

九十二學年度 微機電 系(所) _____ 組碩士班研究生招生考試

科目 生物化學 科號 2205 共 6 頁第 1 頁 *請在試卷【答案卷】內作答

1. True or False (20%, If you believe a statement to be true, write T in answer sheet; if false, write F. An equal points will be deducted for incorrect answers.)

- () 1. D-Glucose is a ketose
- () 2. Glucose residues in cellulose are linked by $\alpha(1\rightarrow4)$ glycosidic bonds
- () 3. Kinesin is a plus-end-directed motor protein
- () 4. Dynein is a motor protein associated with microtubule doublets of a ciliary axoneme.
- () 5. Under non-competitive inhibition, V_{max} is unchanged compared to the uninhibited reaction.
- () 6. Cholesterol is a amphipathic substance
- () 7. A high concentration of cholesterol in a phospholipid membrane would make the membrane more likely to undergo transition to the crystalline state
- () 8. The temperature at which a phospholipid bilayer undergoes transition to the crystalline state is lower if the phospholipid contains unsaturated fatty acids
- () 9. Fatty acids may form spherical micelles in water
- () 10. The two halves (two monolayers) of a cellular bilayer membrane usually contain the same types of lipids

2. Multiple Choice (one answer) (30%)

- () 1. The most important/characteristic "bond" type for maintaining secondary structures in protein assemblies is:
 - A. hydrophobic
 - B. van der Waals
 - C. hydrogen
 - D. covalent
 - E. ion pair.
- () 2. The correct operational relationship between pKa and pH is that:
 - A. both are log functions.
 - B. both are always <7 for acids, and >7 for bases.
 - C. These two concepts are not operationally related in any way since biological fluids contains mixtures of too many acids and bases.
 - D. When $pH = pKa$, the compound in question will have a charge of +0.5.

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- E. When $\text{pH} = \text{pK}_a$, the ionizable compound in question (whether acid or base) will be half protonated and half deprotonated.
- () 3. If equal volumes of 0.05 M NaH_2PO_4 and 0.05 M H_3PO_4 are mixed, which of the following best describes the resulting solution? (pK_a 's for phosphoric acid are 2.0, 6.8 and 12.0)
- A. pH 2 and poorly buffered.
 - B. pH 2 and well buffered.
 - C. pH 6.8 and well buffered.
 - D. pH 12 and well buffered.
 - E. pH 6.8 and poorly buffered.
- () 4. A key feature of redox reactions leading to their importance in biology is that:
- A. the electron that is transferred retains its energy.
 - B. the transferred electron gains energy.
 - C. the electron does not carry energy.
 - D. they occur with transfer of electrons, protons, or neutrons.
- () 5. The tertiary structure of a protein refers to the:
- A. Sequence of amino acids
 - B. Presence of α -helices or β -sheets
 - C. Unique three dimensional folding of the molecule
 - D. Interactions of a protein with other subunits of enzymes
 - E. Interaction of a protein with a nucleic acid
- () 6. Which statement is true concerning the structure of proteins?
- A. The primary structure is the sequence of amino acids.
 - B. α helices and β sheets are examples of secondary structure.
 - C. Side chains (R-groups) of amino acids can be hydrophilic or hydrophobic.
 - D. Proteins made of two or more polypeptide chains have quaternary structure.
 - E. All statements are true.

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- () 7. Proteins 1 and 2 interact strongly. A significant part of the interaction is between the amino acid side chains Arg (Protein 1) and Glu (protein 2). Assume that a mutation occurs in protein 2 that changes the amino acid to one of the amino acids, Asp, Ser, Lys or Leu, what change should disrupt the interaction between proteins 1 and 2 the most? the least?
- A. The most: aspartic acid; the least: leucine
 - B. The most: lysine; the least: serine
 - C. The most: Serine; the least: aspartic acid
 - D. The most: lysine; the least: aspartic acid
 - E. The most: aspartic acid; the least: serine
- () 8. The buffering action of proteins over the pH range of 6-8 depends for the most part on the presence in the protein structure of
- (A) lysine
 - (B) "neutral" amino acid
 - (C) histidine
 - (D) cysteine
 - (E) none of above
- () 9. Which of the following is not a serine protease:
- (A) trypsin
 - (B) chymotrypsin
 - (C) thrombin
 - (D) fibrin
 - (E) all of above
- () 10. At what [S] does the velocity of an enzyme reach the V_{max} ?
- (A) when $[S] = 0.5 K_m$
 - (B) when $[S] = K_m$
 - (C) when $[S] = 2 K_m$
 - (D) when $[S] = 3.14 K_m$
 - (E) none of above

