國立中山大學114學年度學士後醫學系招生考試試題

科目名稱：普通生物及生化概論

※本科目依簡章規定「不可以」使用計算機(選擇題)

選擇題(單一選擇題，共90題，總分150分)

壹、第1~30題，每題1分，共計30分，答錯1題倒扣0.25分，倒扣至本大題零分為止，未作答，不給分亦不扣分。

1. Why aren't insect tracheae associated with capillary beds?
   (A) Insect capillaries are found only around the gut.
   (B) Insects have external gills associated with hemolymph vessels.
   (C) Insects use an air sac respiratory system.
   (D) Insects have an open circulatory system.
   (E) All of the above.
   Ans: (D)

2. During the generation of an action potential, which of the following best explains the absolute refractory period at the molecular level?
   (A) The K^+ channels remain open, preventing the membrane from reaching the threshold potential.
   (B) The Na^+ channels are inactivated, preventing further depolarization despite strong stimuli.
   (C) The Na^+/K^+-ATPase pump is actively hyperpolarizing the membrane, inhibiting depolarization.
   (D) The relative permeability of Na^+ remains high, preventing K^+ efflux from dominating.
   (E) The lipid bilayer of the membrane is temporarily impermeable to all ions.
   Ans: (B)

3. Which of the following best explains why a neuron receiving a simultaneous excitatory postsynaptic potential (EPSP) and inhibitory postsynaptic potential (IPSP) may fail to reach the threshold for an action potential?
   (A) The IPSP causes a transient inactivation of voltage-gated Na^+ channels, making depolarization impossible.
   (B) The inhibitory synapse stabilizes the membrane potential at a level too positive to allow Na^+ channel activation.
   (C) The summation of EPSP and IPSP results in a net change in membrane potential that may be insufficient to reach the threshold.
   (D) The presence of an IPSP leads to immediate degradation of neurotransmitters, reducing excitatory drive.
   (E) The inhibitory synapse actively removes Na^+ from the postsynaptic cell, counteracting the excitatory input.
   Ans: (C)

4. Which of the following is a fundamental physiological difference between cardiac and skeletal muscle that prevents tetanic contractions in cardiac muscle?
   (A) Cardiac muscle lacks functional T-tubules, preventing rapid excitation-contraction coupling.
   (B) Cardiac muscle action potentials involve L-type Ca^{2+} channels, prolonging depolarization and refractory periods.
   (C) The sarcoplasmic reticulum in cardiac muscle lacks ryanodine receptors, preventing sustained Ca^{2+} release.
   (D) The pacemaker activity of cardiac muscle ensures a fixed contractile frequency, preventing summation.
   (E) Cardiac muscle myosin has a significantly lower ATPase activity, preventing repeated cross-bridge cycling.
   Ans: (B)

5. If a human red blood cell takes the shortest possible route from the right ventricle to the right atrium, then it must travel through _____ capillary beds.
(A) one (B) two (C) three (D) four (E) five
Ans: (B)

6. What will happen to a man who is unable to produce LH?
(A) His anterior pituitary is unable to produce FSH.
(B) His Leydig cells are unable to produce testosterone.
(C) He will lose the positive feedback control on FSH release.
(D) His GnRH release by the hypothalamus is decreased.
(E) He will exhibit exaggerated secondary sex characteristics.
Ans: (B)

7. Which of the following statement on the nitrogenous waste is **INCORRECTLY** matched with the benefit of its excretion?
(A) Urea has lower toxicity relative to ammonia.
(B) Uric acid can be stored and excreted as precipitate.
(C) Urea is very insoluble in water.
(D) Ammonia is highly soluble in water.
(E) Uric acid requires minimal amount of water to excrete.
Ans: (C)

8. Which of the following best describes the role of apoptosis in cell signaling?
(A) It randomly destroys cells when there is excess growth.
(B) It integrates multiple signaling pathways to systematically remove cells.
(C) It is triggered only by external signals from neighboring cells.
(D) It primarily occurs in prokaryotic cells to maintain population control.
(E) It amplifies signals by activating multiple caspase proteins.
Ans: (B)

9. Which of the following best describes a primary functional consequence of the blood–brain barrier (BBB) in regulating central nervous system homeostasis?
(A) It prevents the diffusion of small lipophilic molecules, ensuring strict metabolic control within the brain.
(B) It allows selective passive diffusion of hydrophilic neurotransmitters, facilitating rapid neuronal signaling.
(C) It restricts the entry of many circulating immune cells, limiting the brain's immune surveillance.
(D) It actively transports large plasma proteins into cerebrospinal fluid (CSF) to maintain osmotic balance.
(E) It permits the direct exchange of plasma and CSF without specialized transport mechanisms.
Ans: (C)

10. A patient is diagnosed with a rare mutation that impairs the ability of intracellular receptors to dimerize upon hormone binding. Which of the following hormonal responses would be most severely affected?

(A) insulin-mediated glucose uptake in muscle cells
(B) epinephrine-induced glycogen breakdown in hepatocytes
(C) cortisol-induced transcriptional activation in target tissues
(D) parathyroid hormone (PTH)-induced calcium mobilization
(E) growth hormone (GH)-induced IGF-1 secretion from the liver
Ans: (C)

11. _____ are a type of reversible inhibitors that resemble the typical substrate molecule of an enzyme and compete for the binding of the active site to inhibit the enzyme's action.
(A) Non-competitive inhibitors
(B) Competitive inhibitors
(C) Molecular mimics
(D) Agonists
(E) Antagonists
Ans: (B)

12. _____ is a type of cell death that is characterized by its iron dependence and the accumulation of lipid peroxides.
(A) Anoikis (B) Apoptosis (C) Necrosis (D) Ferroptosis (E) Pyroptosis
Ans: (D)

