

國立臺北科技大學九十七學年度碩士班招生考試

系所組別：3713 有機高分子研究所甲組

第二節 生物化學 (選考) 試題

填准考證號碼

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第一頁 共五頁

注意事項：

1. 本試題共 42 題，配分共 100 分 (1-2 題各 10 分，3-42 題各 2 分)。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Define the following items 解釋名詞 (兩分/小題)

- a. DNA ligase
- b. peptide bond
- c. PCR (polymerase chain reaction)
- d. O-glycosidic bond
- e. a sugar nucleotide

2. Draw the following molecular structures 劃結構式 (兩分/小題)

- a. lysine
- b. pyruvate
- c. coenzyme Q
- d. citrate
- e. biotin

3. Which one of the following has the cellular components arranged in order of *increasing* size?

- A) Amino acid < protein < mitochondrion < ribosome
- B) Amino acid < protein < ribosome < mitochondrion
- C) Amino acid < ribosome < protein < mitochondrion
- D) Protein < amino acid < mitochondrion < ribosome
- E) Protein < ribosome < mitochondrion < amino acid

4. The major carrier of chemical energy in all cells is:

- A) acetyl triphosphate.
- B) adenosine monophosphate.
- C) adenosine triphosphate.
- D) cytosine tetraphosphate.

E) uridine diphosphate.

5. 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 DNA in the presence of CaCl_2 .

6. The size of the DNA region specifically recognized by type II restriction enzymes is typically:

- A) 4 to 6 base pairs.
- B) 10 to 15 base pairs.
- C) 50 to 60 base pairs.
- D) 200 to 300 base pairs.
- E) about the size of an average gene.

7. Which pathway is central to virtually all living organisms?

- A) Glycolysis.
- B) Krebs' Cycle
- C) Electron Transport System
- D) Photosynthesis
- E) Fatty acid synthesis and breakdown.

8. The following cellular component is found in all living organisms:

- A) Nucleus
- B) Ribosomes
- C) Chloroplasts
- D) Mitochondria
- E) Cell walls

9. Proteins to be transported out of the cell are synthesized here:

- A) Nucleus
- B) Mitochondrion
- C) Rough Endoplasmic Reticulum
- D) Smooth Endoplasmic Reticulum
- E) Cytosol

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10. What is the charge on the tetrapeptide lys-lys-his-glu at pH 7?

- A) +2
- B) +1
- C) 0
- D) -1
- E) -2

11. Which amino acid is actually an imino acid?

- A) Ala
- B) Asp
- C) Gly
- D) Pro
- E) Trp

12. Which of the following forces are involved in maintaining the primary structure of a protein?

- A) covalent bonds
- B) hydrogen bonds
- C) ionic interactions
- D) hydrophobic interactions
- E) all of these.

13. The protein collagen

- A) has a double helical structure
- B) contains hydroxyproline
- C) contains no glycine
- D) is a prime example of a globular protein
- E) contains no proline

14. Why does myoglobin have a histidine that prevents both O₂ and CO from binding perpendicularly to the heme plane?

- A) This increases myoglobin's affinity for O₂.
- B) This increases myoglobin's affinity for CO.
- C) This lessens the difference in myoglobin's affinity for CO versus O₂.
- D) This prevents the iron of the heme from being oxidized.
- E) This prevents myoglobin's affinity for CO

15. Salting out with ammonium sulfate is based upon proteins interacting with other proteins

via

- A) hydrogen bonds.
- B) ionic bonds.
- C) hydrophobic interactions.
- D) disulfide bonds.
- E) electrostatic attraction

16. The purity of an enzyme at various stages of purification is best measured by:

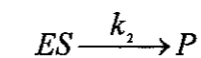
- A) Total protein.
- B) Total enzyme activity.
- C) Specific activity of the enzyme.
- D) Percent recovery of the protein.
- E) Percent recovery of the enzyme.

17. Protein S will fold into its native conformation only when protein Q is also present in the solution. However, protein Q can fold into its native conformation without protein S.

