國立中央大學105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4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80分)

1. Which of the following organisms is a prokaryote? (a) *Saccharomyces cerevisiae* (b) *Caenorhabditis elegans* (c) *Aspergillus niger* (d) *Drosophila melanogaster* (e) *Helicobacter Pylori.*
2. α-helix has ___ residues per turn. (a) 0.34 (b) 0.54 (c) 2 (d) 3.6 (e) 10.5.
3. Which of the following descriptions about Hb (hemoglobin) is incorrect? (a) One Hb can bind 4 O_2 molecules (b) HbA has an $\alpha_2\beta_2$ structure (c) HbF has an $\alpha_2\gamma_2$ structure (d) HbF has a higher affinity for BPG than does HbA (e) CO_2 decreases the binding affinity of Hb for O_2
4. Which of the following descriptions about the Michaelis-Menten rate equation is incorrect? (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) $k_{cat} = V_{max}/[E]_t$ (e) A competitive inhibitor decreases the apparent K_M.
5. Which of the following chemicals is frequently used to stain DNA? (a) bromophenol blue (b) EtBr (c) ninhydrin reagent (d) CNBr (e) BUdR.
6. A DNA segment of 100 base pairs in the B form. What is its approximate molecular weight? (a) 33 (b) 65 (c) 330 (d) 650 (e) 3,300 kD.
7. Which of the following α-amino acids has the highest absorbance at 280 nm? (a) Phe (b) His (c) Arg (d) Glu (e) Trp.
8. Which of the following compounds has the lowest molecular weight? (a) adenosine (b) adenylate (c) adenine (d) guanosine (e) uracil.
9. Which of the following descriptions regarding disaccharide is incorrect? (a) Sucrose is α-D-glucopyranosyl (1→2) β-D-fructopyranoside (b) Sucrose is a nonreducing sugar (c) Lactose is β-D-galactopyranosyl (1→4) β-D-glucopyranose (d) Lactose is a galactoside (e) Cellobiose is β-D-glucopyranosyl (1→4) β-D-glucopyranose.
10. Which of the following restriction endonucleases is an isoschizomer of BamHI (GGATCC)? (a) EcoRI (GAATTC) (b) SpeI (ACTAGT) (c) BglII (AGATCT) (d) SalI (GTCGAC) (e) EagI (CGGCCG).
11. Which scientist made a significant contribution to the understanding of prion? (a) K. B. Mullis (b) J. D. Watson and H. C. Crick (c) A. D. Hershey and M. Chase (d) S. B. Prusiner (e) G. N. Ramachandran.
12. NP-40 is a nonionic detergent that denatures proteins by disrupting which of the following? (a) Hydrogen bonds (b) Disulfide bridges (c) Hydrophobic interactions (d) Salt bridges (e) Covalent bonds.
13. How many stereoisomers for an aldohexose? (a) 2 (b) 4 (c) 8 (d) 16 (e) none of the above.
14. The chemical bond between ribose and base of UMP is an (a) Ether (b) Ester (c) Amide (d) Aldehyde (e) Ketone.
15. The simplest lipids are (a) Triacylglycerol (b) Waxes (c) Fatty acids (d) Cholesterol (e) Glycerophospholipids.
16. Anticodon loops are found in (a) mRNA (b) rRNA (c) tRNA (d) hnRNA (e) snRNA.
17. Which of the following bond-pairs within a peptide backbone show free rotation around both bonds? (a) N-C_α and N-C (b) C_α-C and N-C_α (c) C=O and N-C (d) C=O and N-C_α (e) N-C and C_α-C.