13. Which of the following characteristics would be true of an epithelium specialized for exchange by diffusion (e.g., a respiratory epithelium)?
(A) thin with a relatively large surface area
(B) thick with a relatively large surface area
(C) thin with a relatively small surface area
(D) thick with a relatively small surface area
(E) thin with a small surface area/volume ratio
Ans: (A)

14. Which of the following is **NOT** a stage of cell signaling?
(A) reception (B) transduction (C) termination (D) response (E) none of the above
Ans: (C)

15. Which of the following molecule is **NOT** considered as a second messenger?
(A) acetyl-CoA (B) inositol trisphosphate (C) nitric oxide (D) calcium ion (E) cAMP
Ans: (A)

16. Which intermediate of the urea cycle directly donates one nitrogen atom for urea synthesis?
(A) carbamoyl phosphate
(B) ornithine
(C) oxaloacetate
(D) aspartate
(E) fumarate
Ans: (D)

17. Which of the following complexes of the mitochondrial respiratory chain does **NOT** contribute to the proton gradient across the inner mitochondrial membrane?
(A) Complex I (B) Complex II (C) Complex III (D) Complex IV

(E) cytochrome c oxidase
Ans: (B)

18. What is the function of guanine deaminase in purine metabolism?
(A) conversion of guanine to xanthine
(B) conversion of inosine to guanine
(C) conversion of xanthine to uric acid
(D) synthesis of guanine from IMP
(E) recycling of guanine into GMP
Ans: (A)

19. Which of the following statements about the regulation of ketogenesis is correct?
I. High levels of insulin stimulate ketogenesis by increasing acetyl-CoA availability.
II. The liver lacks b-ketoacyl-CoA transferase, preventing ketone body utilization.
III. Glucagon promotes ketogenesis by enhancing fatty acid oxidation.
(A) I and II
(B) II and III
(C) I and III
(D) III only
(E) All of them are correct.
Ans: (B)

20. Which of the following best describes the mechanism of action of oligomycin?
(A) inhibition of Complex I
(B) blocking of ATP synthase proton channel
(C) uncoupling of oxidative phosphorylation
(D) blocking of cytochrome c function
(E) inhibition of Complex III
Ans: (B)

21. Regulation of cholesterol biosynthesis _____.
(A) involves transcriptional regulation but not covalent regulation
(B) is sensitive to insulin but not glucagon
(C) occurs in the short term primarily by regulating HMG-CoA reductase
(D) involves changes in the rate of biosynthesis of critical enzymes, but not changes in the rate of proteolysis of those enzymes
(E) All of the above are correct.
Ans: (C)

22. Which of the following statements regarding allosteric regulation of enzymes is correct?
I. Allosteric enzymes often exhibit sigmoidal (cooperative) kinetics rather than hyperbolic Michaelis-Menten kinetics.
II. The R-state of an allosteric enzyme has a lower affinity for the substrate than the T-state.
III. Feedback inhibition of a metabolic pathway often involves allosteric regulation of the first committed enzyme.
(A) I and II
(B) II and III
(C) I and III
(D) I only
(E) All of them are correct.

Ans: (C)

23. In humans, pyruvate can be converted to _____.
(A) acetyl-CoA only (B) lactate only (C) ethanol only (D) acetyl-CoA and lactate
(E) acetyl-CoA and ethanol
Ans: (D)

24. Where is the enzyme glucose-6-phosphatase located?
(A) cytosol
(B) endoplasmic reticulum
(C) mitochondria
(D) nucleus
(E) none of the above
Ans: (B)

25. Which of the following is the most distinguishing difference between a purine and a pyrimidine?
(A) Purines are double ring structures while pyrimidines have a single ring.
(B) Purines have nitrogens in the rings while pyrimidines do not.
(C) Pyrimidines have nitrogens in the rings while purines do not.
(D) Purines are found in RNA while pyrimidines are found in DNA.
(E) Purines are found in DNA while pyrimidines are found in RNA.
Ans: (A)

26. Phospholipases break down fats by _____.
(A) adding a phosphate group to them
(B) reducing the double bonds to single bonds
(C) hydrolyzing them
(D) removing acetyl-CoA units
(E) none of the above
Ans: (C)

27. Certain restriction enzymes produce cohesive (sticky) ends. This means that they _____.
(A) cut both DNA strands at the same base pair
(B) cut in regions of high GC content, leaving ends that can form more hydrogen bonds than ends of high AT content
(C) make a staggered double-strand cut, leaving ends with a few nucleotides of single-stranded DNA protruding
(D) make ends that can anneal to cohesive ends generated by any other restriction enzyme
(E) stick tightly to the ends of the DNA they have cut
Ans: (C)

28. All of the following are considered "weak" interactions in proteins, **EXCEPT**:
(A) hydrogen bonds
(B) hydrophobic interactions
(C) ionic bonds
(D) peptide bonds
(E) van der Waals forces
Ans: (D)

29. The force that drives an ion through a membrane channel depends upon _____.

(A) the charge on the membrane
(B) the difference in electrical potential across the membrane
(C) the size of the channel
(D) the size of the ion
(E) the size of the membrane
Ans: (B)

30. Which of the following is a product of the activation of fatty acids?
(A) CoA-SH
(B) ADP
(C) pyrophosphate
(D) none of the above
(E) all of the above
Ans: (C)

貳、第31～90題，每題2分，共計120分，答錯1題倒扣0.5分，倒扣至本大題零分為止，未作答不給分亦不扣分。

31. If you touch a hot stove and burn your hand, the pain isn't actually in your hand—it's in your head. What evidence can you provide to substantiate this claim?
(A) A reflex arc allows the quick response between the hand and the brain; no interpretation occurs.
(B) Sensory neurons and interneurons carry the heat sensation to the brain where it is interpreted as painful.
(C) Motor neurons pull your hand away from the flame, signaling pain to the brain.
(D) Interneurons form connections directly from the burned receptor molecules to the brain.
(E) All of the above.
Ans: (B)