Protein Q, therefore, may function as a _____ for protein S.

- A) ligand
- B) molecular chaperone
- C) protein precursor
- D) structural motif
- E) supersecondary structural unit

18. For enzymes in which the slowest (rate-limiting) step is the reaction



K_m becomes equivalent to:

- A) k_{cat} .
- B) the [S] where $V_0 = V_{max}$.
- C) the dissociation constant, K_d , for the ES complex.
- D) the maximal velocity.
- E) the turnover number.

19. Proteins that catalyze phosphorylation reactions are called

- A) dehydrogenases.
- B) phosphorylases.
- C) kinases.
- D) proteases.

E) phosphatases

20. In common unsaturated fatty acids, the first double bond in the chain is usually in this position:

- A) Between carbons #3 and #4.
- B) Between carbons #7 and #8.
- C) Between carbons #9 and #10.
- D) Between carbons #12 and #13.
- E) Between carbons #17 and #18.

21. Glycolipids are characterized by containing the following non-lipid component:

- A) Sugars
- B) Glycerol
- C) Phosphate
- D) Sphingosine
- E) More than one of these characterize glycolipids.

22. These two lipid vitamins are often found in membranes:

- A) A and D
- B) A and E
- C) D and E
- D) E and K
- E) None of these is the correct pair.

23. The linkage between the sugar and base in nucleic acids is best described as:

- A) Glycoside
- B) N-glycoside
- C) O-glycoside
- D) Thio-glycoside
- E) Ester

24. Nucleosides contain all of the following **except**:

- A) Phosphates
- B) Purines
- C) Pyrimidines
- D) Sugars
- E) All of these are found in nucleosides

25. Histones contain large amounts of which of the following amino acids?

- A) histidine
- B) glutamic acid
- C) lysine
- D) leucine
- E) tryptophan

26. The activities of DNA Polymerase I include all of the following, **except**:

- A) Polymerase activity.
- B) Ability to nick intact double stranded DNA.
- C) 5' → 3' exonuclease.
- D) 3' → 5' exonuclease.
- E) All of these are present in DNA Pol I.

27. The "c" in cDNA stands for this word:

- A) Complete.
- B) Circular.
- C) Complementary.
- D) Chromosomal.
- E) Confusing.

28. The best primers for the PCR reaction have the following feature:

- A) They have a high G-C content.
- B) They have a high A-T content.
- C) They should be palindromic.
- D) The AT/GC ratio does not matter.
- E) They should anneal rapidly, before the larger DNA strands reanneal.

29. Which of the following monosaccharides is a ketose?

- A) glucose
- B) fructose
- C) galactose
- D) mannose
- E) ribose

30. The linkage between the glucose residues in amylopectin and glycogen is:

- A) For the main chain α (1 → 4) and β (1 → 4) for the branches

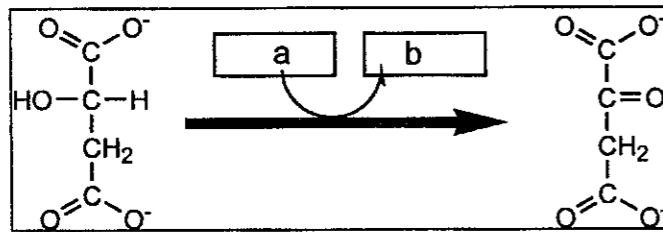
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- B) For the main chain α (1 \rightarrow 6) and α (1 \rightarrow 4) for the branches
- C) For the main chain α (1 \rightarrow 4) and α (1 \rightarrow 6) for the branches
- D) For the main chain β (1 \rightarrow 4) and β (1 \rightarrow 6) for the branches
- E) For the main chain α (1 \rightarrow 4) and β (1 \rightarrow 6) for the branches.

31. Methanol is extremely toxic, but not directly. In the body, it is converted into formaldehyde; that's actually the poison. What kind of enzyme catalyses this conversion?

