory activity.
(B) They have multiple subunits.
(C) They obey Michaelis-Menten kinetics.
(D) The regulatory effect is by altering conformation and interaction of subunits.
19. The function of glycogen phosphorylase is _____.
- (A) to convert glucose-1-phosphate into glucose-6-phosphate
(B) to break down ATP
(C) to catalyze the phosphorolysis of glucose-1-phosphate from glycogen molecules.
(D) to stimulate the build up of glycogen
20. All are true for cAMP-dependent protein kinase EXCEPT:
- (A) also known as PKA.
(B) phosphorylase kinase is a substrate.
(C) two regulatory subunits block catalytic activity without cAMP binding.
(D) phosphorylates glycogen phosphorylase.
21. All of the following are characteristics of hemoglobin's binding of oxygen EXCEPT:
- (A) CO_2 promotes dissociation of O_2 from hemoglobin (Hb) by lowering the pH.
(B) Protons promote binding of oxygen by Hb.
(C) 2,3-Bisphosphoglycerate (BPG) promotes release of O_2 by Hb.
(D) BPG and O_2 are mutually exclusive allosteric effectors of Hb.
22. _____ are the final products of aerobic catabolism.
- (A) Pyruvate and H_2O (B) Acetyl-CoA and CO_2 .

(C) CO₂ and H₂O.

(D) Ammonia and O₂

23. When dietary carbohydrate consumption exceeds the energy needs of the individual, excess carbohydrate is converted to _____ and _____ for energy storage.

(A) amino acids; glucose

(B) fructose; triacylglycerols

(C) triacylglycerols; glycogen

(D) glycogen; protein

24. Under anaerobic conditions, skeletal muscle generates lactate from pyruvate to _____.

(A) lower the pH

(B) promote release of oxygen from Hb

(C) be warning of muscle fatigue

(D) regenerate NAD⁺ for further glycolysis

25. In the TCA cycle, carbon enters the cycle as _____ and exits as _____ with metabolic energy captured as ATP, NADH and FADH₂.

(A) malonate; H₂O

(B) NADH; ATP

(C) acetyl-CoA; CO₂

(D) succinyl-CoA; CO₂

26. In eukaryotic cells, glycolysis occurs in the _____, and the TCA cycle reactions take place in _____.

(A) mitochondria; mitochondria

(B) cytoplasm; mitochondria

(C) cytoplasm; cytoplasm

(D) mitochondria; cytoplasm

27. ATP made in glycolysis and the TCA cycle is the result of _____ phosphorylation, and NADH-dependent ATP synthesis is the result of _____ phosphorylation.

(A) oxidative; substrate-level

(B) oxidative; electron

(C) substrate-level; electron

(D) substrate-level; oxidative

28. _____ is the energy that drives ATP synthesis.

(A) The proton gradient

(B) The electron gradient

(C) The oxidation states of the complexes

(D) Molecular oxygen

29. The final electron acceptor in the electron transport chain is _____.

(A) O₂

(B) H₂O

(C) cytochrome *c*

(D) NAD⁺

30. Gluconeogenesis is the synthesis of _____.

(A) glucose from non-carbohydrate precursors

(B) glycogen from glucose

(C) pyruvate from glucose

(D) glucose from fatty acids

31. The pentose phosphate pathway is an important source of _____, and for _____, an essential precursor for ATP, NAD⁺, FAD, CoA, DNA and RNA.

(A) ATP; NADH

(B) NADH; NADPH

(C) NADPH; ribose-5-phosphate

(D) ribose-5-phosphate; ATP

32. All are substrates for gluconeogenesis EXCEPT _____.

(A) glycerol

(B) lactate

(C) acetate

(D) pyruvate

33. Glycogen synthesis and degradation must be carefully controlled at _____ and _____ to properly serve the metabolic needs for the organism.

(A) glucokinase; hexokinase

(B) hexokinase; glycogen synthase

(C) glycogen synthase; glucokinase

(D) glycogen phosphorylase; glycogen synthase

34. The primary storage form of lipid is _____ and it is normally stored in the _____.

- (A) phospholipid; liver (B) cholesterol; muscles
(C) triacylglycerols; adipocytes (D) triacylglycerols; liver

35. For the complete oxidation of a saturated fatty acid with 16 carbons, how many times must the β -oxidation cycle be repeated?

- (A) 4 (B) 7 (C) 8 (D) 6

36. Propionyl-CoA is a product of the β -oxidation of _____ and is ultimately converted to the TCA cycle intermediate, _____.