32. Oral rehydration solutions that contain both salt and glucose are highly effective in treating severe dehydration caused by diarrhea and vomiting. However, glucose or salt alone are not effective. Why?
(A) Glucose without sodium is broken down too quickly in the mouth by saliva.
(B) Water alone rushes through the digestive tract too quickly to be absorbed by the body tissues.
(C) Sodium transport and glucose transport are coupled in the small intestine so that glucose accelerates absorption of salt and water.
(D) ATP is required to transport sodium unless glucose is available for cotransport.
(E) None of the above.
Ans: (C)

33. How does the digestion and absorption of fat differ from that of carbohydrates?
(A) Processing of fat does not require any digestive enzymes, whereas the processing of carbohydrates does.
(B) Fat absorption occurs in the stomach, whereas carbohydrates are absorbed from the small intestine.
(C) Carbohydrates need to be emulsified before they can be digested, whereas fats do not.
(D) Most absorbed fat enters the lymphatic system, whereas carbohydrates directly enter the blood.
(E) Fat must be partially digested by bacteria in the large intestine before it can be absorbed, which is not the case for carbohydrates.
Ans: (D)

34. Which of the following physiological responses to hemorrhage is correctly described?

(A) The increase in cardiac output due to hemorrhage results in enhanced venous return, which compensates for the blood loss.
(B) Hemorrhage causes a drop in blood pressure, and the baroreceptor reflex increases sympathetic activity, leading to vasoconstriction and increased heart rate to preserve blood pressure.
(C) Blood volume expansion following hemorrhage is mediated by parasympathetic activation, which reduces vasoconstriction.
(D) The physiological response to hemorrhage primarily involves vasodilation to improve blood flow to tissues affected by low blood volume.
(E) Shock caused by hemorrhage results in complete cessation of blood flow to the brain, leading to immediate neuronal death.
Ans: (B)

35. Which of the following statements about lung compliance is true?
(A) Lung compliance is primarily determined by the strength of the diaphragm and intercostal muscles.
(B) Surfactant produced by type II cells increases lung compliance by reducing surface tension.
(C) Decreased lung compliance is associated with increased surfactant production.
(D) Compliance is solely determined by the elasticity of the thoracic cage, with no influence from lung tissue.
(E) High lung compliance always indicates optimal lung function, especially during forced expiration.
Ans: (B)

36. A patient with recurrent hypoglycemia presents with low plasma glucose and elevated plasma insulin during fasting. Which of the following pathophysiological mechanisms is the most likely cause?
(A) Insulinoma causes inappropriate insulin secretion despite fasting hypoglycemia.
(B) Adrenal insufficiency leads to excessive hepatic gluconeogenesis and hyperglycemia.
(C) Glucagon overproduction causes excessive hepatic glycogenolysis and ketogenesis.
(D) Increased cortisol levels stimulates GLUT4-mediated glucose uptake into skeletal muscle.
(E) Reduced hepatic glycogenolysis that is caused by the excessive glucagon secretion.
Ans: (A)

37. Which of the following is an example of how conjugation contributes to the spread of antibiotic resistance?
(A) A bacterium spontaneously mutates to become resistant to penicillin.
(B) An *E. coli* strain transfers a plasmid containing the blaKPC gene to a Klebsiella pneumoniae strain, making it resistant to carbapenems.
(C) A bacterium acquires resistance through exposure to gradually increasing concentration of antibiotics.
(D) A virus introduces antibiotic resistance genes into a bacterial population.
(E) Bacteria develop resistance through adaptive changes in their metabolism.
Ans: (B)

38. Which of the following is **TRUE** on a morphogen?
(A) It is a signaling molecule that is required for cell-to-cell contact within the embryo.
(B) It is a signaling molecule that induces the differentiation of cells within the embryo.
(C) It is a signaling molecule that induces blastulation of the developing embryo.
(D) It is a signaling molecule that induces implantation of the embryo into the uterus of mammals.
(E) It is a signaling molecule that separates out cytoplasmic factors to their respective cells within the developing embryo.

Ans: (B)

39. Please identify the events of mitosis in the correct order.
I. Sister chromatids align on the metaphase plate.
II. The cleavage furrow forms.
III. The nuclear membrane breaks up.
IV. Sister chromatids condense.
V. Sister chromatids separate.
(A) I, II, III, IV, V
(B) IV, III, I, V, II
(C) III, IV, I, V, II
(D) III, II, I, IV, V
(E) IV, I, III, V, II
Ans: (B)

40. Which of the following response is triggered by the activation of acetylcholine receptor on skeletal muscle, a ligand-gated channel?
(A) hyperpolarization by allowing Na^+ ions to exit the muscle fiber
(B) depolarization by allowing K^+ ions to leave the muscle fiber
(C) depolarization by allowing Cl^- ions to enter the muscle fiber
(D) repolarization by activating second messenger systems within the muscle fiber
(E) depolarization by allowing Na^+ ions to enter the muscle fiber
Ans: (E)

41. Which of the following is the correct sequence of sensory processing?
(A) sensory adaptation → stimulus reception → sensory transduction → sensory perception.
(B) stimulus reception → sensory transduction → sensory perception → sensory adaptation.
(C) sensory perception → stimulus reception → sensory transduction → sensory adaptation.
(D) sensory perception → sensory transduction → stimulus reception → sensory adaptation.
(E) stimulus reception → sensory perception → sensory adaptation → sensory transduction.
Ans: (B)

42. Which of the following is the primary function of the corpus luteum?
(A) to nourish and protect the egg cell
(B) to maintain progesterone and estrogen synthesis after ovulation has occurred
(C) to produce prolactin in the alveoli
(D) to stimulate the development of the mammary glands
(E) to support pregnancy in the second and third trimesters
Ans: (B)

43. The clonal selection theory implies that _____.
(A) related people have similar immune responses
(B) antigens activate specific lymphocytes
(C) only certain cells can produce interferon
(D) memory cells are present at birth
(E) the body selects which antigens it will respond to
Ans: (B)

44. Although the membrane of a "resting" neuron is highly permeable to potassium ions, its membrane potential does not exactly match the equilibrium potential for potassium. Why?

