國立中興大學 112 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

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共 80 題單選題，總分 150 分。1～25 題，每題 1 分。26～70 題，每題 2 分。71～75 題，每題 3 分。76～80 題，每題 4 分。（單選，不倒扣）

1. Which of the following amino acid residues has a side chain that can form hydrogen bonds to other molecules?
(A) Leucine
(B) Threonine
(C) Alanine
(D) Glycine

2. Which amino acid displays a free amino group in the tetrapeptide ALA-HIS-ARG-THR?
(A) ALA
(B) HIS
(C) ARG
(D) THR

3 The difference between cysteine and homocysteine is the same as between serine and homoserine. This change from the common amino acid is:
(A) one additional carboxyl group
(B) one additional methylene ($-CH_2-$) bridge
(C) two additional amine groups
(D) presence of a ring system

4 Which of the following amino acid substitutions would be least likely to have a detrimental effect on protein folding and function?
(A) Glu changes to Gln
(B) Trp changes to Thr
(C) Lys changes to Asp
(D) Leu changes to Val

5. Vitamin C (ascorbic acid) prevents scurvy because
(A) it is involved in the formation of the proper β-sheet structure of collagen
(B) it is important in hydroxylation of prolines and lysines in the primary structure of collagen
(C) it encourages the formation of disulfide linkages in collagen
(D) it is an unusual amino acid found in the primary structure of collagen

6. Which of the following amino acid residues would most likely be found in the interior of a globular protein?
(A) Isoleucine
(B) Arginine
(C) Aspartic acid
(D) Threonine

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7. Quaternary structure of proteins is associated with
(A) the overall shape of the polypeptide chain
(B) simple proteins with only one subunit
(C) the relative orientation of one polypeptide to another polypeptide in a multisubunit protein
(D) the sum of secondary and tertiary interactions

8. Which one of the following statements about hemoglobin (Hb) and myoglobin (Mb) is true?
(A) Adult Hb binds to oxygen more tightly than Mb binds
(B) Fetal Hb binds oxygen more tightly than adult Hb
(C) Adult Hb binds oxygen more tightly than either fetal Hb or Mb binds
(D) Both Hb and Mb are tetrameric complex proteins

9. Which of the following is a disorder caused by a genetic mutation in the keratin gene?
(A) Cystic fibrosis
(B) Alzheimer's disease
(C) Epidermolysis bullosa
(D) Sickle cell anemia

10. Which of the following statements about lactate dehydrogenase (LDH) is true?
(A) An enzyme that breaks down lactose in milk
(B) An enzyme that converts lactate to pyruvate during cellular respiration
(C) An enzyme that converts pyruvate to lactate during anaerobic respiration
(D) An enzyme that breaks down glycogen in the liver

11 If the y-intercept of a Lineweaver-Burk plot = 1.23 (sec/millimole) and the slope = 23.3 L/sec, K_M equals:
(A) 0.0348 mM
(B) 0.0527 mM
(C) 18.9 mM
(D) 28.7 mM

12. The Michaelis-Menten constant (K_M) is
(A) a rough measure of the affinity of the enzyme for the substrate
(B) a measure of the resistance of the enzyme to denaturation
(C) related to the molecular weight of the enzyme
(D) a reflection of the percentage of polar amino acids in the enzyme

13. Which of the following statements about ATCase is true?
(A) ATCase is an enzyme involved in glycolysis
(B) ATCase is allosterically regulated by ATP and CTP
(C) ATCase catalyzes the conversion of aspartate and carbamoyl phosphate into citrulline
(D) ATCase is found exclusively in prokaryotes

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14. Which of the following types of amino acids in an active site is most unlikely to be involved in enzyme catalysis?
(A) Those with hydrophilic, neutral side-chains
(B) Those with negatively charged side-chains
(C) Those with positively charge side-chains
(D) Those with hydrocarbon side-chains

15. What is the primary difference between chymotrypsin and trypsin?
(A) Chymotrypsin cleaves peptide bonds between amino acids with basic side chains, while trypsin cleaves peptide bonds between amino acids with acidic side chains
(B) Chymotrypsin is secreted by the pancreas, while trypsin is secreted by the stomach
(C) Chymotrypsin cleaves peptide bonds between amino acids with aromatic side chains, while trypsin cleaves peptide bonds between amino acids with basic side chains
(D) Chymotrypsin is involved in the absorption of amino acids in the small intestine, while trypsin is involved in the breakdown of carbohydrates

16. Which of the following is true about phospholipids, sphingolipids, and cholesterol?
(A) All three are amphipathic molecules
(B) All three contain a glycerol backbone
(C) All three are primarily found in the plasma membrane
(D) All three have a similar chemical structure

17. Which of the following is true about triacylglycerol and lipase?
(A) Triacylglycerol is a type of enzyme, while lipase is a type of lipid
(B) Triacylglycerol is main constituents of body fat in humans, while lipase might be involved in signal transduction
(C) Triacylglycerol and lipase are both found in the plasma membrane
(D) Triacylglycerol and lipase are both primarily involved in carbohydrate metabolism

18. Which of the following four fatty acids has the lowest melting point?
(A) $CH_3(CH_2)_{10}COOH$
(B) $CH_3(CH_2)_{20}COOH$
(C) $CH_3(CH_2)_5CH{=}CH(CH_2)_7COOH$
(D) $CH_3CH_2(CH{=}CHCH_2)_5(CH_2)_2COOH$

19. What type of receptor is the Acetylcholine receptor (AchR)?
(A) Ion channel receptor
(B) G-protein coupled receptor
(C) Enzyme-linked receptor
(D) Nuclear receptor

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20. Which of the following best describes the function of the transducer in G protein-coupled receptor (GPCR) signaling?
(A) G protein binds to extracellular ligands and triggers a conformational change in the GPCR
(B) G protein catalyzes the conversion of GTP to GDP, which in turn activates downstream effectors
(C) G protein couples the activated GPCR to downstream effector proteins, such as ion channels or enzymes
(D) G protein acts as an intracellular signaling molecule that mediates the effects of GPCR activation on gene expression

