國立中央大學 106 學年度碩士班考試入學試題

所別： 企業管理學系 碩士班 一般乙組(一般生)　　共4頁 第1頁

科目： 生物化學(含分子生物學)

本科考試禁用計算器　　＊請在答案卷(卡)內作答

Part I. Multiple choice questions (total 75%): each of questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case.

請於答案卡上作答

1. Why amino acids are soluble in water but not all peptides are soluble?
   (a) The R groups of the amino acid can interact with water non covalently
   (b) The R groups of the amino acid in the peptide are charged
   (c) Individual amino acid are zwitterions at physiological pHs
   (d) All peptides are insoluble in water
   (e) all of the above

2. Which of the following descriptions is **TRUE** for the effect of lowering the $[CO_2]_{dissolved}$ on blood pH?
   (a) An increase in the dissociation of H_2CO_3 → $H^+ + HCO_3^-$ and a drop in pH
   (b) An increase in the dissociation of H_2CO_3 → $H_2O + CO_2$ and a drop in pH
   (c) An increase in the dissociation of $H^+ + HCO_3^-$ → H_2CO_3 and an increase in pH
   (d) A decrease in the dissociation of $H^+ + HCO_3^-$ → H_2CO_3 and a decrease in pH
   (e) No change on blood pH

參考用

3.Why is phosphorylation of sugars beneficial to a cell?
   (a) Phosphorylated sugars are important in regulating cellular pH
   (b) Phosphorylated sugars encode genetic information
   (c) Unphosphorylated sugars can be transported across cell membranes
   (d) Unphosphorylated sugars are rapid degraded by cellular enzymes
   (e) None of the above

4. Which of the following statements is **NOT TRUE** for DNA?
   (a) GC pairs share three hydrogen bonds
   (b) Phosphate groups project toward the middle of the double helix
   (c) Deoxyribose units are connected by 3', 5'-phosphodiester bonds
   (d) The sum of A+G is equal to the sum of T+C
   (e) The 5' ends of both strands are not at the same end of the double helix

5. The polar head group of cholesterol is_____
   (a) The glycerol
   (b) The hydroxyl group
   (c) The alkyl side chain
   (d) The steroid nucleus
   (e) Choline

6. Which of the following is **NOT** a reason why ruptured biological membranes are self-sealing?
   (a) Covalent interactions among lipids
   (b) Hydrophobic interactions between lipids
   (c) Hydrogen bonding between the head groups of the lipids and H_2O
   (d) The amphipathic character of the lipids
   (e) An increase in entropy of the system upon sealing

7. Which of the enzymes represents a major regulation point in glycolysis?
   (a) hexokinase
   (b) phosphofructokinase-1
   (c) pyruvate kinase
   (d) phosphohexose isomerase
   (e) enolase

注意：背面有試題

所別： 企業管理學系 碩士班 一般乙組(一般生)　　共4頁 第2頁

科目： 生物化學(含分子生物學)

本科考試禁用計算器　　＊請在答案卷(卡)內作答

8. How would a pyruvate kinase deficiency affect hemoglobin's affinity for oxygen?
   (a) An increase in the hemoglobin's affinity for oxygen
   (b) A decrease in the hemoglobin's affinity for CO_2
   (c) A decrease in the hemoglobin's affinity for oxygen
   (d) No change in the hemoglobin's affinity
   (e) None of the above.

9. Which of the following is possible explanation for an overly high level of pyruvate in a patient's blood and urine?
   (a) An increase in acetyl-CoA
   (b) A genetic defect in the enzyme isocitrate dehydrogenase
   (c) A genetic defect in the enzyme malate dehydrogenase.
   (d) A deficiency of thiamine
   (e) A deficiency of biotin

10. Which is produced in peroxisomes but not in mitochondria during β oxidation of fatty acids?
   (a) ATP
   (b) $FADH_2$
   (c) acetyl-CoA
   (d) NADH
   (e) H_2O_2

11. If a person's urine contains unusually high concentrations of urea, which one of the following diets is appropriated for eating recently?
   (a) Very low carbohydrate, very high protein
   (b) Very high fat, very low protein
   (c) High carbohydrate, very low protein
   (d) Very high carbohydrate, no protein, no fat
   (e) Very high fat, high carbohydrate, no protein

12. Which of the following phospholipids is produced in eukaryotes but not prokaryotes?
   (a) phosphatidylethanolamine
   (b) phosphatidylinositol
   (c) phosphatidylserine
   (d) phosphatidylglycerol
   (e) none of the above

13. What is the difference between the synthesis of purine and pyrimidine nucleotides?
   (a) pyrimidine biosynthesis is tightly regulated in the cell, whereas purine biosynthesis is not
   (b) purine formation requires a THF derivative, whereas pyrimidine formation does not
   (c) purine biosynthesis starts with the formation of PRPP, whereas pyrimidines incorporate the PRPP near the end of the pathway
   (d) pyrimidines go through many steps, adding a single carbon or nitrogen each time, whereas the basic skeleton for purines is formed by two main precursors
   (e) ATP is required in the synthesis of purines but not in the synthesis of pyrimidines

14. Which of the following enzyme catalyzed the rate-limiting step in cholesterol biosynthesis?
   (a) progesterone to androstenedione
   (b) thiolase
   (c) HMG-CoA synthase
   (d) HMG-CoA reductase
   (e) Mevalonate 5-phosphotransferase

