※單選題，請務必作答於「答案卡」 ※ 注意：請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

1. In Michaelis–Menten enzyme kinetics, Km represents: (2%)
   A) Maximum reaction velocity.
   B) Enzyme concentration at saturation.
   C) Substrate concentration at half-maximal velocity.
   D) Affinity of enzyme for inhibitor.
   E) Rate constant of catalysis.

2. The catalytic triad characteristic of serine proteases consists of: (2%)
   A) Ser–Glu–His
   B) Asp–Cys–His
   C) Asp–His–Ser
   D) Lys–Ser–Asp
   E) Glu–Asp–Ser

3. Glucokinase differs from hexokinase because glucokinase: (2%)
   A) Has a lower Km for glucose.
   B) Is inhibited by glucose-6-phosphate.
   C) Functions mainly at high glucose concentrations.
   D) Is expressed primarily in muscle.
   E) Catalyzes an irreversible reaction.

4. Alanine is a key amino acid in gluconeogenesis because it: (2%)
   A) Enters the TCA cycle directly.
   B) Transports carbon and nitrogen from muscle to liver.
   C) Activates pyruvate dehydrogenase.
   D) Inhibits glycolysis in liver.
   E) Serves as an allosteric effector.

5. Which enzyme enables hepatocytes, but not muscle cells, to release free glucose into the bloodstream? (2%)
   A) Glycogen synthase.
   B) Glycogen phosphorylase.
   C) Phosphoglucomutase.
   D) Glucose-6-phosphatase.
   E) Hexokinase.

6. Which apolipoprotein acts as an essential cofactor for lipoprotein lipase? (2%)
   A) ApoA-I.
   B) ApoB-48.
   C) ApoB-100.
   D) ApoC-II.
   E) ApoE.

見背面

7. Adipocytes cannot directly convert glycerol to glycerol-3-phosphate because they lack: (2%)
   A) NADH.
   B) ATP.
   C) Glycerol kinase.
   D) Glycerol-3-phosphate dehydrogenase.
   E) Hexokinase.

8. PRPP functions in nucleotide biosynthesis primarily by: (2%)
   A) Donating nitrogen atoms.
   B) Providing high-energy phosphate bonds.
   C) Activating ribose for base attachment.
   D) Supplying reducing equivalents.
   E) Regulating transcription.

9. Which feature distinguishes eukaryotic mRNA from prokaryotic mRNA? (2%)
   A) Ribosome-binding sites.
   B) 5′ cap and poly(A) tail.
   C) Direction of translation.
   D) Codon usage.
   E) Presence of start codons.

10. Sphingomyelin synthesis requires which lipid precursor? (2%)
   A) Phosphatidic acid.
   B) Ceramide.
   C) Diacylglycerol.
   D) Cholesterol ester.
   E) Phosphatidylserine.

11. Fetal hemoglobin binds oxygen more tightly than adult hemoglobin because: (2%)
   A) It contains δ-chains.
   B) It lacks iron.
   C) It interacts weakly with 2,3-BPG.
   D) It has higher heme content.
   E) It lacks β-chains entirely.

12. Fatty acid synthesis primarily requires which reducing equivalent? (2%)
   A) NADH.
   B) $FADH_2$.
   C) NADPH.
   D) Coenzyme A.
   E) ATP.

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13. The primary product of the oxidative phase of the pentose phosphate pathway is: (1%)
A) ATP.
B) NADH.
C) NADPH.
D) $FADH_2$.
E) GTP.

14. Which description about transcriptional control of eukaryotic genes is wrong? (5%)
A) "Basal expression" occurs at promoter-proximal elements and the promoter.
B) "Regulated expression" occurs at distal regulatory elements.
C) "Regulated expression" is mediated by various signals, including hormones, heat shock, heavy metals, and chemicals.
D) The distal regulatory elements contain enhancer and repressor elements.
E) None of the above descriptions is wrong.

15. Which description about prokaryotic and eukaryotic RNA polymerase is correct? (5%)
A) The prokaryotic RNA polymerase consists of 7 subunits.
B) The eukaryotic RNA polymerase consists of 10-20 subunits.
C) The prokaryotic RNA polymerase synthesizes monocistronic RNA.
D) Eukaryotic transcription is regulated by one RNA polymerase.
E) The eukaryotic RNA polymerase synthesizes polycistronic RNA.

16. Which of the descriptions below about RNA is correct? (5%)
A) The most abundant RNA in cells is mRNA.
B) rRNA is one component of the ribosome.
C) tRNA serves as the template for protein synthesis.
D) mRNA transfers an amino acid to a growing peptide chain during protein synthesis.
E) tRNA is a protein-coding RNA.

17. The core enzyme of *E. coli* RNA polymerase is *composed of* $\alpha_2\beta\beta'\omega$ subunit. To form an *E. coli* RNA polymerase holoenzyme, which subunit is assembled to the core enzyme? (5%)
A) χ
B) μ
C) η
D) σ
E) κ

18. THIIH phosphorylates the carboxy-terminal domain of RNA polymerase II to regulate transcription. What kind of amino acid in the carboxy-terminal domain of RNA polymerase II is phosphorylated? (5%)
A) Tyr.
B) Ser.
C) Thr.
D) Pro.
E) His.

見背面

國立臺灣大學 115 學年度碩士班招生考試試題

※非選擇題，請務必作答於「**試卷內頁作答區**」

※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之部份及題號。

1. Mutations in the coding sequence of a gene can lead to amino acid substitutions in the resulting protein. Explain how such mutations could cause a loss or alteration of protein function. (簡答題, 6%)

2. Explanation of Terms (名詞解釋，簡答即可)
   A. intrinsically disordered protein (3%)
   B. mixed β-sheet (3%)
   C. Lineweaver–Burk plot (3%)
   D. allosteric enzyme (3%)

3. Describe an experimental approach to determine both the maximum velocity V_{max} and the Michaelis constant (K_m) of an enzyme. What type of data would you collect, and how would you analyze the data to obtain the V_{max} and K_m values? (簡答題, 7%)

4. In biochemistry, the non-protein components required for enzymatic activity are collectively known as cofactors. Without these components, the protein part of the enzyme (called the apoenzyme) is catalytically inactive. The classification of these components is generally broken down into three main categories based on their chemical nature and the strength of their bond to the enzyme. What are these three categories of non-protein components? Give one example to each category. (6%)

5. Explain how the urea cycle is metabolically connected to the Citric Acid (TCA) cycle. Identify the specific intermediate produced in the cytosol that serves as this link and describe its fate. (2%)

6. The urea cycle occurs in two different cellular compartments of the hepatocyte. Name these compartments, identify which enzyme catalyzes the rate-limiting step, and name the essential allosteric activator required for that enzyme's function. (2%)

7. While the plasma membrane is a dynamic fluid, its lipid composition is highly asymmetrical. Discuss the physiological significance of Phosphatidylinositol (PI) and its phosphorylated derivatives being sequestered specifically in the inner (cytoplasmic) leaflet of the membrane bilayer. In your answer, explain how this localization facilitates the PLC-mediated signaling pathway and analyze the consequences for cellular signaling if this asymmetry were lost. (15%)

試題隨卷繳回