21. Which of the following statements about insulin is correct?
(A) Insulin binds to its receptor on liver and muscle cells, which activates a signaling cascade that leads to the activation of glucose transporters (GLUT4) and enzymes involved in glycogen synthesis
(B) Insulin activates glycogen phosphorylase, which breaks down glycogen into glucose and promotes its uptake by cells
(C) Insulin inhibits the activity of glucagon, which promotes glycogen synthesis and glucose uptake in liver and muscle cells
(D) Insulin binds to its receptor on adipose cells, which activates a signaling cascade that leads to the uptake of glucose and its storage as glycogen in liver and muscle cells

22. Which of the following statements about the *Ras* protein is true?
(A) It is a tumor suppressor gene that helps prevent the development of cancer
(B) It is a proto-oncogene that can become mutated and promote cancer development
(C) It is involved in DNA repair and helps maintain genomic stability
(D) It is a viral gene that is incorporated into the host genome and causes cancer

23. Which of the following is true about ATP synthesis by F_1F_0 ATPase
(A) The F_1 subunit is responsible for catalyzing ATP synthesis using ADP as the precursor
(B) ATP synthesis is driven by the electron motive force generated by the electron transport chain
(C) The F_1 subunit pumps protons across the mitochondrial inner membrane
(D) ATP synthesis occurs in the mitochondrial outer membrane

24. Which of the following is a common second messenger in signal transduction pathways?
(A) Epinephrin
(B) Inositol triphosphate
(C) GABA
(D) Acetylcholine

25. What is the function of nuclear receptors
(A) To bind to steroid hormones in the nucleus and promote the transcription of specific genes
(B) To bind to specific neurotransmitters and initiate a signaling cascade
(C) To bind to cytokines on nucleus membrane and regulate the gene expression
(D) To transport extracellular signaling molecules into the nucleus

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26. Which one of the following molecules containing a glycosidic bond?
(A) β-D-galactosamine.
(B) methyl-β-D-glucoside.
(C) 2-deoxy-α-D-ribose.
(D) β-D-glucose-6-phosphate.
(E) α-D-fructose-1, 6-bisphosphate.

27.The statements below for 2,3-bisphosphoglycerate (2,3-BPG) are correct EXCEPT:
(A) erythrocytes typically have high levels of 2,3-BPG.
(B) 2,3-BPG is synthesized from 1,3-BPG.
(C) a kinase converts 2,3-BPG to 3-phosphoglycerate.
(D) 2,3-BPG is involved in unloading oxygen from hemoglobin.
(E) bisphosphoglycerate mutase is an isomerase.

28.Which one of the glycolytic enzymes below generates a mixed anhydride from phosphoric acid?
(A) enolase.
(B) phosphofructokinase.
(C) glyceraldehyde-3-phosphate dehydrogenase.
(D) phosphoglycerate kinase.
(E) aldolase.

29.Order the coenzymes according to their participation sequence within pyruvate dehydrogenase complex. A. NAD+, B. CoA-SH, C. TPP, D. Lipoate (lipoamide), E. [FAD]
(A) A, B, C, D, E
(B) C, B, A, E, D
(C) C, D, B, E, A
(D) B, D, E, A, C
(E) C, E, D, B, A

30. Which of the following processes constitute the two-step reaction catalyzed by isocitrate dehydrogenase involves? A. β-decarboxylation expelling the α-keto carboxyl as CO2., B. oxidation of the C-2 alcohol of isocitrate to form oxalosuccinate., C. oxidation of the C-2 alcohol to form oxaloacetate., D. β-elimination expelling the central carboxyl group as CO2.
(A) A and B
(B) B and C
(C) C and D
(D) A and C
(E) B and D

31.All of statements below are characteristics of the malate-aspartate shuttle EXCEPT:
(A) OAA translocates inner mitochondrial membrane.
(B) electrons of cytosolic NADH are translocated to mitochondrial NADH.
(C) uses two malate dehydrogenase enzymes.
(D) reactions are reversible.
(E) involves transamination.

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32. Which of the following path describe the electron flow in the mitochondria?
(A) NADH → FMN → Coenzyme Q → Cyt A → Cyt B → Cyt C → O2
(B) NADH → FMN → Cyt B → Coenzyme Q → Cyt C → Cyt A → O2
(C) FMNH2 → NAD → Coenzyme Q → Cyt B → Cyt C → Cyt A → O2
(D) NADH → FMN → Coenzyme Q → Cyt B → Cyt C → Cyt A → O2
(E) NADH → FMN → Cyt B → Cyt C → Coenzyme Q → Cyt A → O2

33.Which of the following enzymes is used in both gluconeogenesis and glycolysis?
(A) fructose-1,6-bisphosphatase
(B) glucose-6-phosphatase
(C) pyruvate carboxylase
(D) phosphoglucoisomerase
(E) PEP carboxykinase

34.The statements below are characteristics of glucose-6-phosphate dehydrogenase EXCEPT:
(A) located in the mitochondria.
(B) strongly inhibited by [NADPH].
(C) inhibited by fatty acid-CoA.
(D) uses NADP+ as a coenzyme.
(E) forms a cyclic ester (lactone) of 6-phosphogluconate.

35. Which of the following three reactions can be catalyzed by a transketolase in the pentose phosphate pathway?
I. fructose-6-P + glyceraldehyde-3-P ⇔ xylulose-5-P + erythrose-4-P
II. erythrose-4-P + fructose-6-P ⇔ sedoheptulose-7-P + glyceraldehyde-3-P
III. sedoheptulose-7-P + glyceraldehyde-3-P ⇔ ribose-5-P + xyulose-5-P
(A) I only
(B) II and III
(C) II only
(D) I and III
(E) I and II

36.Which one of the statements below concerning biotin and gluconeogenesis is false?
(A) Biotin is used to add CO2 to certain intermediates in gluconeogenesis.
(B) CO2 is incorporated into the glucose product.
(C) Biotin is capable of binding covalently to CO2.
(D) Biotin helps synthesize an important precursor of phosphoenolpyruvate.
(E) ATP hydrolysis is required to attach CO2 to biotin.