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18. Which scientist made a significant contribution to the discovery of prion? (a) K. B. Mullis (b) J. D. Watson and H. C. Crick (c) A. D. Hershey and M. Chase (d) S. B. Prusiner (e) F. Sanger.
19. Which of the following amino acids has only one codon? (a) Gly (b) Ala (c) Val (d) Trp (e) His.
20. There are approximately "N" protein-coding genes in *E. coli*. "N" is (a) 100 (b) 500 (c) 5,000 (d) 20,000 (e) 200,000.
21. The Western blotting method is originally used for the measure of (a) DNA (b) RNA (c) lipid (d) carbohydrates (e) protein.
22. The source of nitrogen for the synthesis of glucosamine-6-phosphate from fructose-6-phosphate is the amino acid (a) lysine (b) arginine (c) glutamine (d) glutamate (e) asparagine.
23. Which of the following represents a correct compartmentation of a biochemical process with its cellular location? (a) citric acid cycle: mitochondria (b) fatty acid oxidation: endoplasmic reticulum (c) RNA synthesis: Golgi complex (d) gluconeogenesis: lysosome (e) none of the above.
24. Which of the following coenzymes is required by acetyl-CoA carboxylase? (a) NAD^+ (b) NADPH (c) biotin (d) tetrahydrofolate (e) FAD..
25. What are the β-oxidation products of lauric acid (12:0)? (a) 6 acetyl-CoA, 6 NADH, 6 FADH2, 2 ATP used for activation (b) 6 acetyl-CoA, 5 NADH, 5 FADH2, 2 ATP used for activation (c) 6 acetyl-CoA, 6 NADH, 6 FADH2, 1 ATP used for activation (d) 6 acetyl-CoA, 5 NADH, 5 FADH2, 1 ATP used for activation (e) 6 acetyl-CoA, 5 NADH, 4 FADH2, 2 ATP used for activation.
26. Low levels of oxaloacetate with high levels of β-oxidation cause the production of what metabolites, particularly within the liver? (a) 3-hydroxy-3-methyglutaryl-CoA and propionyl-CoA (b) D-methylmalonyl-CoA and L-methylmalonyl-CoA (c) acetate and ethanol (d) acetoacetate and β-hydroxybutyrate (e) all of the above
27. Which of the following roles does the liver play in lipoprotein metabolism? (a) production of chylomicrons (c) uptake of VLDL (c) production of LDL (d) uptake of HDL (e) none of the above.
28. Non-steroidal anti-inflammatory drugs (NSAIDS) like aspirin and ibuprofen act by blocking production of: (a) vitamin D (b) biological waxes (c) prostaglandins (d) sphingolipids (e) none of the above.
29. Which of the following compounds has the greatest effect on the rate-limiting step in purine nucleotide synthesis? (a) aspartate (b) glutamine (c) ADP (d) ribose-1-phosphate (e) phosphoribosylpyrophosphate
30. What is the link between glutathione and the pentose phosphate pathway (PPP)? (a) during the oxidative phase, thiol groups on glucose-6-phosphate dehydrogenase become oxidized and must be reduced by glutathione (b) NADPH from the PPP is needed to keep glutathione in its reduced state (c) glutathione acts as an inhibitor of glucose-6-phosphate dehydrogenase (c) (d) phosphopentose epimerase often produces free radicals that are quenched by glutathione (e)none of the above.

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31. Which pair of enzymes listed below is unique to gluconeogenesis? (a) pyruvate dehydrogenase and fructose-bisphosphatase-1 (b) pyruvate carboxylase and 3-phosphoglycerate kinase (c) PEPCK and pyruvate carboxylase (d) phosphoenolpyruvate carboxykinase (PEPCK) and pyruvate kinase (e) pyruvate carboxylase and phosphofructokinase-1.
32. 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.
33. Of the following molecules derived from amino acids, which is used to transport amino acids across the cell membrane? (a) glutathione (b) S-adenosylmethionine (c) nitric oxide (d) thyroxine (e) γ-aminobutyric acid
34. 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.
35. Which of the following is used to activate phosphatidic acid for conversion to various phospholipids? (a) ATP (b) TTP (c) CTP (d) GTP (e) UTP.
36. Which of the following pairs of enzymes participate in the major route of nitrogen transfer from amino acids to urea? (a) glutaminase and asparaginase (b) transaminases and glutaminase (c) glutamate dehydrogenase and glutaminase (d) amino acid oxidases and glutamate dehydrogenase. (e) transaminases and glutamate dehydrogenase
37. The model of electron transport includes all EXCEPT: (a) four independent mobile complexes (b) mobile coenzyme Q collecting electrons (c) cyt c moving in the intermembrane space (d) proton gradient generated to produce ATP (e) protons driven into the matrix.
38. A highly conserved protein that is involved in protein degradation is: (a) ricin (b) met-aminopeptidase (c) degradase (d) ubiquitin (e) peptidyl transferase.
39. Which of the following do NOT correctly pair a hormone with its function? (a) prolactin – stimulates milk production (b) insulin – regulates metabolism and blood glucose (c) FSH – stimulates processes within the gonads (d) calcitonin – regulates plasma Ca^{2+} (e) ACTH – promotes production of thyroxin.
40. Which of the following coenzymes contains an adenylate group? (a) coenzyme A (b) cobalamin (c) tetrahydrofolate (d) thiamine pyrophosphate (e) pyridoxal phosphate.

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二、簡答題(共 20 分)

1. Please describe the major contributions made by the following scientists: (a) Sidney Altman and Thomas Cech (b) Fred Sanger (c) Rosalind Franklin (d) Kary Mullis (e) Thomas Steitz. (2% each)

2. Please fill in the answers in the following tables.

(1) For each of the following tissue types, list the fuel(s) stored, preferred fuel(s) and exported fuel(s) under normal conditions.

Tissue	fuel(s) stored	preferred fuel(s)	exported fuel(s)
Brain	none	(a)	none
Highly active skeletal muscle	(b)	(c)	lactate, alanine
Adipose	(d)	Fatty acids	(e)

(2) For each of the following biochemical pathways, give the effect of each hormone as either activated (↑), inhibited (↓) or no effect (NE).

	insulin	glucagon	epinephrine
glycolysis (liver)	(a)	(b)	↓
gluconeogenesis	(c)	↑	(d)
glycogen synthesis (muscle)	(e)	(f)	(g)
lipolysis	(h)	(i)	(j)

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