- A) a kinase
- B) an isomerase
- C) a mutase
- D) a dehydrogenase
- E) a protease

32. Which enzyme catalyzes the reaction shown?



- A) isocitrate dehydrogenase
- B) malate dehydrogenase
- C) fumarase
- D) succinate dehydrogenase
- E) acontase

33. Electron flow in the mitochondria follows this pathway.

- A) $\text{NADH} \rightarrow \text{FMN} \rightarrow \text{Coenzyme Q} \rightarrow \text{Cyt A} \rightarrow \text{Cyt B} \rightarrow \text{Cyt C} \rightarrow \text{O}_2$
- B) $\text{NADH} \rightarrow \text{FMN} \rightarrow \text{Cyt B} \rightarrow \text{Coenzyme Q} \rightarrow \text{Cyt C} \rightarrow \text{Cyt A} \rightarrow \text{O}_2$
- C) $\text{FMNH}_2 \rightarrow \text{NAD} \rightarrow \text{Coenzyme Q} \rightarrow \text{Cyt B} \rightarrow \text{Cyt C} \rightarrow \text{Cyt A} \rightarrow \text{O}_2$
- D) $\text{NADH} \rightarrow \text{FMN} \rightarrow \text{Coenzyme Q} \rightarrow \text{Cyt B} \rightarrow \text{Cyt C} \rightarrow \text{Cyt A} \rightarrow \text{O}_2$
- E) $\text{NADH} \rightarrow \text{FMN} \rightarrow \text{Cyt B} \rightarrow \text{Cyt C} \rightarrow \text{Coenzyme Q} \rightarrow \text{Cyt A} \rightarrow \text{O}_2$

34. Which are the three most common ketone bodies?

- A) Acetone, formaldehyde, acetoacetate.
- B) Acetone, butyric acid and oxaloacetate.
- C) Acetone, β -hydroxybutyrate and acetoacetate.
- D) Acetone, β -hydroxybutyrate and oxaloacetate.
- E) Acetocetate, β -hydroxybutyrate and oxaloacetate.

35. Compared to β -oxidation, fatty acid synthesis requires this extra vitamin or cofactor.

- A) Biotin
- B) Riboflavin
- C) Niacin
- D) Pantothenic acid
- E) All of these are used in both pathways.

36. During oxidative phosphorylation, the proton motive force that is generated by electron transport is used to:

- A) create a pore in the inner mitochondrial membrane.
- B) generate the substrates (ADP and P_i) for the ATP synthase.
- C) induce a conformational change in the ATP synthase.
- D) oxidize NADH to NAD^+ .
- E) reduce O_2 to H_2O .

37. The urea cycle is linked to the citric acid cycle by

- A) arginine
- B) citrulline
- C) fumarate
- D) ornithine
- E) aspartate

38. The synthesis of glycogen, starch, and sucrose all:

- A) involve addition of a sugar residue at the reducing end of the growing polymer.
- B) take place in liver and muscle of mammals.
- C) use a sugar nucleotide as substrate.
- D) use glucose 1-phosphate as the only substrate.
- E) use glucose-6-phosphate as substrate.

39. Penicillin inhibits the synthesis of peptidoglycan:

- A) crosslinks.
- B) chains.
- C) branches.
- D) precursors.
- E) all of the above.

40. Which of the following deoxyoligonucleotides will hybridize with a DNA containing the sequence

(5')AGACTGGTC(3')?

- A) (5')CTCATGAG(3')
- B) (5')GACCAGTCT(3')
- C) (5')GAGTCAACT(3')
- D) (5')TCTGACCAG(3')
- E) (5')TCTGGATCT(3')

41. The biochemical property of lectins that is the basis for most of their biological effects is their ability to bind to:

- A) amphipathic molecules.
- B) hydrophobic molecules.
- C) specific lipids.
- D) specific oligosaccharides.
- E) specific peptides.

42. The force that drives an ion through a membrane channel depends upon:

- A) the charge on the membrane.
- B) the difference in electrical potential across the membrane.
- C) the size of the channel.
- D) the size of the ion.
- E) the size of the membrane.