37.Which of the following order is correct for transport of fatty acyl groups from the cytosol into the matrix? A. carnitine acyltransferase, B. tranaslocase of carnitine and O-acylcarnitine, C. carnitine palmitoyltransferase II, D. fatty acyl-CoA synthesis, E. O-acylcarnitine formation
(A) C, B, D, A, E
(B) D, B, E, A, C
(C) D, E, A, C, B
(D) D, A, E, B, C
(E) A, D, E, B, C

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38.During the elongation cycle of fatty acid biosynthesis, the correct sequence of enzyme catalyzed reactions is: A. β-ketoacyl-ACP synthase, B. β-ketoacyl reductase, C. β-hydroxyacyl dehydratase, D. enoyl reductase, E. acetyl transferase

(A) A, B, C, D, E
(B) C, B, D, E, A
(C) B, A, C, D, E
(D) A, C, B, E, D
(E) D, E, A, B, C

39.The correct order for the synthesis of mevalonate from acetyl-CoA is: A. HMG-CoA synthase, B. formation of 3-hydroxy-3-methylglutaryl-CoA, C. β-ketothiolase catalyzed condensation, D. HMG-CoA reductase activity, E. Formation of acetoacetyl-CoA

(A) E, C, D, A, B
(B) C, D, A, B, E
(C) E, B, A, C, D
(D) E, A, B, D, C
(E) C, E, A, B, D

40.What is the correct order of the following four reactions to achieve β-oxidation of fatty acids?
1. Cleavage of acetyl-CoA from the fatty acid., 2. Hydration of a double bond., 3. Formation of a C−C double bond., 4. Oxidation of an alcohol.

(A) 1 → 2 → 3 → 4
(B) 4 → 3 → 2 → 1
(C) 3 → 2 → 4 → 1
(D) 2 → 4 → 3 → 1
(E) 1 → 4 → 3 → 2

41. Which of the following molecule is synthesized in the cytosol and transported to the mitochondrial matrix for subsequent reaction during the urea cycle?

(A) citrulline
(B) ornithine
(C) argininosuccinate
(D) aspartate
(E) fumarate

42.Which type of the following reaction is responsible for generating UMP from OMP during nucleotide biosynthesis?

(A) reduction
(B) decarboxylation
(C) oxidation
(D) condensation
(E) hydrolxylation

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43.Which form of the folate coenzyme below is directly involved in the synthesis of the purine ring?
(A) N5,N10-methenyl THF
(B) N10-formyl THF
(C) N5-formyl THF
(D) tetrahydrofolate
(E) dihydrofolate

44.During a transition mutation, an Adenine will be replaced by:
(A) T.
(B) C.
(C) U.
(D) G.
(E) either T or C

45. Which one of the following statements best describes the structure of a nucleosome ?
(A) DNA wrapped around an octamer that contains two each of H2A, H2B, H3, and H4 with H1 on the outside.
(B) DNA wrapped around an octamer of H1 with H2A,B, H3 & H4 on the outside.
(C) DNA wrapped around an octamer of either H2A/H2B or H3/H4 with H1 on the outside.
(D) DNA wrapped around a tetramer of either H2A/H2B or H3/H4 with H1 on the outside.
(E) None of these

46.Which one of the descriptions below about RNA polymerase III is correct?
(A) is located in the nucleolus and transcribes the RNA genes of large and small ribosome subunits.
(B) is located in the nucleoplasm and transcribes the protein-encoding genes through mRNAs.
(C) transcribes the 5S RNA genes.
(D) transcribes genes associated with tRNA processing.
(E) transcribes tRNA genes and protein transport genes.

47.Which of the eukaryotic RNA polymerase below is/are resistant to α-amanitin in eukaryotic cells?
(A) I only.
(B) II only.
(C) III only.
(D) I and III.
(E) I, II and III.

48.Which one of the below is required for RNA splicing to occur?
(A) a free 5′ hydroxyl created by hydrolysis of the phosphate ester bond
(B) a cyclic phospodiester at the 3′ end of the RNA molecule
(C) a 2′ hydroxyl group
(D) the enzyme splicase
(E) a poly-A tail

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49. The function of the soluble translation factor EF-Tu is:
(A) binds GTP promoting translocation of ribosomes along mRNA.
(B) displaces GDP from the elongation complex.
(C) binds aminoacyl-tRNA in the presence of GTP.
(D) binds initiator tRNA and GTP.
(E) binds to 30 S subunit and drives mRNA binding.

50.The linkage between the tRNA and an amino acid in an amino-acyl tRNA complex is mediated by?
(A) an amide
(B) an acyl phosphate
(C) a hydroxylamine
(D) an ether
(E) an ester

51.Which of the following is the common pathway for how a protein is synthesized and secreted by cells?
(A) RER → lysosome → Golgi apparatus → plasma membrane
(B) Golgi apparatus → RER → transport vesicles → plasma membrane
(C) RER → Golgi apparatus → transport vesicles → plasma membrane
(D) RER → transport vesicles → Golgi apparatus → nucleus
(E) RER → lysosome → transport vesicles → plasma membrane

52. Endomembrane system modulates protein traffic and performs metabolic functions. Which of the following organelle is NOT included in the endomembrane system? (A) mitochondria (B) endoplasmic reticulum (C) Golgi apparatus (D) endosome (E) lysosome

53. Which of the following statements about catabolic pathways is correct? a) degrade complex organic molecules rich in potential energy into simpler waste products with less energy, b) fermentation is a partial degradation of sugars with the use of oxygen, c) aerobic respiration is the most efficient catabolic pathway, d) some prokaryotes harvest chemical energy without oxygen, known as anaerobic respiration, e) catabolism is linked to work by a chemical shaft-GTP. (A) abc (B) abd (C) acd (D) abce (E) ace

54. Which phase of mitosis is characterized by centrosomes located at the opposite pole and chromosomes aligned at the equator of cells? (A) prophase (B) prometaphase (C) metaphase (D) anaphase (E) telophase

55. Which of the following statements about mitosis and meiosis in animals is correct? a) only occurs in diploid cells, b) DNA duplication occurs during prophase before mitosis and meiosis I, c) cell division occurs once in mitosis and meiosis, d) synapsis of homologous chromosomes occurs in meiosis, e) produce two (diploid) or four (haploid) daughter cells with the identically genetic background of parent cells. (A) abc (B) abd (C) acde (D) bde (E) bcd

