

單選題 (共 50 題，每題 2 分)

1. What is the approximate pK_a of a weak acid HA if a solution 0.1 M HA and 0.3 M A^- has a pH of 6.5? (A) 6.6 (B) 6.4 (C) 6.2 (D) 6.0 (E) 5.8
2. The blood buffering system is based on:
(A) the reaction of CO_2 with H_2O to form carbonic acid
(B) the ionization of aqueous carbonic acid to H^+ and the bicarbonate anion
(C) the decrease of the blood pH due to the production of H^+
(D) the excretion of bicarbonate and ammonium from the kidneys
(E) all of the above
3. The enzyme fumarase catalyzes the reversible hydration of fumaric acid to l-malate, but it will not catalyze the hydration of maleic acid, the cis isomer of fumaric acid. This is an example of:
(A) biological activity. (B) chiral activity. (C) racemization.
(D) stereoisomerization. (E) stereospecificity.
4. Which of the following statements about aromatic amino acids is correct?
(A) All are strongly hydrophobic.
(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.
(E) The presence of a ring structure in its R group determines whether or not an amino acid is aromatic.
5. To determine the isoelectric point of a protein, first establish that a gel:
(A) contains a denaturing detergent that can distribute uniform negative charges over the protein's surface.
(B) exhibits a stable pH gradient when ampholytes become distributed in an electric field.
(C) is washed with an antibody specific to the protein of interest.
(D) neutralizes all ionic groups on a protein by titrating them with strong bases.
(E) relates the unknown protein to a series of protein markers with known molecular weights, M_r .
6. Which of the following is an emerging technique for protein sequencing?
(A) NMR spectroscopy
(B) Mass spectrometry
(C) Gel electrophoresis
(D) Phylogenetic analysis
(E) Limited proteolysis

7. Thr residues tend to disrupt an α helix when they occur next to each other in a protein because:
- (A) an amino acids like Thr is highly hydrophobic.
 - (B) covalent interactions may occur between the Thr side chains.
 - (C) electrostatic repulsion occurs between the Thr side chains.
 - (D) steric hindrance occurs between the bulky Thr side chains.
 - (E) the R group of Thr can form a hydrogen bond.
8. Experiments on denaturation and renaturation after the reduction and reoxidation of the disulfide bonds in the enzyme ribonuclease (RNase) have shown that:
- (A) folding of denatured RNase into the native, active conformation, requires the input of energy in the form of heat.
 - (B) native ribonuclease does not have a unique secondary and tertiary structure.
 - (C) the completely unfolded enzyme, with all disulfide bonds broken, is still enzymatically active.
 - (D) the enzyme, dissolved in water, is thermodynamically stable relative to the mixture of amino acids whose residues are contained in RNase.
 - (E) the primary sequence of RNase is sufficient to determine its specific secondary and tertiary structure.
9. The amino acid substitution of Val for Glu in Hemoglobin S results in aggregation of the protein because of _____ interactions between molecules.
- (A) covalent (B) disulfide (C) hydrogen bonding (D) hydrophobic (E) ionic
10. Which one of the following statements is true of enzyme catalysts?
- (A) They bind to substrates, but are never covalently attached to substrate or product.
 - (B) They increase the equilibrium constant for a reaction, thus favoring product formation.
 - (C) They increase the stability of the product of a desired reaction by allowing ionizations, resonance, and isomerizations not normally available to substrates.
 - (D) They lower the activation energy for the conversion of substrate to product.
 - (E) To be effective they must be present at the same concentration as their substrates.
11. In competitive inhibition, an inhibitor:
- (A) binds at several different sites on an enzyme.
 - (B) binds covalently to the enzyme.
 - (C) binds *only* to the ES complex.
 - (D) binds reversibly at the active site.
 - (E) lowers the characteristic V_{\max} of the enzyme.
12. Which of the following is an epimeric pair?
- (A) D-glucose and D-glucosamine (B) D-glucose and D-mannose
(C) D-glucose and L-glucose (D) D-lactose and D-sucrose (E) L-mannose and L-fructose

