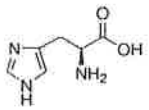
國立中興大學104學年度碩士班招生考試試題

科目：生物化學　　系所：生物科技學研究所

選擇題，每題 1.6 分，答錯倒扣 0.4 分。

1. If a solution has a pH of 2, a nonpolar amino acid in solution will contain which of the following?
   (A) A deprotonated carboxylic acid and an overall charge of -1
   (B) A deprotonated carboxylic acid and an overall charge of +1
   (C) A protonated amine and an overall charge of +1
   (D) A deprotonated amine and an overall charge of +1
   (E) None of above is correct
2. The nucleoside adenosine exists in a protonated form with a pK_a of 3.8. The percentage of the protonated form at pH 4.8 is closest to
   (A) 1　(B) 9　(C) 50　(D) 90
   (E) 99
3. Reactions that have positive standard free energy changes ($\Delta G_o > 0$) can be made to occur in cells by
   (A) Coupling them with exergonic reactions via a common intermediate
   (B) Manipulating the concentrations of products and reactants such that $G < 0$
   (C) Coupling them to the hydrolysis of ATP
   (D) All of the above
4. Which of the following carbohydrates does not have a molecular formula of $C_6H_{12}O_6$?
   (A) Glucose　(B) Fructose　(C) Galactos
   (D) Mannose　(E) Ribose
5. What is the molecular mass (Dalton) of a molecule with the molecular formula of $C_6H_{12}O_6$?
   (A) 96　(B) 154　(C)180
   (D) 192　(E) 252
6. The molecular mass of NaCl is 59 Daltons. A saline solution contains 0.9% NaCl in water. What is the approximately molar concentration (*M*) of this saline solution?
   (A) 0.06　(B)0.09　(C) 0.15
   (D) 0.018　(E) 0.6
7. How much does the radioactivity of a solution of [γ-^{32}P]ATP remain after a 42-day storage? (the half-life of ^{32}P is 14.262 days)
   (A) 1/3　(B) 1/4　(C) 1/6
   (D) 1/8　(E) 1/9
8. Which of the following intermolecular interactions is ready to break by adding reducing agents?
   (A) Covalent bond
   (B) Disulfide bond
   (C) Hydrogen bond
   (D) van der Waals bond
9. What level of protein structure is influenced by primarily hydrogen bonding?
   (A) Primary structure
   (B) Secondary structure
   (C) Tertiary structure
   (D) Quaternary structure
10. The amino acid having the structure depicted below



   (A) Glutamine
   (B) Asparagine
   (C) Histidine
   (D) Tyrosine
   (E) Phenylalanine
11. A scientist is studying the metabolism of proteins in yeast cells to follow the formation of proteins from its earliest point. In her experiment, she will feed the yeast radioactive nutrients and follow the fate of the radioactivity in the cells. Which of the following radioactive atoms will allow her to exclusively

follow proteins in the cell?

(A) Hydrogen (B) Carbon

(C) Nitrogen (D) Phosphorus

(E) Sulfur

12. The length of a B-form DNA fragment is 17 nm. What is the total nucleotide number of this DNA fragment?

(A) 25 (B) 50 (C) 100

(D) 170 (E) 200

13. If the genetic code were to contain 4 bases per codon, what would be maximal number of the amino acids that could be formed from this code?

(A) 20 (B) 64 (C) 80

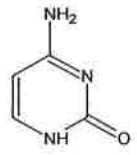
(D) 128 (E) 256

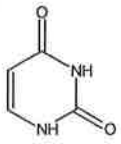
14. RNA instability in alkaline solutions is due to

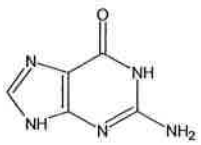
(A) Adenine (B) Ribose (C) Uracil

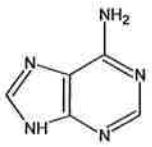
(D) Single strand nature

15. Which of the following bases is not found in DNA?

(A) 

(B) 

(C) 

(D) 

16. A section of mRNA is composed of 28% guanine bases. What percentage of the RNA strand is cytosine bases?

(A) 22 (B) 28

(C) 50 (D) 72

(E) More information is needed to answer this question

17. An mRNA transcript is composed of the following sequence: 5'-AUUGCAUAAGCUCCAU-3'. What is the template strand for this transcript?

