國立中央大學109學年度碩士班考試入學試題

所別： 生命科學系 碩士班 分子與細胞生物組(一般生)　　共3頁 第1頁
生命科學系 碩士班 分子與細胞生物組(在職生)

科目： 生物化學

本科考試禁用計算器　　＊請在答案卷(卡)內作答

一. 單選題(每題 2 分；共 70 分)

1. Which kind of gradian is generated in the electron transport chain during cellular respiration? (a) H^+ (b) OH^- (c) Na^+ (d) Cl^- (e) Mg^{2+}
2. Which of following compounds is **NOT** ketone bodies? (a) acetoacetate (b) acetone (c) acetonitrile (d) β-hydroxybutyrate
3. Which is the rate limited step during fatty acid biosynthesis? (a) reduction of ketoacyl-APC (b) reduction of enoyl-APC (c) Synthesis of malonyl-CoA (d) Hydration of enoyl-CoA (e) conversion to succinyl-CoA.
4. What is the major cholesterol carrier in the human blood? (a) VLDL (b) LDL (c) HDL (d) chylomicrons (e) albumin
5. What is the key enzyme of cholesterol synthesis? (a) HMG-CoA synthase (b) HMG-CoA reductase (c) mevalonate kinase (d) Squalene synthase (e) phosphomevalonate kinase.
6. What kind of reaction is involved in amino acid synthesis and degradation, which could catalyze the conversion between α-keto acid and α-amino acid? (a) nitrogenation (b) ketolization (c) aminization (d) transketolation (e) transamination.
7. A hereditary disease, phenylketonuria (PKU), is caused by metabolism deficiency of which bio-molecular? (a) ketone body (b) sugar (c) lipid (d) amino acid (e) cholesterol.
8. Which of the following compounds has the highest molecular weight? (a) adenine (b) adenosine (c) adenylate (d) uracil (e) uridine
9. What is present in many eukaryotic genes that drastically increases the size of eukaryotic DNA, but are not present in prokaryotic genes? (a) satellite DNA (b) long interspersed elements (c) Alu sequences (d) UTR (e) introns.
10. In a single strand polynucleotide chain, what kind of linkage is between two monomer units? (a) ester linkages (b) amide linkage (c) glycosidic linkage (d) Ether linkage (e) phosphodiester linkage
11. Which of the following molecules has highest molecular weight? (a) a ribose (b) a nucleotide (c) a nitrogenous base (d) a nucleoside (e) a deoxgyribose
12. In *E. coli,* different promoters are recognized by which subunit of RNA polymerase? (a) α (b) β (c) ρ (d) σ (e) ω.
13. During elongation of transcription in eukaryotic cells, the largest subunit of RNA polymerase II will be _____ (a) phosphorylated (b) glycosylated (c) esterified (d) farnesylated (e) ubiquitinated.
14. What is the model for DNA replication? (a) conservative (b) unconservative (c)) toti-conservative (d) hypo-conservative (e) semiconservative.
15. Which of the following genome is replicated by D-loop replication? (a) *E. coli* (b) T7 phage (c)

參考用

注意：背面有試題

mitochondria (d) baculovirus (e) *Drosophila*.

16. The shine-Dalgarno sequence is for _____ binding. (a) DNA polymerase I (b) DNA polymerase II (c) transcription factor (d) ribosome (e) tRNA.
17. Which of the following compounds is an inhibitor of protein translation? (a) chloramphenicol (b) AZT (c) X-Gal (d) fluoroacetate (e) IPTG.
18. Which amino acids that account for most of the UV absorbance at 280 nm in proteins. (a) F and H (b) M and C (c) W and Y (d) D and E (e) Q and N
19. Please choose the **incorrect** one from the following descriptions about the Michaelis-Menten rate equation. (a) K_M measures the substrate concentration at which the reaction rate is $V_{max}/2$ (b) k_{cat} is the turnover number that measures the rate of the catalytic process (c) The ratio k_{cat}/K_M is a convenient measure of enzyme efficiency (d) A noncompetitive inhibitor reduces the apparent V_{max}. (e) A competitive inhibitor increases the apparent K_{cat}
20. Please choose the **incorrect** one from the following descriptions about nucleic acids. (a) The *E. coli* genome contains about 4,600,000 bp (b) The *E. coli* genome contains about 4,200 genes (c) The average length of a gene in *E. coli* is ~ 100 bp (d) Most DNA is in the B form (e) RNA-RNA and DNA-RNA helices are A form.
21. Determine the mRNA sequence transcribed from the following DNA segment:

    5'-GCCATTTCCCGTTA-3'

    (a) 5'-CGGTAAAGGGAAT-3', (b) 5'-CGGUAAAGGGCAAU-3',

    (c) 5'-TAACGGCAAATGGC-3', (d) 5'-UAACGGCAAAUGGC-3',

    (e) 5'-UAACGGGAAAUGGC-3'
22. Which of the following organisms has the **largest** genome in size? (a) *Drosophila melanogaster* (b) *E. coli* (c) Bacteriophage ϕX174 (d) Adenovirus AD-2 (e) *Saccharomyces cerevisiae*.
23. B form DNA has a rise of (a) 15 (b) 20 (c) 34 (d) 5.4 (e) 3.4 Å/bp.
24. The α-helix of a polypeptide is best characterized by (a) 1.2 (b) 2.4 (c) 3.6 (d) 4.8 (e) 6.0 residues/turn.
25. Which of the following dyes is most commonly used in staining protein on the SDS-PAGE? (a) bromophenol blue (b) EtBr (c) ninhydrin reagent (d) CNBr (e) commassie brilliant blue.
26. Which of the following dyes is most commonly used in staining DNA in an agarose gel? (a) bromophenol blue (b) EtBr (c) ninhydrin reagent (d) CNBr (e) commassie brilliant blue.
27. Which of the following lipids is **not** a major component of cellular membranes? (a) glycerophospholipids (b) sphingolipids (c) fatty acids (d) glycosphingolipids (e) glycoglycerolipid.
28. The Watson-Crick base pairing scheme for an A-T base pair includes (a) a hydrogen bond between a keto oxygen and an extracyclic amino group (b) a hydrogen bond between two ring nitrogen atoms (c) an ionic bond between the positively charged adenine amino group and a negatively

polarized keto group (d) hydrophobic interaction (e) both "a" and "b".

29. A DNA segment of 1000 base pairs in the B form. What is its approximate molecular weight? (a) 3.3 (b) 33 (c) 66 (d) 330 (e) 660 kDa.
30. A protein is composed of 100 amino acids. What is its approximate molecular weight? (a) 11 (b) 22 (c) 110 (d) 220 (e) 3,30 kDa.
31. Which of the following amino acids has an indole side chain? (a) Phe (b) Trp (c) Tyr (d) Lys (e) His.
32. How many different codons are used to decode argnine? (a) 1 (b) 2 (c) 3 (d) 4 (e) 6.
33. Triton X-100 is a nonionic detergen that denatures proteins by disrupting which of the following? (a) hydrogen bonds (b) disulfide bridges (c) hydrophobic interactions (d) salt bridges (e) covalent bonds.
34. Which of the following reactions is **not** located in the mitochondria? (a) tricarboxylic acid cycle (b) cholesterol biosynthesis (c) ketone body synthesis (d) β-oxidation (e) electron transport and oxidative phosphorylation.
35. Which amino acid is complexed to iron-sulfur clusters to enable them to associate with proteins? (a) methionine (b) cysteine (c) serine (d) lysine (e) tyrosine.

二、簡答題(共 30 分)

1. The hnRNAs need to be processed to become mature mRNAs. Please write down the processes for hnRNAs. (9 points)
2. The replisome is a complex molecular machine that carries out DNA replication. Please write down three enzymes are included in the replisome. (9 points)
3. You are given 500 ml of a solution at pH 7.5 containing an unknown concentration of nicotinamide adenine dinucleotide (NADH, the molar extinction coefficient of NADH is 6600 $M^{-1}cm^{-1}$ at 340 nm and pH 7.5). You place 0.5 ml of this solution in a 0.5 cm wide, 0.5 cm long, 2 cm high quartz cuvette and determine the absorbance at 340 nm (A_{340nm}) of this solution to be 0.33. What is the molarity of the NADH solution? How many moles of NADH are in the 500 ml of solution? (6 points)
4. Draw the chemical structure of the following compounds (2 points for each): (a) urea (b) dATP (c) aspartate