

※ 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」。

單選題 共 40 題 (A) (B) (C) (D) (E) 5 選 1 答錯不倒扣

第 1 至 20 題 每題 2 分 第 21 至 40 題 每題 3 分

1. All are correct about enhancer sequences in eukaryotic cells except:
 - A. they can occur either upstream or downstream of the gene.
 - B. they can be in either orientation (bi-directional).
 - C. enhancer function is dependent on recognition by a specific transcription factor.
 - D. specific transcription factor binding at an enhancer stimulates transcription by interacting with RNA polymerase II.
 - E. All are correct.
2. Amino-acyl-tRNA synthetases catalyze the reaction of a:
 - A. specific amino acid attachment to the 3'-OH at the 3'-CCA of a specific tRNA.
 - B. specific amino acid attachment to the 5'-OH at the 5'-CCA of a specific tRNA.
 - C. specific tRNA with ATP to form a so called "charged tRNA" that interacts with a specific site on mRNA.
 - D. All of the above.
 - E. None of the above.
3. Acidification of the stomach uses all of the following types of transport EXCEPT:
 - A. Cl⁻ ion channels
 - B. H⁺/K⁺ ATPase
 - C. antiporters
 - D. symporters
 - E. All of above are used by stomach parietal cells.
4. Which of the following component(s) is NOT required for the secretory pathway using cotranslational translocation machinery?
 - A. ribosome
 - B. signal recognition particle (SRP)
 - C. ATPase
 - D. translocon
 - E. All of above are used in the secretory pathway.
5. Which of the following pathway(s) is NOT the fate of internalized proteins after endocytosis?
 - A. Internalized proteins move to the lysosome for protein degradation.
 - B. Internalized proteins transport to Golgi through retrograde transport
 - C. Internalized proteins recycle back to the plasma membrane
 - D. Internalized proteins associate with ribosome for newly protein synthesis
 - E. All of above are correct.

見背面

6. Which part of the ribosome is responsible for peptidyl transfer?

- A. 18S
- B. 5S
- C. 23S
- D. 2.8S
- E. 16S

7. Given a gene sequence below, please predict the transcript(s)?

5'- A T T C C G -3'
3'- T A A G G C -5'

- A. 5'-CGGAAC
- B. 5'-AAACCG
- C. 5'-AAUCCG
- D. 5'-UGGAAU
- E. 5'-AUUCCG

8. The following methods can separate proteins based on their mass except?

- A. centrifugation
- B. ion exchange chromatography
- C. SDS polyacrylamide gel electrophoresis
- D. gel filtration chromatography
- E. native polyacrylamide gel electrophoresis

9. A Holiday junction structure is a(n)

- A. intermediate in genetic recombination
- B. double-stranded DNA break
- C. collapsed replication fork
- D. thymine-thymine dimmer
- E. all of the above

10. A mutation that changes a cysteine codon to a tryptophan codon is called a

- A. missense mutation.
- B. nonsense mutation.
- C. frameshift mutation.
- D. silent mutation.
- E. Indel deletion.

11. What do all β -barrel transmembrane proteins have in common?
- A. The structural rigidity compared to α -helical transmembrane proteins.
 - B. The number of negative peaks in their hydropathy plots.
 - C. The diameter of the barrel.
 - D. The number of β strands.
 - E. The general function, i.e. membrane transport.
12. The two monolayers of the plasma membrane in a human red blood cell :
- A. both contain gangliosides.
 - B. both contain glycolipids.
 - C. have the same abundance of phosphatidylinositol.
 - D. exchange phospholipids only through spontaneous flip-flops.
 - E. have different overall electrical charges, with negatively charged phospholipids (e.g. phosphatidylserine) normally enriched in the inner monolayer.
13. The permeability of a protein-free lipid bilayer to various molecules depends on their properties. Sort the following in order of low to high permeability from left to right.
- (1) O₂ (2) ATP (3) RNA oligonucleotide
(4) Na⁺ (5) Glucose (6) Urea
- A. (3),(2),(5),(4),(1),(6)
 - B. (2),(3),(6),(4),(5),(1)
 - C. (3),(4),(2),(5),(1),(6)
 - D. (3),(2),(4),(5),(6),(1)
 - E. (2),(3),(4),(6),(5),(1)
14. Which one is responsible for the progression of G1 to S phase?
- A. Unphosphorylated Rb
 - B. Hypophosphorylated Rb
 - C. Hyperphosphorylated Rb
 - D. Phosphorylated p53
 - E. Cyclin B
15. Which one plays the "sliding clamp" in the DNA replication?
- A. Cyclin A
 - B. Cyclin B
 - C. Cyclin D
 - D. p53
 - E. PCNA

