

國立臺北科技大學九十九學年度碩士班招生考試

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第二節 生物化學 試題 (選考)

第一頁 共四頁

注意事項：

1. 本試題共 31 題，配分共 100 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。

(1~27 題：2 分/小題 共 54 分)

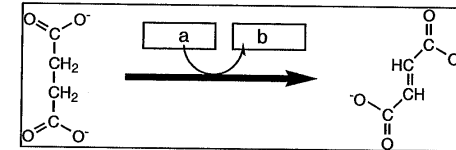
1. A sequence of amino acids in a certain protein is found to be -Ser-Gly-Pro-Gly-. The sequence is most probably part of a(n):
 - A) antiparallel β sheet
 - B) parallel β sheet
 - C) α helix
 - D) α sheet
 - E) β turn
2. The net charge on the peptide abbreviated CAKE in a solution at pH 7 is closest to
 - A) -2
 - B) -1
 - C) 0
 - D) +1
 - E) +2
3. In living cells, nucleotides and their derivatives can serve as:
 - A) carriers of metabolic energy.
 - B) enzyme cofactors.
 - C) intracellular signals.
 - D) precursors for nucleic acid synthesis.
 - E) all of the above.
4. Which of the peptides would absorb light at 280 nm?
 - A) ala-lys-his
 - B) ser-gly-asn
 - C) ala-ala-trp
 - D) val-pro-leu
 - E) ser-val-ile
5. The inner (plasma) membrane of *E. coli* is about 75% lipid and 25% protein by weight. How many molecules of membrane lipid are there for each molecule of protein? (Assume that the average protein is M_r 50,000 and the average lipid is 750.)
 - A) 100
 - B) 200
 - C) 1000
 - D) 10,000
 - E) 50,000
6. Assuming that the average amino acid residue contributes 110 to the peptide molecular weight, what will be the minimum length of the mRNA encoding a protein of molecular weight 50,000?
 - A) 133 nucleotides
 - B) 460 nucleotides
 - C) 1,400 nucleotides
 - D) 5,000 nucleotides
 - E) a minimum length cannot be determined from the data given.
7. Roughly how many amino acids are there in one turn of an α helix?
 - A) 1
 - B) 2.8
 - C) 3.6
 - D) 4.2
 - E) 10
8. A good transition-state analog:
 - A) binds covalently to the enzyme.
 - B) binds to the enzyme more tightly than the substrate.
 - C) binds very weakly to the enzyme.
 - D) is too unstable to isolate.
 - E) must be almost identical to the substrate.
9. 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
10. Determination of the sequence of amino acids in a peptide is done by
 - A) x-ray crystallography

注意：背面尚有試題

- B) Edman degradation
 C) treatment with cyanogen bromide
 D) trypsin hydrolysis
 E) treatment with alkyl halides
11. Which separates on the basis of molecular weight?
 A) gel filtration
 B) affinity chromatography
 C) cation exchange
 D) anion exchange
 E) cation or anion exchange
12. In the Watson-Crick model of DNA structure (now called B-form DNA):
 A) a purine in one strand always hydrogen bonds with a purine in the other strand.
 B) A-T pairs share three hydrogen bonds.
 C) G-C pairs share two hydrogen bonds.
 D) the 5' ends of both strands are at one end of the helix.
 E) the bases occupy the interior of the helix.
13. The biological role of restriction enzymes is to:
 A) aid recombinant DNA research.
 B) degrade foreign DNA that enters a bacterium.
 C) make bacteria resistant to antibiotics.
 D) restrict the damage to DNA by ultraviolet light.
 E) restrict the size of DNA in certain bacteria.
14. What is the approximate length of a DNA molecule (in the B form) containing 1,000 base pairs?
 A) 0.034 μm
 B) 0.34 μm
 C) 3.4 μm
 D) 34 μm
 E) 340 μm
15. Glycolysis in the erythrocyte produces pyruvate that is further metabolized to:
 A) CO_2
 B) ethanol
 C) glucose
 D) hemoglobin
 E) lactate
16. The Lineweaver-Burk graph is easier to use for determining enzyme parameters than a saturation curve. If the y-intercept = 1.91 (sec/millimole) and the slope = 75.3 L/sec, Km equals:

- A) 0.0254 millimolar (mM)
 B) 0.523 millimolar (mM)
 C) 5.23 millimolar (mM)
 D) 39.4 millimolar (mM)
 E) 75.3 millimolar (mM)