(A) The resting neuronal membrane is also slightly permeable to sodium ions.
(B) The resting neuronal membrane is also fully permeable to sodium ions.
(C) The resting neuronal membrane is also fully permeable to calcium ions.
(D) The resting neuronal membrane is also impermeable to sodium ions.
(E) The resting neuronal membrane is also highly permeable to chloride ions.
Ans: (A)

45. A mutation in the vasopressin receptor V2 (V2R) leads to a loss of function in the renal collecting ducts. Which of the following is the most likely clinical manifestation?
(A) Production of hyperosmotic urine due to an increased insertion of aquaporin-2 (AQP2) in the lumenal surface of the collecting duct cells.
(B) The excessive water retention by unregulated vasopressin signaling results in hypertension.
(C) Impaired water reabsorption in the collecting ducts leads to polyuria with hypoosmotic urine.
(D) Compensatory increase in aldosterone secretion that enhances sodium reabsorption in the proximal tubule.
(E) Enhanced renin-angiotensin system activation leads to the eventual increase in plasma volume.
Ans: (C)

46. Which of the following statements most accurately describes the neural regulation of gastrointestinal function?
(A) Short reflexes are entirely contained within the enteric nervous system, whereas long reflexes involve the CNS.
(B) The myenteric plexus primarily regulates secretion, while the submucous plexus controls motility.
(C) The vagus nerve primarily inhibits digestive function by releasing norepinephrine onto enteric neurons.
(D) Sensory input from stretch receptors in the GI tract directly stimulates gastric acid secretion without central processing.
(E) The enteric nervous system requires central nervous system input to regulate peristalsis.
Ans: (A)

47. Which of the following correctly describes the absorption of carbohydrates in the small intestine?
(A) Glucose and galactose enter enterocytes via sodium-glucose cotransporters (SGLT1).
(B) Fructose is absorbed via active transport, requiring ATP.
(C) Lactose is directly absorbed across the brush border without enzymatic breakdown.
(D) Sucrose absorption requires luminal amylase activity.
(E) Cellulose is digested by human enzymes into monosaccharides for absorption.
Ans: (A)

48. Which of the following statements correctly explains the relationship between lipoproteins and cardiovascular disease risk?
(A) High-density lipoproteins (HDL) facilitate the transport of triglycerides from adipose tissue to the liver.
(B) Low-density lipoproteins (LDL) are responsible for cholesterol uptake by peripheral tissues, and an elevated LDL/HDL ratio is associated with an increased risk of atherosclerosis.
(C) Very-low-density lipoproteins (VLDL) transport dietary cholesterol to skeletal muscle for metabolism.
(D) Cholesterol homeostasis is primarily regulated by renal excretion rather than hepatic processing.
(E) Increased LDL uptake by hepatocytes is directly regulated by epinephrine binding to β-adrenergic receptors.

Ans: (B)

49. Which of the following most accurately describes a mechanism leading to autoimmune disease?
(A) Clonal expansion of autoreactive T cells in the absence of regulatory T cell inhibition.
(B) Failure of macrophages to recognize bacterial pathogens, leading to autoantibody production.
(C) Excessive activation of the complement system in response to allergens.
(D) Increased function of regulatory T cells that suppress immune responses to self-antigens.
(E) Overproduction of IgA antibodies that neutralize self-antigens.
Ans: (A)

50. Which mechanism does **NOT** contribute to genome evolution?
(A) gene duplication as a result of unequal crossover
(B) epigenetic modifications
(C) genetic mutations
(D) exon duplication and shuffling
(E) movement of transposons
Ans: (B)

51. Which of the following statement on the cellular metabolism is **INCORRECT**?
(A) The net energy yield from each glucose molecule via glycolysis is 2 ATP plus 2 NADH.
(B) The conversion of pyruvate to acetyl-CoA occurs in mitochondria.
(C) The conversion of pyruvate to acetyl-CoA yields one NADH.
(D) The net energy yield from one glucose molecule via citric acid cycle is 3 NADH, 1 $FADH_2$, plus 1 ATP.
(E) The production of ATP by ATP synthase is mediated by chemiosmosis.
Ans: (D)

52. Why your immune system responds faster and stronger to the exposure of a pathogen after you have been previously vaccinated against the same pathogen?
(A) The vaccine stays in the body permanently to fight the infection.
(B) Vaccine-primed memory cells respond quickly to the subsequent pathogen exposure.
(C) The vaccine makes the pathogen weaker over time.
(D) Your body produces antibodies continuously after vaccination.
(E) The pathogen mutates to become less harmful after vaccination.
Ans: (B)

53. Which of the following mechanisms does **NOT** play a significant role in regulating gastric acid secretion?
(A) Histamine binds to H_2 receptors on the parietal cells to enhance HCl secretion.
(B) Gastrin directly stimulates the Na^+/K^+-ATPase in parietal cells.
(C) Somatostatin inhibits acid secretion by suppressing gastrin release from G cells.
(D) Acetylcholine released from vagal efferents promotes acid secretion via M_3 receptors.
(E) Carbonic anhydrase in parietal cells facilitates acid secretion by generating protons.
Ans: (B)

54. Which of the following contributes to the high efficiency of gas exchange in fish gills?
(A) The high degree of oxygen saturation of water significantly contribute to high efficiency in gas exchange.
(B) The back-and-forth movement of water maximizes oxygen uptake.