- (A) odd-chain fatty acids; citrate (B) even-chain fatty acids; isocitrate
(C) odd-chain fatty acids; succinyl-CoA (D) even-chain fatty acids; succinate

37. The brain normally uses _____ as its source of metabolic energy, but during starvation _____ may be the major source of energy.

- (A) glucose; ketone bodies (B) ketone bodies; fatty acids
(C) fatty acids; amino acids (D) amino acids; glucose

38. The committed step in cholesterol biosynthesis is catalyzed by _____.

- (A) HMG-CoA synthase (B) HMG-CoA reductase
(C) squalene monooxygenase (D) HMG-CoA lyase

39. The major circulatory complex for cholesterol and cholesterol esters ("bad cholesterol") is the _____.

- (A) HDL (B) IDL (C) VLDL (D) LDL

40. _____ is the common product of purine catabolism.

- (A) Xanthine (B) Uric acid (C) Inosine (D) Hypoxanthine

問答題 (40 分)

1. Describe the primary, the secondary, the tertiary, and the quaternary structures of proteins. (16%)
2. Describe the strategy for determining the amino acid sequence of a protein. (12%)
3. Describe how the enzyme activity can be regulated through the allosteric regulation, covalent modification, and proteolytic activation. (12%)

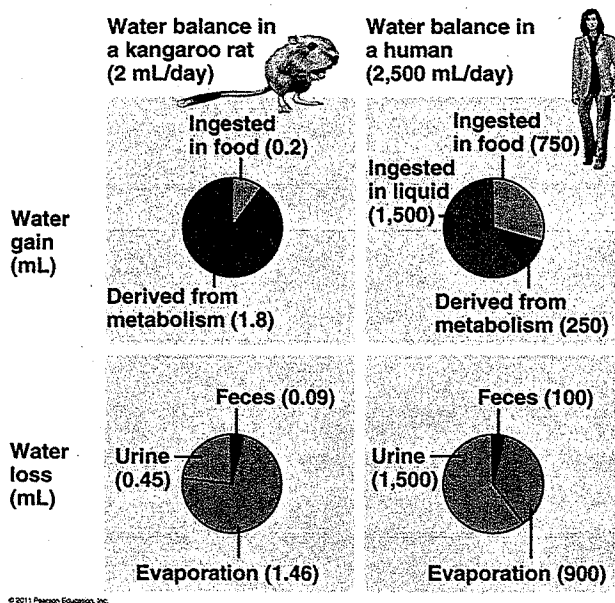
國立中山大學 101 學年度轉學生招生考試試題

科目：普通生物學【生科系學士班三年級】

題號：7018
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一、問答題 (共 68 分)

01. 請描繪一般神經細胞的結構[請標示樹突(dendrite)、細胞本體(cell body)、軸突(axon)與軸丘(axon hillock)]。(6%)
02. 請比較內分泌(endocrine)、旁分泌(paracrine)與自分泌(autocrine)三種細胞訊息傳導的方式 (6%)
03. 下圖為兩種陸生哺乳類水份平衡的比例圖，請根據下圖比較跳鼠(kangaroo rat)與人類獲取水份與流失水分的差異。(6%)



04. 請陳述一個新物種產生的理論過程，以及異域種化(allopatric speciation)在其中所扮演的角色。(10%)
05. 請說明內共生假說之所以被認為可以解釋真核生物胞器起源的證據為何 (10%)
06. 請將文昌魚、盲鰻、八目鰻、軟骨魚、條鰭魚、腔棘魚、肺魚、兩生類、羊膜類之間的親緣關係畫出來，並說明每一個親緣關係樹上的節間上的重要演化事件為何？並請指出硬骨魚這個名詞包含了以上那些類群？(20%)
07. 請就食物網穩定性與生物累積作用的觀點說明，為什麼不應該食用櫻花蝦與黑鮪魚？此外養殖漁業是否就是一项永續的產業？為什麼？(10%)

二、單選題 (每題 2 分; 共 32 分)