56. Albinism is a congenital disease due to the loss of melanin in animals. One man got married to a woman, but they did not conceive that both of them are carriers of albinism. If they give birth to two children, what is the probability of both offspring being afflicted with this disease? (A) 1/2 (B) 1/4 (C) 1/8 (D) 1/16 (E) 1/64

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57. Watson and Crick built an antiparallel double helix model structure of DNA. Which type of bond holds two strands of DNA together? (A) covalent bond (B) hydrogen bond (C) Van der Waals interaction (D) ionic bond (E) metallic bond

58. Transcription generates pre-mRNA and undergoes modification with 5'cap and 3' poly-A tail. Which of the following statements about the structure and function of these pre-mRNA alterations is NOT correct? (A) poly-A tails are usually consisting of 50-250 adenine (B) facilitate the export of mature mRNA from the nucleus (C) protect mRNA from hydrolytic degradation (D) help ribosomes attach to 3' end of mRNA in cytosol (E) none

59. Which of the following statements about sickle cell anemia is correct? a) hereditary disease, b) missense mutation of hemoglobin, c) carriers are afflicted by this disease, d) deleterious effects on kidney and brain, e) severe symptoms lead to death at the elderly population. (A) abc (B) abd (C) abcd (D) ade (E) abde

60. The RNA-guided Cas9 nuclease and clustered regularly interspaced short palindromic repeats (CRISPR) enable efficient genome engineering in eukaryotic cells. Which of the following statements about this system is correct? a) originally belong to the microbial adaptive immune system, b) RNA-guided Cas9 nuclease cleaves genetic elements, c) engages DNA repair system, d) a useful tool for specific gene knockdown, e) insertion or deletion usually leads to frameshift mutations. (A) abd (B) abcd (C) bde (D) abce (E) all

61. Noncoding RNAs play multiple roles in regulating gene expression. Which of the following statements about noncoding RNA is correct? a) noncoding RNAs include microRNAs, piwi-interacting RNAs, mRNAs, and long noncoding RNAs, b) noncoding RNAs can be translated into polypeptides, c) long noncoding transcript of XIST is essential for condensation of heterochromatin, d) microRNA-protein complexes recognize target mRNA and block its translation, e) piwi-interacting RNAs play an indispensable role in germ cells of animal species. (A) abc (B) bcd (C) bcde (D) acde (E) cde

62. Which of the following mechanism is NOT how bacteria defend against phage infection? (A) bacteria with mutant receptors unrecognizable to phages (B) restriction enzymes degrade exogenous genetic elements (C) type II topoisomerases facilitate conformational changes of DNA during replication and transcription (D) CRISPR-Cas system (E) none

63. COVID-19 pandemic outbreak leads to millions of death globally and these catastrophes are caused by the life-threatening SARS-CoV-2. Which of the following statements about the SARS-CoV-2 is NOT correct? (A) belongs to coronavirus carrying single-stranded RNA (B) only affects the upper and lower respiratory tracts (C) accesses host cells via the receptor for ACE2 (D) uses glycoprotein spike to connect to ACE2 receptor (E) none

64. Myoneural junction plays a role in innervation of muscle fiber. Please arrange in order the following processes of muscle contraction. a) calcium release from sarcoplasmic reticulum, b) acetylcholine released into synaptic cleft, c) sarcolemma depolarization d) myosin II swivels to approximate active site of actin molecule, e) troponin C aids in unmasking active site of active molecule f) moving thin filament toward center of sarcomere. (A) abcdef (B) bacdef (C) bcadef (D) cbaedf (E) bcaedf

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65. Which of the following tissue is NOT one of the four fundamental tissue types in animals? (A) epithelial tissue (B) connective tissue (C) adipose tissue (D) muscle tissue (E) nervous tissue

66. Polar bear hibernation behavior relies on which type of tissue and organelle to survive under frigid winter in the arctic pole? (A) white adipose tissue; rough ER (B) white adipose tissue; smooth ER (C) brown adipose tissue; rough ER (D) brown adipose tissue; smooth ER (E) brown adipose tissue; mitochondria

67. Which of the following statements about the endocrine system is NOT correct? (A) hormones are secreted into the bloodstream (B) hormone binding needs specific receptors presented on target cells (C) heart is not an endocrine organ (D) insulin secreted from pancreas promotes cellular uptake of glucose (E) leptin secreted by adipose tissue suppresses appetite

68. Coagulation is a delicate mechanism controlling clot formation and preventing blood drainage. What kind of dietary deficiency and clotting factor deficiency would lead to defective blood clotting and hemophilia? (A) vitamin E; factor VIII (B) vitamin B12; factor VIII (C) vitamin E; von Willebrand factor (D) vitamin B12; von Willebrand factor (E) phylloquinone; factor VIII

69. Which of the following statements about the estrus cycle is NOT correct? (A) each cycle takes approximately 28 days to complete (B) FSH stimulates follicle growth (C) LH surge promotes ovulation (D) corpus luteum secrets progesterone and estradiol to elicit a positive feedback loop to stimulate GnRH releasing from hypothalamus (E) elderly women undergo menopause, the cessation of ovulation and menstruation

70. Which brain structure is associated with emotional memory, especially for the sensation of fear? (A) nucleus accumbens (B) corpus callosum (C) amygdala (D) Wernicke's area (E) hippocampus

71. Which of the following factors can contribute to genetic variation in a population?
(A) Mutation (B) Natural selection (C) Genetic drift (D) Gene flow (E) All of the above

72. Which of the following statements about the evolution of seed plants is true?
(A) Seed plants evolved from ferns. (B) Seed plants first appeared in the Devonian period. (C) Seeds allowed plants to reproduce without water. (D) Gymnosperms produce flowers and fruits. (E) Angiosperms first appeared in the Carboniferous period.

73. Which of the following statements accurately describes the life cycle of fungi?
(A) Fungi reproduce asexually through fragmentation. (B) Fungi have a diploid dominant life cycle. (C) Fungi produce spores that are dispersed by wind or water. (D) Fungi produce seeds that are enclosed in a fruiting body. (E) Fungi have a single-celled life cycle.