(C) Very high blood pressure in the circulatory system of fishes contributes to high efficiency in gas exchange.
(D) The co-current exchange mechanism contributes highly to the gas exchange.
(E) The countercurrent exchange mechanism contributes highly to the gas exchange.
Ans: (E)

55. The transfers of motor, sensory, and cognitive information between the brain hemispheres is facilitated by _____, the major neural connection between the right and left hemispheres of the human brain.
(A) the basal nuclei
(B) the thalamus
(C) the reticular formation
(D) the corpus callosum
(E) the motor cortex
Ans: (D)

56. Why is Taq polymerase used in a polymerase chain reaction (PCR)?
(A) Taq polymerase has proofreading activity and thus makes fewer errors than other DNA polymerases.
(B) Unlike other DNA polymerases, Taq polymerase is heat stable and survives the 94 °C denaturation step in PCR.
(C) Unlike other DNA polymerases, Taq polymerase is not inhibited by dideoxy nucleotides.
(D) Unlike other DNA polymerases, Taq polymerase can produce DNA from an RNA template.
(E) Taq polymerase is more efficient than other DNA polymerases.
Ans: (B)

57. Which is the final step of blood clotting cascade before the formation of a network of fibers?
(A) The soluble plasma protein fibrin is converted to the insoluble protein prothrombin.
(B) The soluble plasma protein thrombin is converted to the insoluble protein fibrin.
(C) The soluble plasma protein fibrinogen is converted to the insoluble protein fibrin.
(D) The soluble plasma protein fibrinogen is converted to the insoluble protein thrombin.
(E) The soluble plasma protein prothrombin is converted to the insoluble protein thrombin.
Ans: (C)

58. Which of the following is the primary cause of the second heart sound (S2)?
(A) the closure of the atrioventricular (AV) valves at the beginning of systole
(B) the opening of the aortic and pulmonary valves during ventricular ejection
(C) the closure of the aortic and pulmonary valves at the beginning of diastole
(D) the rapid filling of the ventricles during early diastole
(E) the closing of the AV valves at the end of diastole
Ans: (C)

59. Which neurotransmitter is commonly associated with the reward system and pleasure sensations in the brain?
(A) acetylcholine
(B) serotonin
(C) GABA
(D) dopamine
(E) glutamate
Ans: (D)

60. Which of the following is the feature of the ascending portion of the loop of Henle?
(A) It is permeable to water and impermeable to sodium.
(B) It is permeable to water and permeable to sodium.
(C) It is impermeable to water and permeable to sodium.
(D) It is impermeable to water and impermeable to sodium.
(E) It is the site of active transport of water.
Ans: (C)

61. The structure of NAD+ does not include _____.
(A) a flavin nucleotide
(B) a pyrophosphate bond
(C) an adenine nucleotide
(D) nicotinamide
(E) two ribose residues
Ans: (A)

62. An integral membrane protein can be extracted with _____.
(A) a buffer of alkaline or acid pH
(B) a chelating agent that removes divalent cations
(C) a solution containing detergent
(D) a solution of high ionic strength
(E) hot water
Ans: (C)

63. Which of the following statements about a plot of V_0 vs. [S] for an enzyme that follows Michaelis-Menten kinetics is **false**?
(A) As [S] increases, the initial velocity of reaction V_0 also increases.
(B) At very high [S], the velocity curve becomes a horizontal line that intersects the y-axis at K_m.
(C) K_m is the [S] at which $V_0 = 1/2\ V_{max}$.
(D) The shape of the curve is a hyperbola.
(E) The y-axis is a rate term with units of μm/min.
Ans: (B)

64. The oxidation of 3 mol of glucose by the pentose phosphate pathway may result in the production of _____.
(A) 2 mol of pentose, 4 mol of NADPH, and 8 mol of CO_2
(B) 3 mol of pentose, 4 mol of NADPH, and 3 mol of CO_2
(C) 3 mol of pentose, 6 mol of NADPH, and 3 mol of CO_2
(D) 4 mol of pentose, 3 mol of NADPH, and 3 mol of CO_2
(E) 4 mol of pentose, 6 mol of NADPH, and 6 mol of CO_2
Ans: (C)

65. An enzyme-catalyzed reaction was carried out with the substrate concentration initially a thousand times greater than the K_m for that substrate. After 9 minutes, 1% of the substrate had been converted to product, and the amount of product formed in the reaction mixture was 12 μmol. If, in a separate experiment, one-third as much enzyme and twice as much substrate had been combined, how long would it take for the same amount (12 μmol) of product to be formed?
(A) 1.5 minutes
(B) 13.5 minutes

(C) 27 minutes
(D) 3 minutes
(E) 6 minutes
Ans: (C)

66. The double-reciprocal transformation of the Michaelis-Menten equation, also called the Lineweaver-Burk plot, is given by $1/V_0 = K_m/(V_{max}[S]) + 1/V_{max}$. To determine K_m from a double-reciprocal plot, you would _____.
(A) take the x-axis intercept where $V_0 = 1/2\ V_{max}$
(B) multiply the reciprocal of the x-axis intercept by −1
(C) multiply the reciprocal of the y-axis intercept by −1
(D) take the reciprocal of the x-axis intercept
(E) take the reciprocal of the y-axis intercept
Ans: (B)

67. The inner (plasma) membrane of *E. coli* is about 75% lipid and 25% protein by weight. How many molecules of membrane lipid are there for each molecule of protein? (Assume that the average protein is Mr 50,000 and the average lipid is 750.)
(A) 1　(B) 50　(C) 200　(D) 10,000　(E) 50,000
Ans: (C)