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科目 生物化學 科號 2205 共 6 頁第 4 頁 *請在試卷【答案卷】內作答

() 11. A polypeptide 5 amino acids long is split into various smaller fragments, and the amino acid sequences of some of the fragments are determined. The identified fragments include: his-gly-ser, ala-his, and ala-ala. Predict the primary sequence of the polypeptide.

- A. his-gly-ser-ala-ala
- B. ala-his-gly-ser-ala
- C. ala-ala-his-gly-ser
- D. his-gly-ser-ala-ala
- E. cannot be determined without more information.

() 12. Blood bicarbonate can be thought of as:

- A. the ionized (deprotonated) form of carbonic acid, which is derived from CO₂ and water.
- B. the protonated form of carbon dioxide.
- C. a transient species that cannot be measured in body fluids.
- D. being formed from hydrogen peroxide via the action of catalase.

() 13. Which of the following statements about mitochondria is false?

- A. They contain an inner and an outer membrane.
- B. The region enclosed by the inner membrane is termed the matrix.
- C. They contain DNA and ribosomes.
- D. They are an important site for energy production in cells.
- E. They contain stacked internal thylakoid membranes.

() 14. Okazaki fragments are:

- A. RNA fragments that serve as primers for discontinuous DNA replication.
- B. Low molecular weight proteins that bind tightly to newly synthesized DNA fragments during discontinuous DNA replication
- C. DNA fragments with short stretches of RNA attached at the 5' ends of the DNA
- D. The DNA segments synthesized by DNA polymerase I which are ligated together to form a completed DNA strand
- E. none of the above

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() 15. *E. coli* DNA polymerase I has all of the following characteristics EXCEPT:

- A. a 5' → 3' exonuclease activity on a second subunit of the polymerase.
- B. a 3' → 5' exonuclease activity
- C. a 5' → 3' DNA polymerase activity.
- D. relatively low rate of polymerization
- E. relatively low processivity

3. DNA adopts a B form helix in living cells but can adopt alternative structures under special circumstances. Which of the following physical properties of DNA are different in A-form and B-form DNA. Put an X that are different and a S that are the same. (10%, points will be deducted for incorrect answers.).

- _____ (1) The helical pitch (base pairs per helical turn)
- _____ (2) The helix direction (right-handed or left-handed)
- _____ (3) The tilt of the bases away from the helix axis
- _____ (4) The width and depth of the major and minor grooves
- _____ (5) The overall width of the double helix (in the direction perpendicular to the helix axis).