74. Which of the following protists is responsible for causing malaria in humans?
(A) Euglena (B) Paramecium (C) Trypanosoma (D) Plasmodium (E) Amoeba

75. Which of the following diseases is caused by archaea?
(A) Tuberculosis (B) Cholera (C) Influenza (D) Lyme disease (E) None of the above

第 11 頁　背面有題，請繼續作答。

國立中興大學112學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 12 頁

76. If a population of beetles initially consists of 50 individuals, and 10 of them have a gene that confers resistance to pesticides, what is the frequency of this gene in the population?
(A) 0.1 (B) 0.2 (C) 0.4 (D) 0.6 (E) 0.8

77. Which of the following is NOT a characteristic of plant meristems?
(A) They are regions of active cell division. (B) They contain undifferentiated cells that give rise to all plant tissues. (C) They are found only in the tips of stems and roots. (D) They allow plants to continue growing throughout their lives. (E) They are the sites of hormone synthesis in plants.

78. What is the carrying capacity of a population that grows according to the logistic growth model if the intrinsic growth rate is 0.2 and the population size is currently 800 individuals?
(A) 1,000 (B) 2,000 (C) 4,000 (D) 8,000 (E) 16,000

79. Plant species A has a diploid chromosome number of 12. Plant species B has a diploid number of 16. A new species, C, arises as an allopolyploid from A and B. The diploid number for species C would probably be (A) 14. (B) 16. (C) 28. (D) 56. (E) 102.

80. Community have four different species (A to D) as follows: A: 20%、B: 20%、C: 30%、D: 30%. What is the Shannon diversity index (H) of community?
(A) 0.986. (B) 1.624. (C) 0.828. (D) 1.366 (E) 2.569

科目：普通生物及生化概論

題號	答案	題號	答案	題號	答案	題號	答案	題號	答案	題號	答案	題號	答案
1.	b	16.	a	31.	a	46.	C	61.	E	76.	B	91.	
2.	a	17.	b	32.	d	47.	a	62.	C	77.	E	92.	
3.	b	18.	d	33.	d	48.	c	63.	B	78.	D	93.	
4.	d	19.	a	34.	a	49.	c	64.	E	79.	C	94.	
5.	b	20.	c	35.	d	50.	e	65.	C	80.	D	95.	
6.	a	21.	a	36.	b	51.	C	66.	E	81.		96.	
7.	c	22.	b	37.	d	52.	A	67.	C	82.		97.	
8.	b	23.	a	38.	a	53.	C	68.	E	83.		98.	
9.	c	24.	b	39.	e	54.	C	69.	D	84.		99.	
10.	C	25.	a	40.	C	55.	B	70.	C	85.		100.	
11.	C	26.	b	41.	b	56.	D	71.	E	86.			
12.	a	27.	C	42.	b	57.	B	72.	C	87.			
13.	b	28.	c	43.	b	58.	D	73.	C	88.			
14.	d	29.	C	44.	d	59.	B	74.	D	89.			
15.	C	30.	e	45.	a	60.	D	75.	E	90.			

國立中興大學 112 學年度學士後醫學系招生考試

試題參考答案疑義釋疑公告

科目	題號	疑義答覆	釋疑結果
普通生物及生化概論	8	2,3-BPG 是 Hb 的 inhibitor，會抑制 Hb 結合氧氣。新生胎兒的 Hb 的 His143 易突變為 Ser，造成新生兒 Hb 對 2,3-BPG 結合力下降，反而會造成新生兒 Hb 對氧氣的親和力上升。	維持原答案(B)
	9	一般來說，Keratin 5 及 14 蛋白突變會發生 Epidermolysis bullosa，但近年文獻指出 Keratin K18 突變會造成 cystic fibrosis.	答案更改為(A)或(C)
	10	在無氧呼吸(anaerobic respiratory)的狀態下，葡萄糖會先經過 Glycolysis 轉換成 pyruvate，並產生兩個 ATP 分子。隨後 pyruvate 會被 LDH 酵素催化還原成 lactate，並產生氧化態 NAD+。LDH 也會逆向反應將 lactate 氧化成 pyruvate，但前提是 NAD+及 lactate 的濃度夠高的狀態，此過程的條件並非是氧氣濃度高所造成。故第 10 題答案仍維持(C)。	維持原答案(C)
	11	slope 單位分子分母寫反，故此題無正確答案。	本題送分
	16	phospholipids, sphingolipids, and cholesterol 為兩性分子，並且皆存在於細胞膜。	答案更改為(A)或(C)
	19	AChR 可以分為 nAChR 及 mAchR，前者為 channel，後者為 GPCR。	答案更改為(A)或(B)
	20	本題 D 選項的敘述，最大的問題點在於 G protein 在訊息傳遞的機制中，會停留在細胞膜上，不是扮演細胞內訊號分子(intracellular signalling molecules)的角色。故不選 D。	維持原答案(C)
	31	根據所提供之課本圖例下方之說明（1）已	維持原答案(A)

普通生物及生化概論		經很清楚的註明為 cytosol 了，所以答案(B)並無不妥，因此答案仍維持為所公布之參考答案（A）為唯一選項。	
	46	本題所列選項嚴格來說並無正確的答案 由於亦無以上皆非之選項，所以本題建議送分。	本題送分
	55	選項 B DNA duplication occurs during prophase before mitosis and meiosis I，DNA 複製發生在 interphase，此選項非正確答案。故此題無正確答案。	本題送分
	59	選項 C 異形核子通常不具有貧血的病徵，僅有在極端環境，如高海拔才會影響血紅素攜帶氧氣的能力。因而，一般情形下，異形核子通常不會患有鐮刀型貧血症並且可以正常生活。此外，sickle cell trait 並非一種疾病，而是泛指帶有鐮刀型貧血症基因的異形核子族群。故選項 C 非正確答案。 選項 E 鐮刀型貧血患者如果有嚴重貧血，通常會在年輕的時候因為貧血緣故早逝。因而選項 E 並非答案。鐮刀型貧血患者並非全部患有嚴重貧血，患者可能會隨著年紀增長貧血情形漸趨嚴重。就 E 選項敘述 severe symptoms lead to death at the elderly population，先決條件是假設患有嚴重貧血的話，患者通常無法活到老年，而是在年輕就病逝，因而 E 選項並非正確答案。	維持原答案(B)
	60	選項(D) a useful tool for specific gene knockdown，綜觀期刊論文研究，利用 CRISPR-Cas9 進行 gene knockdown 是可行的。在細胞模式中有其他方法可以取代 CRISPR-Cas9 來執行 gene knockdown，可以利用 siRNA 或是 shRNA 達到一樣的效果。現行 CRISPR-Cas9 為一有效率進行基因剔除 (gene knockout) 的方法，並且為大多數人所利用，但 CRISPR-Cas9 在 gene knockdown 研究也提供一種新的方式進行此實驗。但就效率而言，CRISPR-Cas9 需要花費較久的時間，對比 siRNA 或是 shRNA 則是可以快速達到 gene knockdown 的	答案更正為(E)