68. The specificity of signaling pathways includes all of the following **EXCEPT**:
(A) flippase-catalyzed movement of phospholipids from the inner to the outer leaflet.
(B) migration of signal proteins into membrane rafts.
(C) phosphorylation of target proteins at Ser, Thr, or Tyr residues.
(D) the ability to be switched off instantly by hydrolysis of a single phosphate-ester bond.
(E) the assembly of large multiprotein complexes.
Ans: (A)

69. During strenuous exercise, the NADH formed in the glyceraldehyde 3-phosphate dehydrogenase reaction in skeletal muscle must be reoxidized to NAD+ if glycolysis is to continue. The most important reaction involved in the reoxidation of NADH is _____.
(A) dihydroxyacetone phosphate → glycerol 3-phosphate
(B) glucose 6-phosphate → fructose 6-phosphate
(C) isocitrate → α-ketoglutarate
(D) oxaloacetate → malate
(E) pyruvate → lactate
Ans: (E)

70. The type of membrane transport that uses ion gradients as the energy source is _____.
(A) facilitated diffusion
(B) passive transport
(C) primary active transport
(D) secondary active transport
(E) simple diffusion
Ans: (D)

71. In the alcoholic fermentation of glucose by yeast, thiamine pyrophosphate is a coenzyme required by _____.

(A) aldolase
(B) hexokinase
(C) lactate dehydrogenase
(D) pyruvate decarboxylase
(E) transaldolase
Ans: (D)

72. Which of the following statements concerning signal transduction by the insulin receptor is **NOT** correct?
(A) Activation of the receptor protein kinase activity results in the activation of additional protein kinases.
(B) Binding of insulin to the receptor activates a protein kinase.
(C) Binding of insulin to the receptor results in a change in its quaternary structure.
(D) The receptor protein kinase activity is specific for tyrosine residues on the substrate proteins.
(E) The substrates of the receptor protein kinase activity are mainly proteins that regulate transcription.
Ans: (E)

73. A sequence of amino acids in a certain protein is found to be -Ser-Gly-Pro-Gly-. The sequence is most probably part of a(n) _____.
(A) antiparallel β sheet
(B) parallel β sheet
(C) α helix
(D) α sheet
(E) β turn
Ans: (E)

74. Which of the following statements regarding polysaccharides is correct?
I. Glycogen is more highly branched than amylopectin, with α(1→6) branch points occurring every 8-12 glucose residues.
II. Chitin is a linear homopolysaccharides of glucose connected by α(1→4) linkages.
III. The debranching enzyme in glycogenolysis has both transferase and glucosidase activity.
(A) I and II
(B) II and III
(C) I and III
(D) III only
(E) All of them are correct.
Ans: (C)

75. A newborn is diagnosed to have severe metabolic acidosis, ketosis, and hyperammonemia. Plasma amino acid analysis shows markedly elevated branched-chain amino acids. Which of the following statements is correct?
I. The primary defect is in the degradation of leucine, isoleucine, and valine.
II. The enzyme deficiency affects a complex that requires biotin as a cofactor.
III. Restriction of aromatic amino acids in the diet is the key step of treatment.
(A) I and II
(B) II and III
(C) I and III
(D) I only
(E) All of them are correct.

Ans: (D)

76. Steriod hormone response elements (HREs) are _____ , which, when bound to _____, alter gene expession at the level of _____.
(A) intron sequences; activated hormone receptor; translation
(B) nuclear proteins; hormone; transcription
(C) plasma membrane proteins; hormone; transcription
(D) sequences in DNA; receptor-hormone complex; replication
(E) sequences in DNA; receptor-hormone complex; transcription
Ans: (E)

77. The synthesis of both glycerophospholipids and triacylglycerols involves _____.
(A) serine
(B) phosphatidylethanolamine
(C) phosphatidic acid
(D) phosphocholine
(E) phosphatidic acid phosphatase
Ans: (C)

78. Which of the following factors contribute to increasing the melting point of a fatty acid?
(A) introducing cis-double bonds
(B) adding methylene groups
(C) introducing trans-double bonds
(D) increased number of double bonds
(E) increased fatty acid chain length
Ans: (E)

79. Which of the following statements about the synthesis of Δ^3-isopentenyl pyrophosphate (IPP) from acetate is **NOT** true?
(A) Biotin is required.
(B) Carbon dioxide is liberated.
(C) ATP is consumed.
(D) Mevalonate is an intermediate.
(E) NADPH is the electron donor.
Ans: (A)

80. Which cofactor is required for all transaminase (aminotransferase) reactions?
(A) thiamine pyrophosphate (B) pyridoxal phosphate (C) biotin
(D) folic acid (E) lipoic acid
Ans: (B)

81. Which one of the following statements about β-oxidation is true?
(A) The pathway helps to generate energy and acetyl-CoA from malonyl-CoA.
(B) The pathway produces NADPH and NADH as products.
(C) The pathway is highly activated in all tissues when glucose is available.
(D) The rate-limiting step depends on fatty acyl-CoA entering the mitochondria.
(E) All reactions in the pathway could also be used in the biosynthesis of fatty acid.
Ans: (D)

82. The component of both glycerophospholipids and sphingolipids involves _____.
(A) saturated fatty alcohol
(B) phosphatidic acid phosphatase
(C) phosphoethanolamine
(D) phosphocholine
(E) mixed-function oxidase
Ans: (D)