16. Post-translational modifications modulate a protein activity. To study the functional effect of a protein phosphorylated at Ser/Thr, we generate a non-phosphorylatable mutant by changing to Ala. What amino acids are used for creating a phosphomimetic mutant?
- A. Asn and Gln
 - B. Lys and Arg
 - C. Leu and Ile
 - D. Asp and Glu
 - E. Tyr and Phe
17. Which one does not involve in splicing of introns in nuclear mRNA primary transcripts?
- A. RNA helicase
 - B. ATP
 - C. CTD (C-terminal domain) of RNA polymerase II large subunit
 - D. snRNPs
 - E. endonucleases
18. How are most voltage-gated channels inactivated?
- A. by closing degrading channel proteins
 - B. by ligand binding
 - C. by changes in membrane potential
 - D. through interaction with other membrane proteins
 - E. by closing spontaneously soon after opening
19. Which of the following statements regarding hormone and cellular signal transduction is correct?
- (1) Amino acid and protein hormones usually act by binding to a receptor on the cell surface.
 - (2) A second messenger is a substance that binding to its receptor on the cell surface.
 - (3) cAMP is an intracellular second messenger.
- A. (1)
 - B. (2)
 - C. (3)
 - D. (1) and (3)
 - E. (2) and (3)
20. Which of the following shows the correct order of potency for stem cells?
- A. Totipotent > Multipotent > Pluripotent
 - B. Totipotent > Pluripotent > Multipotent
 - C. Pluripotent > Totipotent > Multipotent
 - D. Multipotent > Totipotent > Pluripotent
 - E. None is correct

21. Treatment of the RNA polymerase/DNA complex with DNase in vitro is a DNA footprinting technique used to:
- A. identify the termination sequence for transcription.
 - B. locate the start site for transcription.
 - C. locate the promoter site.
 - D. identify the position of enhancer sequences.
 - E. None of the above.
22. The heptapeptide repeat in the carboxy terminal domain (CTD) in the RPB1 subunit of RNA polymerase II is phosphorylated to _____.
- A. convert to an elongation complex
 - B. bind to DNA
 - C. form a holo-RNA polymerase II
 - D. initiate transcription
 - E. activate termination
23. Heat shock element (HSE) is a(n) _____ found in the _____ region of genes whose transcription is activated in response to _____.
- A. silencer; enhancer; cold
 - B. response element; promoter; elevated temperature
 - C. promoter; enhancer; elevated temperature
 - D. enhancer; response element; elevated temperature
 - E. silencer; promoter; cold
24. Which of the following statement(s) is correct regarding to the membrane transport?
- (1) If a transported molecule carries a net charge, its movement may be influenced by the electrochemical gradient.
 - (2) All transport proteins, i.e. transporters, are transmembrane proteins containing multiple membrane-spanning segments.
 - (3) Active transport requires ATPase to utilize ATP hydrolysis to move ions or small molecules across the membrane from higher concentration to lower concentration.
- A. 1 and 3
 - B. 2 and 3
 - C. 3 only
 - D. 1 and 2
 - E. All of above are correct.
25. Which of the following statement(s) is correct regarding to protein endocytosis or exocytosis?
- (1) Receptor-mediated endocytosis of ligands generally occurs through clathrin/AP2-coated vesicles.
 - (2) SARS-CoV-2 appears to infect cells by first binding viral spike proteins with host protein receptors. The virus is then endocytosed into the host cells.
 - (3) Neurotransmitters are typically released from synaptic vesicles into the synaptic cleft via exocytosis

- A. 1 and 2
- B. 2 and 3
- C. 1 and 3
- D. 3 only
- E. All of above are correct.

26. Which statement is correct?

- A. RNA polymerase I transcribes mRNA.
- B. RNA polymerase II transcribes 28S rRNA.
- C. RNA polymerase III transcribes mRNA.
- D. All of the above.
- E. None of the above.

27. Regarding transcription factor II H (TFIIH), which statement is correct?

- A. TFIIH is a multimeric protein containing 11 subunits.
- B. TFIIH exhibits helicase activity using GTP as an energy source.
- C. TFIIH phosphorylates the CTD of Polymerase II.
- D. TFIIH possesses the catalytic domain of the peptidyl transfer.
- E. All of the above.