		目的。就實驗目的而言，CRISPR-Cas9 是針對 genome 進行改造，而 siRNA 及 shRNA 的目標是 mRNA，所以就僅有 CRIPSR-Cas9 系統改造過後的細胞能夠保有 gene knockdown 特徵的遺傳物質，不會因為細胞複製而喪失。	
	65	基本四大組織為上皮組織、結締組織、肌肉組織以及神經組織。雖然脂肪組織為結締組織的一種，但題目有明確指出下列何者並非四種基本組織，因而選項僅有脂肪組織符合題意所圈選出的答案。	維持原答案(C)
	71	All of the above factors can contribute to genetic variation in a population, making option E the correct answer. (D 負面的影響也是影響)。	維持原答案(E)
普通生物及生化概論	72	Option A is incorrect because seed plants did not evolve from ferns. Instead, both groups evolved from a common ancestor but diverged into distinct lineages.	維持原答案(C)
	73	Answer: E is incorrect because although some fungi are single-celled, others have complex multicellular structures. But Its life cycle is not single-celled.	維持原答案(C)
	76	Answer: B. 0.2 Explanation: The frequency of the resistance gene in the population can be calculated as the number of individuals with the gene divided by the total number of individuals in the population. In this case, there are 10 individuals with the gene, and a total of 50 individuals in the population. Therefore, the frequency of the gene is: Frequency = Number of individuals with gene / Total number of individuals Frequency = 10 / 50 Frequency = 0.2 Therefore, the frequency of the gene in the population is 0.2, or 20%. 未明確說明是「同型合子」或「異型合子」，故 A、B 兩個答案都給分。	答案更正為(A)或(B)
	77	C: It’s not only at the tips of stems and roots	答案更正為(C)或(E)

	78	本題因考題資訊不足，本題送分。	本題送分
	79	題目已經明確告知 A, B 兩物種的染色體數目，而且已告知為單選，故認為仍維持原答案。	維持原答案(C)

生化概論

莊老師(施政安)老師提供

3. Ans: B

[解析]

Amino acid	R group
1) Cysteine	-CH_2SH
2) Homocysteine	-**CH_2** CH_2SH
3) Serine	-CH_2OH
4) Homoserine	-**CH_2** CH_2OH

6. Ans: A

[解析] Globular protein 內側常為 Nonpolar amino acids : aromatic amino acids, BCAA (Val, Leu, **Ile**)

9. Ans: C (釋疑後 A, C 皆可)

[解析] Epidermolysis bullosa (表皮鬆解性水皰症), 俗稱泡泡龍

11. Ans: C (釋疑後送分: 因 slope 單位寫反了)

[解析]

1) 直線方程式: y = ax + b (1)

2) 因 y 軸截距/intercept 值= 1.23 = $\frac{1}{Vmax}$ = b ;

且斜率/slop = 23.3 = a, 代入 (1)

得 y = 23.3x + 1.23 (2)

3) 當 y = 0 時代入(2), 求得 x = - $\frac{1.23}{23.3}$ = - $\frac{1}{Km}$, 故 $Km = \frac{23.3}{1.23} \approx 18.943$

故選 (C) 18.9

12. Ans: A

[解析] $Km = \frac{K-1 + K2}{K1} \approx \frac{K-1}{K1} = Kd$ (**d**issociation constant) = $\frac{1}{affinity}$

(當 $K_{-1} >> K_2$), 故選 (A)

15. Ans: C

[解析]

Serine peptidase	Amino acids in Binding site
1) Trypsin	Lys, Arg (basic amino acid)
2) Chymotrypsin	Phe, Tyr, Trp (aromatic amino acid)

16. Ans: A (釋疑後 A, C 皆可)

[解析] Biochemistry: cholesterol 被視為 amphipathic compound

18. Ans: D

[解析] Melting point order: SFA (B > A) > MUFA (C) > PUFA (D)

(SFA/**s**aturated **f**atty **a**cid; MUFA/**m**ono**u**nsaturated **f**atty **a**cid; PUFA/**p**oly**u**nsaturated **f**atty **a**cid)

19. Ans: A (釋疑後 A, B 皆可)

[解析] Acetylcholine: Na^+ channel

21. Ans: A (校方解答)

[解析] GLUT4 不存在於 liver (GLUT4 in skeletal muscle, heart, and adipose tissue)

故應無解才對

23. Ans: A

[解析] F_0F_1-ATP synthase in mitochondrial **inner** membrane:

(1) F_1: **ADP + Pi → ATP by β-subunit**, γ-subunit (rotor)

(2) F_0: c-subunit (rotor), a-subunit (proton half-channel),

25. Ans: A (校方解答)

[解析]

Nuclear receptor 粗分兩類:

1) Cytoplasmic receptor: **steroid** hormone binding to its receptor **firstly in cytosol and then transporting to nucleus**.
2) Nuclear receptor: other hormones binding to their receptors in nucleus (hormones: retinoic acid, thyroid hormone, 1,25-$(OH)_2$-vitamin D_3)

故嚴格而言本題無解

28. Ans: C

[解析]

1) To generate a mixed anhydride from phosphoric acid:指生成 1,3BPG

2) 1,3BPG is generated from the action of **glyceraldehyde-3-phosphate dehydrogenase (C)**

30. Ans: E

[解析] Isocitrate → step 1: dehydrogenation to **oxalosuccinate (B)** + $2H^+$ + $2e^-$ → step2: decarboxylation to **α-keto**glutarate + **CO_2 (D)**

32. Ans: D

[解析] **NADH** → complex I (**FMN**) → **CoQ** → complex III (**cyt**ochrome **b**) → **cyt**ochrome **c** → complex IV (**cyt**ochrome **a** → a_3) → **O_2**

34. Ans: A

[解析] (A) 修正: Pentose phosphate pathway in **cytosol**.