83. Sterol regulatory element-binding protein (SREBP) controls the gene expression of cholesterol biosynthesis. What happens when there is the presence of a high cellular concentration of cholesterol?
(A) It increases the proteolytic cleavage and releases SREBP into the nucleus.
(B) SREBP is hold in the Golgi apparatus in a complex with SREBP-cleavage-activating protein (SCAP) to produce a regulatory domain fragment.
(C) It activates SREBP by inducing the conformational change for cholesterol biosynthesis.
(D) It stabilizes the SCAP-SREBP complex by the anchoring of insulin-induced gene protein (Insig).
(E) SREBP acts as a corepressor of RXR-LXR dimer to terminate the gene expression of cholesterol biosynthesis.
Ans: (D)

84. Histones contain large amounts of which of the following amino acids?
(A) leucine (B) lysine (C) glutamic acid (D) histidine (E) tryptophan
Ans: (B)

85. Release of succinate from succinyl-CoA can be coupled to GTP synthesis because:
(A) Coenzyme A is a "high energy" compound, just like GTP.
(B) The link between succinate and CoA involves an acid anhydride to phosphate.
(C) The thioester bond between succinate and CoA has a large $-\Delta G$ of hydrolysis.
(D) The amide bond between succinate and CoA has a large $-\Delta G$ of hydrolysis.
(E) None of the above.
Ans: (C)

86. Gout is caused by high levels of uric acid. What are the possible causes?
(A) G-6-phosphatase deficiency
(B) PRPP mutation
(C) HGPRT deficiency
(D) all of the above
(E) none of the above
Ans: (D)

87. The final reduced species in the electron transport chain is _____.
(A) O_2 (B) H_2O (C) coenzyme Q (D) cytochrome c (E) none of the above
Ans: (B)

88. Which of the following statements concerning β-oxidation of fatty acids is **false**?
(A) Initiation occurs at the methyl end of the fatty acid.
(B) β-oxidation is the primary route for degradation of fatty acids.
(C) β-oxidation takes place in the mitochondrial matrix.
(D) Two-carbon units are successively eliminated with each round.
(E) None of the above.
Ans: (A)

89. Many antibiotics, especially for viruses and cancer therapy involve inhibition of folic acid reactions, especially because folic acid is essential for _____.
(A) synthesis of many amino acids
(B) conversion of uracil to thymine for DNA synthesis
(C) synthesis of deoxyribose for DNA synthesis
(D) All of these reactions above are reasons why inhibitors of folic acid act as antibiotics.
(E) None of these reactions explains the reason why inhibitors of folic acid act as antibiotics.
Ans: (B)

90. Individuals with diets high in coconut oil consume large amounts of lauric (12:0). What are the β-oxidation products of lauric acid?
(A) 6 acetyl-CoA, 6 NADH, 6 $FADH_2$
(B) 6 acetyl-CoA, 6 NADH, 5 $FADH_2$
(C) 6 acetyl-CoA, 5 NADH, 5 $FADH_2$
(D) 6 acetyl-CoA, 5 NADH, 6 $FADH_2$
(E) none of the above
Ans: (C)

國立中山大學 114 學年度學士後醫學系招生考試試題答案疑義釋疑公告

科目	題號	釋疑答覆	釋疑結果
普通生物及生化概論	16	In the urea cycle, the nitrogen atoms in urea come from two sources: ammonia and aspartate. Aspartate donates one nitrogen atom by reacting with citrulline to form argininosuccinate catalyzed by argininosuccinate synthetase. It is therefore that aspartate directly contributes one nitrogen atom to urea synthesis. (Ref: Lehninger Principles of Biochemistry 8th Ed. p.634-635)	維持原公布答案(D)
	19	I. High levels of insulin stimulate ketogenesis by increasing acetyl-CoA availability. This is incorrect. High insulin levels promote the storage of fat, thus inhibiting fatty acid oxidation and ketone body production. It is therefore that insulin inhibits ketogenesis. (Ref: Lehninger Principles of Biochemistry 8th Ed. p.859-860) II. The liver lacks β-ketoacyl-CoA transferase, preventing ketone body utilization. This is correct. The liver lacks β-ketoacyl-CoA transferase, which is required for the utilization of ketone bodies as fuels. It is therefore that liver is a producer of ketone bodies. (Ref: Lehninger Principles of Biochemistry 8th Ed. p.619-620) III. Glucagon promotes ketogenesis by enhancing fatty acid oxidation. This is correct. Glucagon promotes ketogenesis by stimulating the breakdown of stored fat and enhancing fatty acid oxidation. The increased availability of acetyl-CoA from fatty acid oxidation leads to the production of ketone bodies in the liver. (Ref: Lehninger Principles of Biochemistry 8th Ed. p.862-863)	維持原公布答案(B)
	63	(B) is the best answer. At very high [S], the velocity curve does become a horizontal line, but it intersects the y-axis at ***V*max**, not *K*m. (E) is a valid answer due to a typographical error of the unit. The y-axis is a rate term with units of **μM/min**, not μm/min.	答案更改為(B)或(E)皆可
	70	Facilitated diffusion allows molecules like glucose or ions to move passively through a membrane **without** requiring an ion gradient for energy. In contrast, secondary active transport **requires an ion gradient** created by primary active transport (e.g., the sodium-potassium pump) to drive the movement of molecules **against** their concentration gradient.	維持原公布答案(D)
	86	選項(B)應為 PRPP synthetase mutation	答案更改為(A)或(C)皆可
	87	“reduced species”根據一般化學定義為”還原態物質”。有氧呼吸電子傳遞鏈中，氧氣為最後電子的接受者，而水為最後還原態物質。	維持原公布答案(B)