13. A small molecule that *decreases* the activity of an enzyme by binding to a site other than the catalytic site is termed a(n):
(A) allosteric inhibitor. (B) alternative inhibitor. (C) competitive inhibitor.
(D) stereospecific agent. (E) transition-state analog.
14. A transition-state analog:
(A) is less stable when binding to an enzyme than the normal substrate.
(B) resembles the active site of general acid-base enzymes.
(C) resembles the transition-state structure of the normal enzyme-substrate complex.
(D) stabilizes the transition state for the normal enzyme-substrate complex.
(E) typically reacts more rapidly with an enzyme than the normal substrate.
15. Which of the following is *not* a reducing sugar?
(A) Fructose (B) Glucose (C) Glyceraldehyde (D) Ribose (E) Sucrose
16. In glycoproteins, the carbohydrate moiety is always attached through the amino acid residues:
(A) asparagine, serine, or threonine. (B) aspartate or glutamate.
(C) glutamine or arginine. (D) glycine, alanine, or aspartate.
(E) tryptophan, aspartate, or cysteine.
17. Which of the following best describes the cholesterol molecule?
(A) Amphipathic (B) Nonpolar, charged (C) Nonpolar, uncharged (D) Polar, charged
(E) Polar, uncharged
18. An integral membrane protein can be extracted with:
(A) a buffer of alkaline or acid pH. (B) a chelating agent that removes divalent cations.
(C) a solution containing detergent. (D) a solution of high ionic strength. (E) hot water.
19. Movement of water across membranes is facilitated by proteins called:
(A) annexins. (B) aquaporins. (C) hydropermeases. (D) selectins. (E) transportins.
20. Ubiquitin is a:
(A) component of the electron transport system. (B) protease. (C) protein kinase.
(D) protein phosphorylase. (E) protein that tags another protein for proteolysis.
21. Which of these cofactors participates directly in most of the oxidation-reduction reactions in the fermentation of glucose to lactate?
(A) ADP (B) ATP (C) FAD/FADH₂ (D) Glyceraldehyde 3-phosphate
(E) NAD⁺/NADH
22. The anaerobic conversion of 1 mol of glucose to 2 mol of lactate by fermentation is accompanied by a net gain of: (A) 1 mol of ATP (B) 1 mol of NADH
(C) 2 mol of ATP (D) 2 mol of NADH (E) none of the above.
23. Which of the following compounds *cannot* serve as the starting material for the synthesis of glucose via gluconeogenesis?
(A) acetate (B) glycerol (C) lactate (D) oxaloacetate (E) α-ketoglutarate

24. All of the following enzymes involved in the flow of carbon from glucose to lactate (glycolysis) are also involved in the reversal of this flow (gluconeogenesis) *except*:
- (A) 3-phosphoglycerate kinase. (B) aldolase. (C) enolase. (D) phosphofructokinase-1.
(E) phosphoglucoisomerase.
25. The metabolic function of the pentose phosphate pathway is:
- (A) act as a source of ADP biosynthesis.
(B) generate NADPH and pentoses for the biosynthesis of fatty acids and nucleic acids.
(C) participate in oxidation-reduction reactions during the formation of H₂O.
(D) provide intermediates for the citric acid cycle.
(E) synthesize phosphorus pentoxide.
26. Glycogen is converted to monosaccharide units by:
- (A) glucokinase (B) glucose-6-phosphatase (C) glycogen phosphorylase
(D) glycogen synthase (E) glycogenase
27. Which of the following is *not* an intermediate of the citric acid cycle?
- (A) Acetyl-coA (B) Citrate (C) Oxaloacetate (D) Succinyl-coA
(E) α -Ketoglutarate
28. Which of the following is *not* true of all naturally occurring DNA?
- (A) Deoxyribose units are connected by 3',5'-phosphodiester bonds.
(B) The amount of A always equals the amount of T.
(C) The ratio A+T/G+C is constant for all natural DNAs.
(D) The two complementary strands are antiparallel.
(E) Two hydrogen bonds form between A and T.
29. In the laboratory, recombinant plasmids are commonly introduced into bacterial cells by:
- (A) electrophoresis – a gentle low-voltage gradient draws the DNA into the cell.
(B) infection with a bacteriophage that carries the plasmid.
(C) microinjection.
(D) mixing plasmids with an extract of broken cells.
(E) transformation – heat shock of the cells incubated with plasmid in the presence of CaCl₂.
30. Which one of the following analytical techniques does *not* help illuminate a gene's cellular function? (A) DNA microarray analysis (B) Protein chip analysis (C) Southern blotting
(D) Two-dimensional gel electrophoresis (E) Two-hybrid analysis
31. Transamination from alanine to α -ketoglutarate requires the coenzyme:
- (A) biotin. (B) NADH. (C) thiamine pyrophosphate (TPP).
(D) pyridoxal phosphate (PLP). (E) No coenzyme is involved.
32. Urea synthesis in mammals takes place primarily in tissues of the:
- (A) brain. (B) kidney. (C) liver. (D) skeletal muscle. (E) small intestine.