(A) 5'-ATTGCATAAGCTCCAT-3'

(B) 5'-ATGGTGCTTATGCAAT-3'

(C) 5'-AUGGUGCUUAUGCAAU-3'

(D) 5'-TAACGTATTCGAGGTA-3'

(E) 5'-UAACGUAUUCGAGGUA-3'

18. Where are anticodons found in cells?

(A) rRNA (B) mRNA (C) tRNA

(D) siRNA (E) cDNA

19. Which of the following statement regarding translation in eukaryotes is FALSE?

(A) There is only one start codon, which is AUG

(B) There is three stop codons, which are UAG, UAA and UGA

(C) Shine-Dalgarno sequence on mRNA is required for the recognition by ribosome

(D) Translation is performed by 80S ribosome

(E) Translation is inhibited by cycloheximide

20. Which is TRUE about transcription and translation?

(A) Transcription and translation may occur simultaneously in prokaryotic cells

(B) Transcription and translation may occur simultaneously in eukaryotic cells

(C) Transcription and translation occur within the same cellular compartments in eukaryotic cells

(D) Splicesomes remove exon from the pre-mRNA and splice together the introns in eukaryotic cells

(E) All of the above

21. Which is the most likely average size (Dalton) of proteins encoded by a 1-kb open reading frame?

(A) 13,000 (B) 25,000 (C) 37,000

(D) 56,000 (E) 60,000

22. Which of the following amino acid sequences might be a signal peptide that is able to direct its following sequence passing through an organelle membrane?

(A) MAKRTQAILLLLLAISLIMVSSA
(B) MASQEEEEEGPLIWTSTTSNAT
(C) MAALLTRDEHTKKKKDGRSTN
(D) MAPTPHEPGPAGPDPVPAPPSSA
(E) MSTHSTTHSGGQGNQEHTSSEA

23. What is the cofactor for the activity of T4 DNA ligase?
(A) NADH (B) NADPH
(C) ATP (D) GTP
(E) GDP

24. What is heterochromatin?
(A) DNA that can be transcribed
(B) DNA that cannot be transcribed
(C) DNA that contains transposons
(D) DNA laterally inherited from other organisms

25. What would be a direct result of a mutated, nonfunctional gene for primase in a cell?
(A) Inability to repair DNA damages
(B) Inability to replicate DNA
(C) DNA cannot be transcribed
(D) Inability to splice pre-mRNA
(E) Inability to produce siRNA

26. What event would activate a G protein?
(A) Replacement of GDP with GTP
(B) Replacement of GTP with GDP
(C) Hydrolysis of GDP
(D) Hydrolysis of GTP

27. Monoclonal refers to
(A) A single clone of antibody-producing cells
(B) All the antibody molecules which are identical
(C) The binding with same antigenic site with identical binding affinities
(D) All of the above

28. Which of the following statements regarding enzyme-catalyzed reactions is FALSE?
(A) Enzymes form complexes with their substrates
(B) Enzymes lower the activation energy for chemical reactions
(C) Enzymes change the K_{eq} for chemical reactions
(D) Reactions occur at the "active site" of enzymes, where a precise 3D orientation of amino acids is an important feature of catalysis

29. Most of the ATP produced in cellular respiration comes from which of the following processes?
(A) Glycolysis
(B) Krebs cycle
(C) Oxidative phosphorylation
(D) Substrate-level phosphorylation

30. How many CO_2 molecules are produced from the TCA cycle per acetyl CoA?
(A) 1 (B) 2 (C) 3 (D) 4
(E) 36

31. What is the primary purpose of fermentation when a microorganism is cultivated in the absence of oxygen?
(A) produce amino acids for protein synthesis
(B) generate a proton gradient for ATP synthesis
(C) generate alcohol for beverages
(D) regenerate NAD^+ from NADH allowing glycolysis to continue

32. Animals cannot convert fatty acids into glucose because
(A) Acetyl CoA cannot be converted to pyruvate
(B) Absence of malate synthase
(C) Absence of dehydrogenase
(D) absence of α-ketoglutarate dehydrogenase