國立中山大學114學年度學士後醫學系招生考試試題答案疑義釋疑公告

科目	題號	釋疑答覆	釋疑結果
普通生物及生化概論	89	folic acid 對於許多胺基酸的生合成並不是必需的，且 Met 為必需胺基酸，動物體內無法進行合成，而 Gly 及 Ser 皆可由其他來源得到，並不會因為缺乏 folic acid 而導致可抑制癌細胞或病毒生存。另外，ribonucleotide reductase 對於 deoxyribose 生成的反應才是必需的酵素。因此，由於 folic acid 對於 conversion of dUMP to dTMP (即 conversion of uracil to thymine)是必需且重要的，若缺乏則癌細胞及病毒之 DNA 合成將會出問題。	維持原公布答案(B)

生化概論

莊老師(施政安) 提供

A. 114 年度中山後西醫試題命中事實

題號	講　　義	總復習	實戰解析
7	4-93 (urea)	p18	-
8	6-113, 166 (apoptosis);	p3	-
	BAND 7/2/2025 公告		
10	BAND 5/3/2025 公告 (nuclear receptor)	-	-
11	2-144 (competitive inhibitor)	p20	-
14	爭議	-	-
15	5-116 (2^0 messenger);	p.36	T3-23
	BAND 1/3/2025 公告		
16	4-106 (urea cycle) (爭議)	p48	-
17	4-39 (ETC)	-	T2-38
18	4-146 (G → X)	p6	-
19	4-206 (glucagon) (爭議)	-	-
20	4-63 (oligomycin);	p34	T2-44
	BAND 3/3/2025 公告		
21	4-251 (HMG-CoA reductase)	-	-
22	2-111; 3-165 (allosteric enzyme)	p2	T1-38
23	3-172 (fates of pyruvate)	-	-
24	3-225 (G6Pase)	p23, 52	-
25	3-4 (base structure)	-	-

26	3-131 (phospholipase)	-	-
27	6-247 (restriction enzyme)	-	-

題號	講　　義	總復習	實戰解析
28	1-239 (stabilized force)	-	-
30	3-161; 4-190 (FA activation)	-	-
48	4-293 (lipoprotein)	-	-
50	BAND 6/3/2025 公告	p8	-
51	4-68 (TCA cycle)	p30	-
56	6-239 (PCR)	p41	-
61	5-12 (NAD^+)	p14	-
62	5-81 (detergent); BAND 14/3/2025 公告	p56	-
63	2-138	-	-
64	3-243 (PPP)	-	-
65	2-205 (kinetics)	-	-
66	2-135 (Lineweaver-Burk plot))	-	-
67	none		
68	5-84 (flippase); BAND 4/3/2025 公告	-	-
69	3-175 (lactic fermentation)	p8	-
70	5-91 (secondary active transport)	-	-
71	4-14; 5-17 (pyruvate decarboxylase(	-	-
72	5-125 (insulin);	p.55	-

BAND 24/2/2025 公告

73	1-319 (β-turn)	-	T1-13 (100%)

題號	講　　義	總復習	實戰解析
74	3-78 (carbohydrate)	-	T2-18
75	4-125 (BCAA)	-	-
76	5-118 ; 6-211 (nuclear receptor)	-	-
77	4-275 (phsphophatidate);	-	-
	BAND 27/2/2025 公告		
78	3-122; 5-73 (T_m of fatty acid)	-	-
79	4-252, 253 (cholesterol biosynthesis);	-	-
	BAND 9/1/2025 公告		
80	4-97; 5-15 (PLP);	p22	T3-35
81	4-213 (β-oxidation)	-	-
82	3-97 (choline in lipid)	-	-
83	4-283 (SREBP);	-	-
	BAND 8/1/2025 公告		
84	1-51; 3-21 (histone)	-	T1-12 (100%)
85	3-149, 250 (succinyl-CoA)	-	-
86	4-172 (gout) (爭議)	p32	-
87	4-59 (ETC)	-	-
88	4-194 (β-oxidation)	-	-
89	5-175,176, 177 (folate)	p35	-
90	4-190 (β-oxidation)	p30	-

(註: ***符號含義***: 4-39 = 第四回講義第 39 頁; p25 = 總復習講義第 25 頁;

T1-7 = 實戰解析試題 Test one/第 7 題; T2-33 = 實戰解析試題

Test two/第 33 題; T3-2 = 實戰解析試題 Test three/第 2 題)

B. 114 年度中山後西醫試題爭議題分析

18) 本題未表明答案內之敘述是要有電子傳遞次序故**(A)(B)(D)皆可選**

(含 FeS cluster 有 complex I, II, III: (A) in complex III; (B)/FADH2 to CoQ 經 complex II; (D)/NADH to CoQ 經 complex I)

23) a. Fatty acid, Glucose and Amino acid 皆可產生 Acetyl-CoA

b. The oxaloacetate can derive from pyruvate, alanine, serine, threonine, tryptophan and cysteine.

c. 本題**無解或(E) none of the above**

41) 本題未表明答案內之敘述是一次性或完整性反應: 基本

Oxidative phosphorylation 一次性反應是 NADH → 2.5ATP or FADH2→ 1.5ATP 皆比 (A) (C) (D) 少 故**應送分**

42) hydrogen ≠ proton: 故**應無解 (送分)**

生物學

張劍鴻(張芸潔) 提供

中山大學 學士後醫 生物學 考題分析

課程大綱	114 中山	113 中山	112 中山	111 中山	中山(%)
Unit 1 細胞生物學	6	4	9	2	9
Unit 2 動物生理學	31	27	24	9	40
Unit 3 巨分子及生物化學	10	7	12	1	13
Unit 4 分子生物學	6	5	10	10	14
Unit 5 DNA生物科技	3	1	4	2	4
Unit 6 微生物免疫	4	6	5	5	9
Unit 7 植物學	0	0	2	9	5
Unit 8 演化學	0	0	4	6	4
Unit 9 生態學	0	0	0	1	0
總計	60	50	70	45	100