33. The DNA binding motif for many prokaryotic regulatory proteins, such as the *lac* repressor, is: (A) helix-turn-helix. (B) homeobox. (C) homeodomain. (D) leucine zipper. (E) zinc finger.
34. Which of the following are features of the wobble hypothesis?
(A) A naturally occurring tRNA exists in yeast that can read both arginine and lysine codons.
(B) A tRNA can recognize only one codon.
(C) Some tRNAs can recognize codons that specify two different amino acids.
(D) The “wobble” occurs only in the first base of the anticodon.
(E) The third base in a codon always forms a normal Watson-Crick base pair.
35. Processing of a primary mRNA transcript in a eukaryotic cell does *not* normally involve:
(A) attachment of a long poly(A) sequence at the 3' end.
(B) conversion of normal bases to modified bases, such as inosine and pseudouridine.
(C) excision of intervening sequences (introns).
(D) joining of exons.
(E) methylation of one or more guanine nucleotides at the 5' end.
36. An Okazaki fragment is a:
(A) fragment of DNA resulting from endonuclease action.
(B) fragment of RNA that is a subunit of the 30S ribosome.
(C) piece of DNA that is synthesized in the 3' → 5' direction.
(D) segment of DNA that is an intermediate in the synthesis of the lagging strand.
(E) segment of mRNA synthesized by RNA polymerase.
37. Functional DNA is *not* found in:
(A) bacterial nucleoids. (B) chloroplasts. (C) lysosomes. (D) mitochondria.
(E) nuclei.
38. Which of the following fatty acid is unsaturated?
(A) Arachidonic acid (B) Lauric acid (C) Palmitic acid (D) Stearic acid ◦
39. The molar concentration of pure water at 25°C is _____.
(A) 36 M (B) 55.5 M (C) 10^{-14} M (D) 65 M ◦
40. An enzyme that transfers a phosphate group from ATP to a substrate is usually called _____.
(A) phosphatase (B) kinase (C) lipase (D) polymerase ◦
41. Which of the following amino acid *cannot* be phosphorylated?
(A) Tyrosine (B) Serine (C) Threonine (D) Glycine ◦
42. Which of the following enzyme can hydrolyze PIP_2 into IP_3 and DAG?
(A) Protein kinase C (B) Adenylate cyclase (C) Phospholipase C
(D) Glycogen synthase (E) Glycogen phosphorylase

43. A major component of RNA but *not* of DNA is:
(A) adenine. (B) cytosine. (C) guanine. (D) thymine. (E) uracil.
44. Which of the following methods does *not* separate molecules by size ?
(A) Gel filtration chromatography (B) Flow cytometry (C) Agarose gel electrophoresis (D) SDS-PAGE (E) Molecular sieve
45. DNA polymerase I in *E. coli* has proofreading activity, because it processes
(A) 5'→3'exonuclease activity (B) 3'→5'exonuclease activity
(C) 5'→3'endonuclease activity (D) 3'→5'endonuclease activity
(E) None of the above
46. Which method apply polymerase chain reaction (PCR) ?
(A) Site-directed mutagenesis of a gene (B) ELISA (C) Northern blot
(D) Yeast two-hybrid (E) Flow cytometry
47. Which of the following methods is *not* suitable to investigate protein-protein interaction ?
(A) Western blot (B) Immunoprecipitation (C) RNAi
(D) Yeast two hybrid screening (E) Phage-display
48. Which description is *incorrect* about a cloning vector ?
(A) It usually carries an antibiotic resistance gene.
(B) pET 23b(+) can accommodate insert up to 50 kb.
(C) It usually carries a multiple cloning site.
(D) It usually carries a replication origin.
49. Which of the following experiment can be used to study DNA-protein interactions ?
(A) RFLP (restriction fragment length polymorphism).
(B) Gel Mobility Shift.
(C) FISH (fluorescence in situ hybridization).
(D) Yeast two-hybrid system.
(E) Two-dimensional gel electrophoresis
50. The bacterium *E. coli* requires simple organic molecules for growth and energy—it is therefore a:
(A) chemoautotroph. (B) chemoheterotroph. (C) lithotroph.
(D) photoautotroph. (E) photoheterotroph.