33. The cells dependent solely on glucose as an energy source are
(A) Muscle cells
(B) Brain cells

(C) Cardiac cells
(D) Kidney cells
(E) Both cardiac and kidney cells

34. Which of these are structures within cells which contain the digestive enzymes to eliminate waste and debris?
(A) Rough endoplasmic reticulum
(B) Smooth endoplasmic reticulum
(C) Golgi body
(D) Lysosome
(E) Peroxisome

35. Which of the following molecules will pass most freely through the cell membrane?
(A) Oxygen (B) Water
(C) Glucose (D) Sodium ion
(E) Insulin

36. Cholesterol is essential for normal membrane functions because it
(A) Plugs up the cardiac arteries of older men
(B) Cannot be made by higher organisms
(C) Keeps membranes fluid
(D) Spans the thickness of the bilayer

37. What structure is present in eukaryotic cells but not prokaryotic cells?
(A) Cell membrane
(B) Nucleus
(C) 70S Ribosome
(D) Pili

38. Gram staining is a helpful technique for differentiating between different types of bacteria. What part of the bacterial envelope is exploited by the gram staining process?
(A) The capsule
(B) The peptidoglycan
(C) The cell membrane
(D) The flagella

39. Which of the following best describes fungi?
(A) Chemoheterotrophic
(B) Chemoautotrophic
(C) Photoautotrophic
(D) Lithoautotrophic

40. Which of the following would not be considered an organism?
(A) Archaebacterium
(B) Fungi
(C) Prion
(D) Protozoa
(E) None of above

41. *E. coli* BL21 (DE3) strain has the genotype [F- *ompT* *hsdS*$_b$ ($r_b^- m_b^-$) *gal dcm* (DE3)]. What is the mean of (DE3)?
(A) The cell carries a copy of prophage P1
(B) The cell carries a copy of transposon Tn3
(C) The cell carries the lysogenic T7 polymerase gene
(D) The cell is not able to produce restriction enzyme

42. Which of these is an example of disease caused by prion?
(A) HIV
(B) Parkinson's disease
(C) Alzheimer's disease
(D) Mad cow disease

43. Which pair of prefix and its definition is false?
(A) Kilo, 10^{-3}
(B) Micro, 10^{-6}
(C) Nano, 10^{-9}
(D) Pico, 10^{-12}
(E) Femto, 10^{-15}

44. What is the order of the sizes of the following? A,

Mitochondria; B, Ribosome; C, *Escherichia coli*; D, Red blood cell.

(A) A < B < C < D

(B) B < A < C < D

(C) C < A < B < D

(D) C < B < A < D

45. Of the following type of molecules, which is always found in virions?

(A) Protein

(B) Lipid

(C) Carbohydrate

(D) DNA

46. Which of the following about eukaryotes is FALSE?

(A) Most eukaryotes including mice, zebrafish, fruit fly, nematodes, etc. are all diploid

(B) Polyploidy is common for both plants and animals

(C) Totipotency is a common trait for cell of plants but not animals

(D) Mutations in somatic cells barely can be passed on to the next generation

(E) Somatic mutations can result in cancer

47. Why is it necessary to receive a flu shot every year in order to avoid getting the flu?

(A) Influenza virus undergoes genetic mutation throughout the year which allows it to evade the previously created cellular defenses

(B) Your body must be resupplied with fresh antibodies every year in order to maintain the immunity to the flu

(C) Your body must be reintroduced to influenza yearly in order to your body to continue creating antibodies

(D) The maximum lifespan of plasma cells that produce the antibodies against influenza is about one year

48. Epigenetic changes

(A) Can lead to phenotype or gene expression changes

(B) Are caused by changes other than DNA sequences

(C) May remain through cell divisions

(D) May pass on to progenies

(E) All of the above

49. Which phase of the cell cycle involves DNA replication?

(A) G1　(B) S　(C) G2

(D) M　(E) G0

50. The checkpoint at the end of which phase is considered the most important aspect of cell cycle regulation, as many potential problems with it can lead to cancer?

(A) G1　(B) S　(C) G2

(D) M　(E) G0

問答題 (每小題 5 分)

1. Briefly describe the principle and capability of the following analysis tools.

A. Southern blot

B. Western blot

C. Size exclusion chromatography (gel filtration)

D. Fluorescent in situ hybridization (FISH)