35. Ans: D

[解析]

1) Transketolase: transfer 2-C unit
2) 只有 I 和 III 是轉移 2 個碳分子
3) (**I**)反應中碳數變化: C6 + C3 ↔ **C5 (= C3 + C2)** + **C4 (= C6-C2)**
   (III)反應中碳數變化 : C7 + C3 ↔ **C5 (= C3 + C2)** + **C5 (= C7 - C2**)

38. Ans: A (校方解答)

[解析]

1) acetyl transferase:正確稱 **m**alonyl/**a**cetyl-ACP **t**ransferase (MAT)
   其受質為 acetyl-CoA or malonyl-CoA
2) (**E**) acetyl transferase → (**A**) β-ketoacyl-ACP synthase → (**B**) β-ketoacyl reductase → (**C**) β-hydroxyacyl dehydratase → (**D**) enoyl reductase

1) 111 年釋疑中說 acetyl transferase 是(translocation step to start a new fatty acid), 此說法是錯誤的, (translocation step to start a new fatty acid)是由(**A**) β-ketoacyl-ACP synthase*執行 (ACP = **a**cyl **c**arrier **p**rotein).
   (*Smith: The animal fatty acid synthase- one gene, one polypeptide, seven enzymes, FASEB J. 1994, 8:1248)
4) β-ketoacyl-ACP synthase(KS) 功能: two functions
   ① condensation: acetyl-KS + malonyl-ACP → β-ketoacyl-ACP
   ② **interthiol transacylation**: butyryl-ACP + KS → ACP + butyryl-KS
   (Witkowski, Joshi and Smith; Characterization of the interthiol acyltransferase reaction catalyzed by the β-ketoacyl synthase domain of the animal fatty acid synthase, Biochemistry, 1997, 36:16338)
   (Mindrebo *et al.*; Gating mechanism of elongating β-ketoacyl-ACP synthases, Nature Communication, 2021, 11: 1727)
   (Pavia *et al.*; Animal fatty acid synthase: a chemical nanofactory, Chemical Reviews, 2021, 121:9502)
   故無解才對.(正確次序為 **E, A, B, C, D**)

41. ns: B

[解析]

Cytosol		Mitochondria
Arginine ← ←		citrulline
↓		↑
Urea + **Ornithine**	→	**Ornithine** + carbamoyl phosphate

43. Ans: B

[解析] C2 and C8 of purine ring are come from **N^{10}-formyl-tetrahydrofolate (= N^{10}-formyl-THF)**

46. Ans: C (釋疑後送分)

[解析]

1) (C): 5S RNA ≠ **5S rRNA (比較正確)**
2) RNA polymerase III 可以轉錄之 genes:
   tRNA, 5S rRNA, 7SL RNA, 6U snRNA, SINE (例:*Alu* RNA)
3) 7SL RNA (also called 7S RNA)會組成 SRP (**s**ignal **r**ecognition **p**article):
   SRP 會協助 **protein transport** from cytosol to ER.
   故**應選(E)**才正確

48. Ans: C

[解析] Branch point **A** with **2'-OH,** which attacks the **G** of 5'splice site (GU site).

51. Ans: C

[解析] Protein in cytosol recognized by SRP → rough ER (**RER**) → transport vesicles → **Golgi apparatus** → **transport vesicles** → **plasma membrane**

故選(C)

e) a chemical shift to **ATP**

57. Ans: B

[解析]

1) B-DNA stability forces[a]: **H-bond** and base stacking force
2) Base stacking force > H-bond[a]
3) Base stacking force : ***van der Waals*** force (major) and hydrophobic interaction[b]

故 B, C 皆可(若考 major force: 則應選 C)

([a]Leninger edition/ Nelson and Cox: Principles of Biochemistry, 2021, 8th edition, p.271)

([b]R. L. Miesfeld and M. M. McEvoy, Biochemistry, 2017, p.96)

60. ns: D (釋疑後更正為 E)

[解析]

1) d)修正: CRISPR-Cas9 system 主要討論 gene **knock-in** or **knock-out**.
2) 釋疑中說有 gene knockdown: 國際上有 CRISPRi (CRISPR interference) 方法沒錯, 但是使用 dCas9 (**d**eactivated form of Cas9/ loss of nuclease))和題目中講的 Cas9 不同故**作者認為應維持原解 (D)**

61. Ans: E

[解析]

1)

a)修正: noncoding RNA 不包含 **mRNA**

b)修正: **noncoding RNA ≠ mRNA** (mRNA = coding RNA, 會合成 protein)

1) ncRNA (noncoding RNA):
miRNA, siRNA, piRNA, lncRNA (例: XIST RNA), **R**NA template in **te**lomerase (**TER**C) *etc* in eukaryotes

63. Ans: B

[解析] Co-SARS-2 攻擊之地*: 只要有 ACE2 存在之組織皆可 (例: brain, eyes, heart, lung, liver, kidney *etc*)

(*Malena Fini *et al*, Body location of ACE-2: on the trail of the keyhole of SARS-CoV-2, Frontiers in Medicine, December 2020, volume 7, Article 594495)

生 物 學

張劍鴻(張芸潔)老師提供

中興大學 112學年度 學士後醫學系
生物試題命題範疇分析

✦ 本年度中興後醫的普通生物及生化概論共有 80 題，試卷總分為150分，配分如下：

(1) 第 1 -25題，每題 1 分，共25分。
(2) 第26-70題，每題 2 分，共90分。
(3) 第71-75題，每題 3 分，共15分。
(4) 第76-80題，每題 4 分，共20分。

✦ 在此針對第51-80題的做分析：題目全數為生物學課本 Campbell 的生物領域概念，若能循正規的方式準備，確實熟悉Campbell生物學之概念，在這75分當中，要有60以上的表現並不困難。