4. Give equation(s) or statement(s) explaining the meaning of the following terms. (10%)

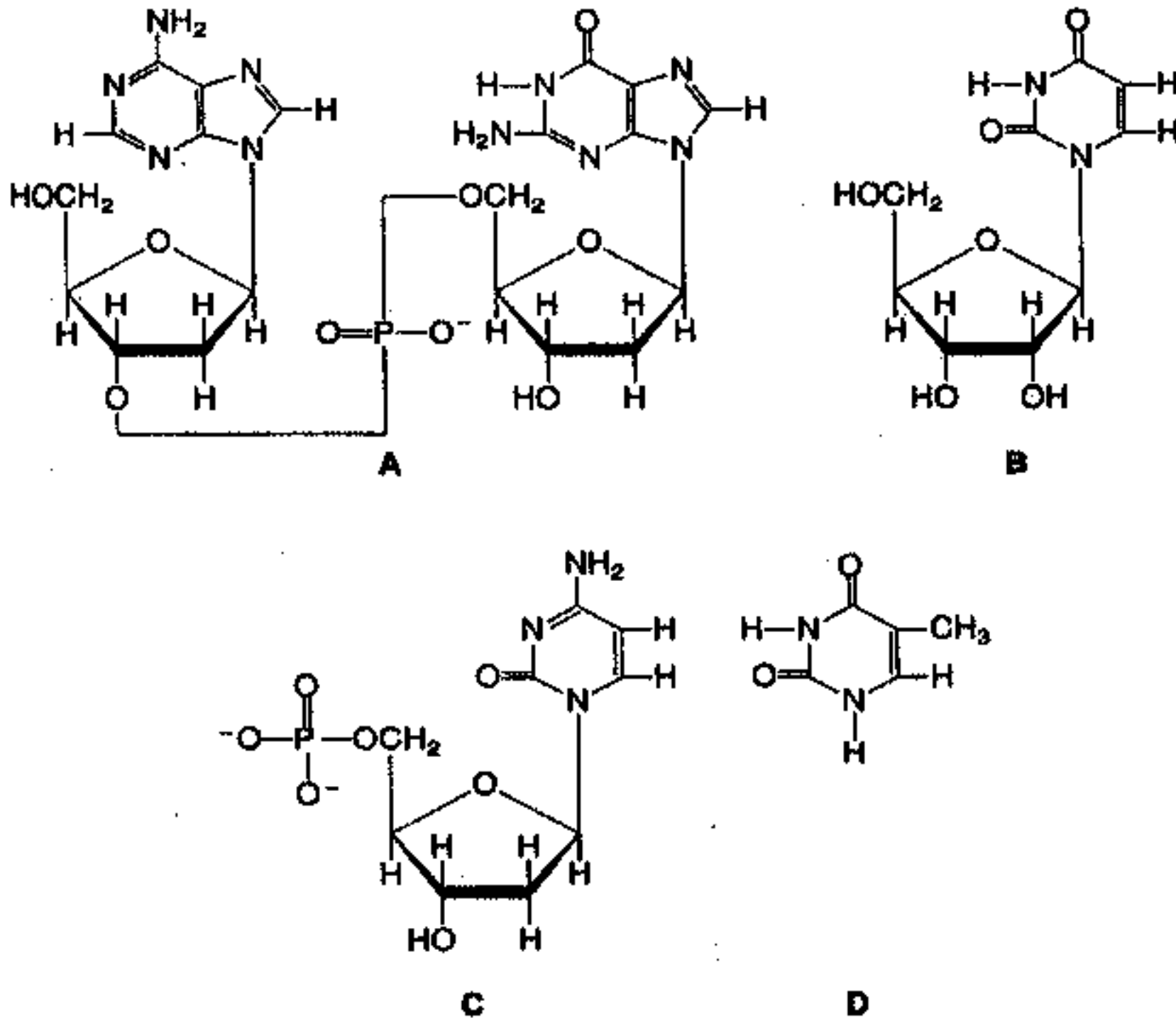
- (1) Bohr effect.
- (2) Homology
- (3) Arrhenius equation
- (4) Hill equation
- (5) Fab fragment

5. Answer the following simple questions (15%)

- (1) What features of the DNA double helix promote the solubility of double-stranded DNA in water?
- (2) In muscular contraction, to which protein does calcium binding cause a conformational change in the sarcomere, allowing myosin headpieces to bind to actin?
- (3) What is the primary energy source in red muscle?
- (4) What is the primary energy source in white muscle?
- (5). What are the five classes of immunoglobulins?

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6. Fill in the blanks with the letters corresponding to the structures shown above (i.e. A, B, C, D). Note that each blank may have multiple correct letter answers. Make sure to write in all the letters that correctly answer each question. (15%)

- _____ (1) Contains ribose?
- _____ (2) Contains a pyrimidine?
- _____ (3) Contains guanine?
- _____ (4) Contains a phosphate monoester?
- _____ (5) Contains a phosphodiester?
- _____ (6) Is a nucleoside?
- _____ (7) Is (or contains) a nucleotide?
- _____ (8) Could be component of RNA.
- _____ (9) Could be a component of DNA.
- _____ (10) Could (if the structure was in DNA) base pair with adenine.