17. Which enzyme catalyzes the reaction shown?



- A) isocitrate dehydrogenase
 B) malate dehydrogenase
 C) fumarase
 D) succinate dehydrogenase
 E) α -ketoglutarate dehydrogenase
18. During β oxidation of fatty acids, _____ is produced in peroxisomes but not in mitochondria.
 A) acetyl-CoA
 B) FADH_2
 C) H_2O
 D) H_2O_2
 E) NADH
19. What is the correct order of function of the following enzymes of β oxidation?
 1. β -Hydroxyacyl-CoA dehydrogenase
 2. Thiolase
 3. Enoyl-CoA hydratase
 4. Acyl-CoA dehydrogenase
 A) 1, 2, 3, 4
 B) 3, 1, 4, 2
 C) 4, 3, 1, 2
 D) 1, 4, 3, 2
 E) 4, 2, 3, 1
20. Penicillin and related drugs inhibit the enzyme _____; this enzyme is produced by _____.
 A) β -lactamase; bacteria
 B) transpeptidase; human cells
 C) transpeptidase; bacteria
 D) lysozyme; human cells

- E) aldolase; bacteria
21. Carbon monoxide (CO) is toxic to humans because:
- it binds to myoglobin and causes it to denature.
 - it is rapidly converted to toxic CO₂.
 - it binds to the globin portion of hemoglobin and prevents the binding of O₂.
 - it binds to the Fe in hemoglobin and prevents the binding of O₂.
 - it binds to the heme portion of hemoglobin and causes heme to unbind from hemoglobin.
22. Analysis of x-ray diffraction data yields a(n); analysis of 2D NMR data yields a(n) .
- electron density map; count of hydrogen atoms in the molecule
 - shadow of protein's outline; estimate of protein's molecular volume
 - table of interatomic distances; electron density map
 - electronic density map; table of interatomic distances
 - 3-d protein structure; 2-d protein structure
23. If an aerobic organism (for example, the bacterium *E. coli*) were fed each of the following four compounds as a source of energy, the energy yield per mole from these molecules would be in the order:
- alanine > glucose > palmitate (16:0).
 - glucose > alanine > palmitate
 - glucose > palmitate > alanine
 - palmitate > alanine > glucose
 - palmitate > glucose > alanine
24. Glucose breakdown in certain mammalian and bacterial cells can occur by mechanisms other than classic glycolysis. In most of these, glucose 6-phosphate is oxidized to 6-phosphogluconate, which is then further metabolized by
- an aldolase-type split to form glyceric acid and glyceraldehyde 3-phosphate
 - an aldolase-type split to form glycolic acid and erythrose 4-phosphate
 - conversion to 1,6-bisphosphogluconate
 - decarboxylation to produce keto- and aldopentoses
 - oxidation to a six-carbon dicarboxylic acid
25. Oxidative phosphorylation and photophosphorylation share all of the following *except*:
- chlorophyll.
 - involvement of cytochromes.
 - participation of quinones.
 - proton pumping across a membrane to create electrochemical potential.
 - use of iron-sulfur proteins.
26. In amino acid catabolism, the first reaction for many amino acids is a(n):
- decarboxylation requiring thiamine pyrophosphate (TPP)

- hydroxylation requiring NADPH and O₂
- oxidative deamination requiring NAD⁺
- reduction requiring pyridoxal phosphate (PLP)
- transamination requiring pyridoxal phosphate (PLP)

27. The order of compounds and intermediates found in the citric acid cycle is as follows:
- Iso*-Citrate → Aconitate → α-Ketoglutarate → Fumarate → Malate → Oxaloacetate
 - Aconitate → *iso*-Citrate → Oxaloacetate → α-Ketoglutarate → Malate → Fumarate
 - Aconitate → *iso*-Citrate → α-Ketoglutarate → Fumarate → Malate → Oxaloacetate
 - Aconitate → *iso*-Citrate → α-Ketoglutarate → Malate → Fumarate → Oxaloacetate
 - Iso*-Citrate → Aconitate → α-Ketoglutarate → Malate → Oxaloacetate → Fumarate

28. The number of structurally different polysaccharides that can be made with 20 different monosaccharides is far greater than the number of different polypeptides that can be made with 20 different amino acids, if both polymers contain an equal number (say 100) of total residues. Explain why. (10分)

29. A biochemist is attempting to separate a DNA-binding protein (protein X) from other proteins in a solution. Only three other proteins (A, B, and C) are present. The proteins have the following properties: (9分)

	pI (isoelectric point)	Size <i>M_r</i>	Bind to DNA?
protein A	7.4	82,000	yes
protein B	3.8	21,500	yes
protein C	7.9	23,000	no
protein X	7.8	22,000	yes

What type of protein separation techniques might she use to separate

- protein X from protein A?
- protein X from protein B?
- protein X from protein C?

30. Draw the following molecular structures 劃結構式 (3分/小題 共12分)
- palmitic acid
 - glycerol
 - xylose
 - glutamate

31. Define the following items 解釋名詞 (3分/小題 共15分)

- a. holoenzyme
- b. amino acid
- c. intron
- d. Chargaff's rules
- e. polymerase chain reaction (PCR)