01. Which of the events listed below occurs in the light reactions of photosynthesis?
(A) NADP is produced. (B) NADPH is reduced to NADP⁺. (C) Carbon dioxide is incorporated into PGA. (D) ATP is phosphorylated to yield ADP. (E) Light is absorbed and funneled to reaction-center chlorophyll *a*.
02. Land plants are composed of all of the following tissue types *except*
(A) mesodermal (B) epidermal (C) meristematic (D) vascular (E) ground tissue.
03. All of the following cell types are correctly matched with their functions *except*
(A) mesophyll-photosynthesis. (B) guard cell-regulation of transpiration. (C) sieve-tube member-translocation. (D) vessel element-water transport. (E) companion cell-formation of secondary xylem and phloem.
04. Water rises in plants primarily by cohesion-tension. Which of the following is *not* true about the cohesion-tension model?
(A) Water loss (transpiration) is the driving force for water movement. (B) The "tension" of this model represents the excitability of the xylem cells. (C) Cohesion represents the tendency for water molecules to stick together by hydrogen bonds. (D) The physical forces in the capillary-sized xylem cells make it easier to overcome gravity. (E) The water potential of the air is more negative than the xylem.
05. An example of a mutualistic association between a plant and a fungus would be
(A) nitrogen fixation. (B) *Rhizobium* infection. (C) mycorrhizae. (D) parasitic infection. (E) assisted pollination.
06. In the life cycle of an angiosperm, which of the following stages is diploid?
(A) megaspore (B) generative nucleus of a pollen grain (C) polar nuclei of the embryo sac (D) microsporoocyte (E) both megaspore and polar nuclei
07. A parent with an S₁S₂ genotype exhibiting sporophytic self-incompatibility can potentially fertilize which of the following plant genotypes of the same species with pollen grains?
(A) S₁S₃ (B) S₂S₃ (C) S₃S₄ (D) S₁S₄ (E) S₂S₄
08. The rapid leaf movements resulting from a response to touch (thigmotropism) primarily involve
(A) rapid growth response. (B) potassium channels. (C) nervous tissue. (D) aquaporins. (E) stress proteins.
09. A plant will recognize a pathogenic invader
(A) if it has many specific plant disease resistance (*R*) genes. (B) when the pathogen has an *R* gene complementary to the plant's antivirulence (*Avr*) gene. (C) only if the pathogen and the plant have the same *R* genes. (D) if it has the specific *R* gene that corresponds to the pathogen molecule encoded by an *Avr* gene. (E) when the pathogen secretes *Avr* protein.

10. In an analysis of the nucleotide composition of DNA, which of the following will be found?
(A) $A = C$ (B) $T = G$ (C) $A = G$ and $C = T$ (D) $A + C = G + T$ (E) $G + C = T + A$
11. To repair a thymine dimer by nucleotide excision repair, in which order do the necessary enzymes act?
(A) exonuclease, DNA polymerase III, RNA primase (B) helicase, DNA polymerase I, DNA ligase (C) DNA ligase, nuclease, helicase (D) DNA polymerase I, DNA polymerase III, DNA ligase (E) endonuclease, DNA polymerase I, DNA ligase
12. In the structural organization of many eukaryotic genes, individual exons may be related to which of the following?
(A) the sequence of the intron that immediately precedes each exon (B) the number of polypeptides making up the functional protein (C) the various domains of the polypeptide product (D) the number of restriction enzyme cutting sites (E) the number of start sites for transcription
13. There are 61 mRNA codons that specify an amino acid, but only 45 tRNAs. This is best explained by the fact that
(A) some tRNAs have anticodons that recognize four or more different codons. (B) the rules for base pairing between the third base of a codon and tRNA are flexible. (C) many codons are never used, so the tRNAs that recognize them are dispensable. (D) the DNA codes for all 61 tRNAs but some are then destroyed. (E) competitive exclusion forces some tRNAs to be destroyed by nucleases.
14. The tryptophan operon is a repressible operon that is
(A) permanently turned on. (B) turned on only when tryptophan is present in the growth medium. (C) turned off only when glucose is present in the growth medium. (D) turned on only when glucose is present in the growth medium. (E) turned off whenever tryptophan is added to the growth medium.
15. Which of the following describes the function of an enzyme known as Dicer?
(A) It degrades single-stranded DNA. (B) It degrades single-stranded mRNA. (C) It degrades mRNA with no poly-A tail. (D) It trims small double-stranded RNAs into molecules that can block translation. (E) It chops up single-stranded DNAs from infecting viruses.
16. Two potential devices that eukaryotic cells use to regulate transcription are
(A) DNA methylation and histone amplification. (B) DNA amplification and histone methylation. (C) DNA acetylation and methylation. (D) DNA methylation and histone modification. (E) histone amplification and DNA acetylation.