

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。  
選擇題，每題 4 分，共 60 分，所有考題務必在答案卷上作答

- Which of the following situations would result in an increase in ketone body synthesis?
  - High insulin/glucagon ratio.
  - High citrate levels in the cytosol.
  - High levels of fructose 2,6-bisphosphate.
  - Low oxaloacetate levels in the mitochondria.
  - Low acetyl CoA levels in the mitochondria.
- The fluidity of a lipid bilayer will be increased by:
  - increasing the temperature.
  - decreasing the temperature.
  - increasing the length of the alkyl chains.
  - decreasing the number of unsaturated positions.
  - increasing the number of saturated positions.
- The first metabolic intermediate that is common to the aerobic metabolism of glucose and fatty acids is
  - acetyl CoA.
  - Pyruvate.
  - Citrate.
  - beta-hydroxybutyrate.
  - glyceraldehyde 3-phosphate.
- Which amino acid whose R group bearing a positive charge at pH 9
  - Leucine.
  - Histidine.
  - Tyrosine.
  - Glutamic acid.
  - Lysine.
- The three-dimensional structure of an enzyme in complex with its substrate was determined by X-ray crystallography. The structure revealed that a methionine residue in the active site of the enzyme is in close proximity to an isoleucine residue on a substrate. Which of the following would be the predominant interaction between these two amino acids?
  - covalent bond.
  - disulfide bond.
  - ionic interaction.
  - hydrophobic interaction.

6. Consider the average *in vivo* turnover rates for proteins, DNA, and mRNA. Which of the following orders best describes the turnover rate from fastest (shortest average lifetime) to slowest (longest average lifetime)?
- A. mRNA > DNA > proteins.
  - B. mRNA > proteins > DNA.
  - C. Proteins > mRNA > DNA.
  - D. Proteins > DNA > mRNA.
  - E. DNA > mRNA > protein.
7. A physician would like to determine the global patterns of gene expression in two different types of tumor cells in order to develop the most appropriate form of chemotherapy for each patient. Which of the following techniques would be most appropriate for this purpose?
- A. Southern blot.
  - B. Northern blot.
  - C. Western blot.
  - D. ELISA.
  - E. Microarray.
8. A 2-week-old infant is diagnosed with a urea cycle defect. Enzymic analysis showed no activity for ornithine transcarbamoylase (OTC). Molecular analysis revealed that the mRNA product of the gene for OTC was identical to that of a control. Which of the techniques listed below was most likely used to analyze the size and amount of the mRNA?
- A. Dideoxy chain termination.
  - B. Northern blot.
  - C. Polymerase chain reaction.
  - D. Southern blot.
  - E. Western blot.
9. Which of the following is best described as being trans-acting?
- A. CAP site.
  - B. Operator.
  - C. Promoter.
  - D. Repressor.
10. Which of the following is required for both prokaryotic and eukaryotic proteins synthesis?
- A. Binding of the small ribosomal subunit to the Shine-Dalgarno sequence.
  - B. fMet-tRNA.
  - C. Movement of the mRNA out of nucleus and into the cytoplasm.
  - D. Recognition of the 5'-cap by initiation factor.
  - E. Translocation of the peptidyl-tRNA from A site to P site.

11. A pharmaceutical company is studying a new antibiotic that inhibits bacterial protein synthesis. When this antibiotic is added to an in vitro protein synthesis system that is translating the mRNA sequence AUGUUUUUUUAG, the only product formed is dipeptide fMet-Phe. What step in protein synthesis is most likely inhibited by the antibiotic?
- Initiation.
  - Binding of charged tRNA to the ribosomal A site.
  - Peptidyltransferase activity.
  - Ribosomal translocation.
  - Termination.
12. The extent of DNA synthesis in a cell could most specifically be determined by measuring the incorporation of radiolabeled:
- Leucine.
  - Phosphate.
  - Ribose.
  - Thymidine.
  - Uracil.
13. Which of the following statements best describes glucose?
- It is a ketose and usually exists as a furanose ring in solution.
  - It is a C-4 epimer of galactose.
  - It is utilized in biological systems only in the L-isomeric form.
  - It is produced from dietary starch by the action of  $\alpha$ -amylase.
  - Homopolysaccharides of glucose, formed by the action of glycosyltransferases, are always branched molecules that contain only  $\beta$ -glycosidic linkages.
14. The conversion of pyruvate to acetyl CoA and CO<sub>2</sub>:
- Is reversible
  - Involves the participation of lipoic acid.
  - Is activated when pyruvate dehydrogenase (PDH, E1) of the pyruvate dehydrogenase complex is phosphorylated by PDH kinase in the presence of ATP
  - Occurs in the cytosol.
  - Depends on the coenzyme biotin.
15. Which of the following statements regarding both sphingomyelin and phosphatidylcholine is correct?
- Both are synthesized from ceramide.
  - Both contain 2 fatty acids linked via ester bonds.
  - Both contain choline as part of their polar headgroups.
  - Phosphatidylcholine is a membrane lipid, but sphingomyelin is used for fuel storage.
  - Phosphatidylcholine contains a phosphate group, but sphingomyelin does not.

問答題，共 40 分

1. Describe and compare the following terms: (20%)
  - a. Transcriptome vs. Functional genomics
  - b. Glycoproteins vs. Proteoglycans
  - c. Small interfering RNAs (siRNAs) vs. MicroRNAs (miRNAs)
  - d. DNA polymerase vs. RNA polymerase
  - e. DNA microarray vs. Protein microarray
2. RNA polymerase I, II, III have varying levels of sensitivity to the poison called  $\alpha$ -amanitin which is from the mushroom *Amanita phalloides*. RNA polymerase II is completely sensitive to the poison; RNA polymerase III have intermediates sensitivity; and RNA polymerase I is insensitive to the poison. What would happen to transcription of the rRNA genes, tRNA genes and the genes for the glucose transporter if an eukaryote was poisoned with  $\alpha$ -amanitin? (10%)
3. Please list three different classes of DNA-binding domains and three different classes of transcription-activation domains found in eukaryotic transcription factors.(10%)