生物各試題命題範疇分析

		第51-70題，二分題
51	Unit 1 細胞生物學	Endomembrane system，完全命中 正課講義：Chap 1 細胞構造和功能， page 25 複習課程：Unit 1 Cell Biology, page 2
52	Unit 1 細胞生物學	Endomembrane system，完全命中 正課講義：Chap 1 細胞構造和功能， page 25 複習課程：Unit 1 Cell Biology, page 2
53	Unit 3 生物化學	Anaerobic respiration ，完全命中 正課講義：Chap 16 細胞呼吸， page 77-79 複習課程：Unit 3 Biochemistry, page 13

54	Unit 4 分子生物學	Mitosis，完全命中 正課講義：Chap 17 有絲分裂， page 31-33 複習課程：Unit 4 Molecular Biology, page 4
55	Unit 4 分子生物學	Mitosis and meiosis，該題送分 正課講義：Chap 18 減數分裂， page 35 複習課程：Unit 4 Molecular Biology, page 8
56	Unit 4 分子生物學	Probability laws of Mendelian inheritance，完全命中 正課講義：Chap 19 孟德爾， page 35-39 複習課程：Unit 4 Molecular Biology, page 10
57	Unit 4 分子生物學	Probability laws of Mendelian inheritance，完全命中 正課講義：Chap 19 孟德爾， page 35-39 複習課程：Unit 4 Molecular Biology, page 10
58	Unit 4 分子生物學	Probability laws of Mendelian inheritance，完全命中 正課講義：Chap 22 基因表現， page 40-47 複習課程：Unit 4 Molecular Biology, page 26
59	Unit 4 分子生物學	Point mutations，完全命中 正課講義：Chap 22 基因表現， page 85-88 複習課程：Unit 4 Molecular Biology, page 31-32
60	Unit 5 生物科技	CRISPR-Cas9 system，完全命中 正課講義：Chap 24 DNA 科技， page 74-78 複習課程：Unit 5 Biotechnology, page 6 Unit 6 Microbiology and Immunology, page 11
61	Unit 4 分子生物學	Noncoding RNAs，完全命中 正課講義：Chap 23 基因表現控制， page 60-70 複習課程：Unit 4 Molecular Biology, page 36
62	Unit 7 微生物免疫學	Phages，完全命中 正課講義：Chap27 微生物， page 98-99 複習課程：Unit 6 Microbiology and Immunology, page 21
63	Unit 7 微生物免疫學	Virus- COVID-19，命中 正課講義：Chap27 微生物， page 118 複習課程：Unit 6 Microbiology and Immunology, page 22

64	Unit 2 動物生理學	Sliding-filament model，完全命中 正課講義：Chap 8 運動， page 13-19 複習課程：Unit 2 Animal Physiology, page 18-19
65	Unit 2 動物生理學	Body structure，完全命中 正課講義：Chap 4 身體構造和功能， page 12-18 複習課程：Unit 2 Animal Physiology, page 5
66	Unit 8 生物化學	Hibernation，完全命中 正課講義：Chap 16 細胞呼吸， page 86 複習課程：Unit 3 Biochemistry, page 13
67	Unit 2 動物生理學	Atrial natriuretic peptide，完全命中 正課講義：Chap 12 排泄系統， page 93 複習課程：Unit 2 Animal Physiology, page 48
68	Unit 2 動物生理學	Blood clotting，完全命中 正課講義：Chap 9 運輸系統， page 92-99 複習課程：Unit 2 Animal Physiology, page 28
69	Unit 2 動物生理學	Reproduction cycles，完全命中 正課講義：Chap 13 生殖系統， page 54-57 複習課程：Unit 2 Animal Physiology, page 51-53
70	Unit 2 動物生理學	Amygdala，完全命中 正課講義：Chap 6 神經系統， page 49-50 複習課程：Unit 2 Animal Physiology, page 11
		第71-75題，三分題
71	Unit 8 演化學	Alter allele frequencies，完全命中 正課講義：Chap33 演化機制， page 76-82 複習課程：Unit 8 Evolution, page 17-18
72	Unit 7 植物學	Digestive system，完全命中 正課講義：Chap30 植物多樣性， page 53 複習課程：Unit 7 Plant Biology, page 30
73	Unit 8 演化學	Life cycle of fungi，命中 正課講義：Chap 31 真菌， page 11-13 複習課程：Unit 8 Evolution, page 3-4

74	Unit 7 微生物免疫學	Plasmodium，完全命中 正課講義：Chap27 微生物， page 195-196 複習課程：Unit 6 Microbiology and Immunology, page 29
75	Unit 7 微生物免疫學	Prokaryote，完全命中 正課講義：Chap27 微生物， page 48-51 複習課程：Unit 6 Microbiology and Immunology, page 18
		第76-80題，四分題
76	Unit 8 演化學	Hardy-Weinberg，完全命中 正課講義：Chap33 演化機制， page 49-55 複習課程：Unit 8 Evolution, page 17-18
77	Unit 7 植物學	Meristems，完全命中 正課講義：Chap28 植物構造和生長， page 48-50 複習課程：Unit 7 Plant Biology, page 8-10
78	Unit 9 生態學	Population growth models，資料不足，送分題 正課講義：Chap36 族群和生活史， page 20 複習課程：Unit 9 Ecosystems, page 5-6
79	Unit 8 演化學	Allopolyploid，完全命中 正課講義：Chap34 物種起源， page 64 複習課程：Unit 8 Evolution, page 21
80	Unit 9 生態學	Shannon diversity index，人腦計算不易 正課講義：Chap37_多樣性和群落， page 25 複習課程：Unit 9 Ecosystems, page 8

國立大學 學士後醫 生物學 考題分析

課程大綱	112 清大	111 清大	112 中興	111 中興	112 中山	111 中山
Unit 1 細胞生物學	3	0	6	0	9	2
Unit 2 動物生理學	10	11	10	7	24	9
Unit 3 巨分子及生物化學	1	3	4	1	12	1
Unit 4 分子生物學	2	6	12	8	10	10
Unit 5 DNA生物科技	2	1	1	2	4	2
Unit 6 微生物免疫	7	5	4	1	5	5
Unit 7 植物學	0	2	1	4	2	9
Unit 8 演化學	2	2	5	6	4	6
Unit 9 生態學	3	0	2	1	0	1
總計	30	30	45	30	70	45
生化範疇試題	30	30	35	40	20	45
總題數	60	60	80	70	90	90