注意：背面有試題

國立中央大學 106 學年度碩士班考試入學試題

所別： 企業管理學系 碩士班 一般乙組(一般生) 共4頁 第3頁

科目： 生物化學(含分子生物學)

本科考試禁用計算器 ＊請在答案卷(卡)內作答

15. The synthesis of which of the following molecules would be inhibited by aspirin?
    (a) prostaglandin F_2.
    (b) prostaglandin D_2
    (c) prostaglandin E_2
    (d) prostaglandin H_2
    (e) all of the above

16. Which of the following descriptions is **NOT TRUE**?
    (a) Eukaryotic DNA is present in the nucleus and attached to the nuclear matrix
    (b) Histones are rich in lysine and arginine
    (c) H2A, H2B, H3, and H4 form core particles
    (d) H1 binds to linker DNA
    (e) Interphase chromosome includes highly condensed regions of euchromatin

17. Which of the following description about the initiation of eukaryotic DNA replication is **NOT TRUE**?
    (a) ORC recognizes replication origins
    (b) Cdc18 and Cdt1 binding to recruit MCM
    (c) MCM binds to DNA and unwind DNA, so it has a helicase activity
    (d) Cdc45 binding to form pre-initiation complex
    (e) Pre-Replicative complex (Pre-RC) formation occurs in S phase

18. Which of the following description about the nucleotides excision repair is **NOT TRUE**?
    (a) Damaged nucleotides are removed by nick translation
    (b) The first enzyme in this pathway cleaves two phosphodiester bonds
    (c) This system is chiefly responsible for the mutagenic effect of ultraviolet light
    (d) This process begins up to a kbp away from the site to be repaired
    (e) Deficiency of this enzyme in humans greatly increases the risk of skin cancer

19. Which of the following describes the correct sequence of enzyme activity upon the lagging strand?
    (a) primase, DNA ligase, DNA polymerase III, DNA polymerase I
    (b) primase, DNA polymerase I, DNA polymerase III, DNA ligase
    (c) primase, DNA polymerase III, DNA polymerase I, DNA ligase
    (d) DNA polymerase III, primase, DNA polymerase I, DNA ligase
    (e) DNA polymerase III, helicase DNA ligase, DNA polymerase I

20. Which of the following description about prokaryotic translation is **NOT TRUE**?
    (a) A polypeptide chain is synthesized, emerging from a hole near the bottom of the large subunit
    (b) EF-Tu brings aminoacyl-tRNA to the P site of the ribosome
    (c) 16S rRNA interacts with codon and anticodon for codon-anticodon recognition
    (d) Peptide bond formation is catalyzed by the peptidyltransferase which locates in 23S rRNA
    (e) EF-G is responsible for the translocation because it mimic the structure of EF-Tu with aminoacyl-tRNA

21. Which of the following descriptions about Eukaryotic mRNA is **NOT TRUE**?
    (a) Cap-binding complex binds to the 5' end
    (b) Has poly-A tail
    (c) Is polycistronic
    (d) Is packed with hnRNP, SR proteins to be transported to the cytosol
    (e) Is matured in the nucleus

22. Which enzyme is to link tRNA to amino acid?
    (a) Aminoacyl-tRNA methylase
    (b) Aminoacyl-tRNA kinase
    (c) Aminoacyl-tRNA trasnferase
    (d) Aminoacyl-tRNA synthestase
    (e) Aminoacyl-tRNA deacylase

注意：背面有試題

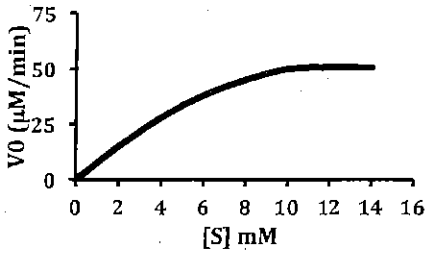
所別： 企業管理學系 碩士班 一般乙組(一般生)　　共4頁 第4頁

科目： 生物化學(含分子生物學)

本科考試禁用計算器　　＊請在答案卷(卡)內作答

Questions 23-25 calculate the indicated parameters using the information below

To characterize a new isolated enzyme, a series of test tubes are set up. Each tube contains 0.1μM enzyme and various substrate concentrations. The activity (V_0) of the enzyme in each tube is measured and is plotted vs [S]. The plot is shown below.



23. What is Vmax for the enzyme with this substrate?
   (a) 50 mM/min
   (b) 0.05 mM/min
   (c) 10 μM/min
   (d) 30 μM/min
   (e) 10 mM/min

24. What is the k_{cat} (turnover number) for the enzyme?
   (a) 5 x 10^2/ min
   (b) 5 x 10^3/ min
   (c) 5 x 10^2 /s
   (d) 1.0/ min
   (e) 1x 10^2/ s

25. Why does the plot eventually plateau?
   (a) The enzyme becomes inhibited at high substrate concentrations
   (b) The enzyme affinity for substrate changes
   (c) The enzyme is being degraded by proteases
   (d) The substrate is being degraded
   (e) The active site is saturated with substrate

Part II Short Answer and Essay Questions (total 25%):

26. The replication origin contains many AT base pairs. Why is it significant? (5%)

27. How might defective mitochondria lead to cancer? (7%)

28. What makes sucrose a good "transport" form of carbon? (7%)

29. Why don't active muscle cells export pyruvate, which can also be converted to glucose via gluconeogenesis? (6%)