28. Regarding transfer RNA (tRNA), which statement is correct?

- A. tRNA has a universal 5'-CAA-3' tail.
- B. tRNA's acceptor stem maintains the anticodon region.
- C. tRNA's D stem has two 8-oxoguanines.
- D. tRNA has to be charged before transcription.
- E. None of the above.

29. What method can be used to functionally inactivate a gene without altering its sequence?

- A. gene knockout
- B. RNA interference
- C. dominant negative mutation
- D. CRISPR/Cas9
- E. B and C

30. Which of the following is a feature that defines a cell dying via apoptosis?

- A. the nucleus condenses and then fragments.
- B. small membrane bodies are released and then engulfed by other cells.
- C. the cell shrinks.
- D. Fas ligand can trigger apoptosis
- E. all of the above

31. Which of the following statements regarding transmembrane proteins is correct?
- (1) typically exposed only to one side of the membrane.
 - (2) released from the membrane by a gentle extraction procedure such as salt treatment.
 - (3) often further attached to the membrane via a GPI anchor.
 - (4) sometimes covalently attached to a fatty acid chain that inserts into the membrane.
 - (5) cannot contain β sheets in the part of their structure that interacts with the membrane interior.
- A. (1) and (2)
B. (3) only
C. (4) only
D. (3) and (4)
E. (4) and (5)
32. Which of the following situations in a neuron results in action potentials that have extended depolarization phases?
- A. Stimulating the voltage-gated K^+ channels.
 - B. Inhibiting the voltage-gated Na^+ channels.
 - C. Compromising the inactivation mechanism in voltage-gated K^+ channels.
 - D. Compromising the inactivation mechanism in voltage-gated Na^+ channels.
 - E. None of the above.
33. What kind of DNA repair is carried out by the Crispr/Cas9 complex?
- A. Homologous recombination
 - B. Non-homologous end-joining
 - C. Nuclear excision repair
 - D. Mismatch repair
 - E. Base excision repair
34. Fc receptors recognize :
- A. Viral antigen
 - B. Variable region of antibody
 - C. Constant region of antibody
 - D. MHC class I
 - E. MHC class II
35. Which one is NOT the function of histocompatibility complex?
- A. Routinely displays the degraded cellular proteins
 - B. Prevents auto-immune response.
 - C. Presents pathogen-derived peptides to immune cells.
 - D. Recruits NK cells
 - E. MHC class I presents epitopes to $CD8^+$ cytotoxic T cell.

36. Which of the following is not known to be involved in transcription initiation by eukaryotic RNA polymerase II (Pol II)?
- A. DNA helicase
 - B. Pol II binding to TATA box
 - C. Chromatin remodeling
 - D. The transcription factors binding to enhancers
 - E. Protein phosphorylation and acetylation
37. Which one of the following statements about mitochondrial DNA is incorrect?
- A. Mutations in mitochondrial DNA will cause genetic diseases.
 - B. The mammalian mitochondria DNA is wrapped by histone-like proteins.
 - C. Mitochondrial genetic codes differ from standard nuclear codes.
 - D. The products of mitochondrial genes are not exported to cytosol.
 - E. The mitochondria of a developing embryo are derived from the mother's egg.
38. A microRNA (miRNA) is a small non-coding RNA, which can down-regulate mRNA expression levels. Please choose the correct statement about animal miRNA.
- A. A miRNA can recognize many mRNAs.
 - B. It is 10-20 nucleotides in length single-stranded RNA.
 - C. It is perfectly complementary to its mRNA targets.
 - D. It is a ribonuclease.
 - E. It most binds to the coding region of mRNA.
39. Which of the following statements regarding stem cells is correct?
- (1) Induced pluripotent stem cells can differentiate into any of the 3 germ layer cells.
 - (2) Cord blood stem cells are multipotent.
 - (3) Hypoxic condition in stem cell niches is necessary for maintaining stem cells in an undifferentiated state.
- A. (1)
 - B. (2)
 - C. (3)
 - D. (1) and (3)
 - E. All of above
40. Which of the following statements regarding Transposable elements (TEs) is correct?
- (1) TEs are DNA sequences that have the ability to change their position within a genome.
 - (2) TEs are randomly distributed in the genome.
 - (3) Transposable elements can be divided into two major classes based on whether they use DNA or RNA as intermediate for integration into genome.
- A. (1) only
 - B. (2) only
 - C. (3) only
 - D. (2) and (3)
 - E. (1) and (3)