

國立中山大學 112 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)

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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. _____ refer to the aggregates of rough endoplasmic reticulum (rER) and polysomes that confer the cytological hallmark of neurons revealed by the conventional staining.
 - (A) Wallerian stumps
 - (B) Cajal masses
 - (C) Nissl bodies
 - (D) Leeuwenhoek processes
 - (E) Schwann recesses
 Ans: (C)
2. Collections of neuronal cell bodies in the central nervous system are called:
 - (A) Ganglia
 - (B) Neuroglia
 - (C) Nodes
 - (D) Nuclei
 - (E) White matter
 Ans: (D)
3. _____ connect the intermediate filament system of two adjacent epithelial cells.
 - (A) Adherent junctions
 - (B) Desmosomes
 - (C) Occluding junctions
 - (D) Gap junction
 - (E) Focal contacts
 Ans: (B)
4. What will happen when you trigger an action potential at each end of a very long axon?
 - (A) Both action potentials will continue their transmissions to their respective distal ends.
 - (B) The action potential starts close to the soma will transmit to the other end.
 - (C) The action potential starts far away from the soma will transmit to the other end.
 - (D) Two action potentials will merge into one action potential that subsequently transmits to the axon terminal in a larger amplitude.
 - (E) Two action potentials will cancel each other around the middle of this axon.
 Ans: (E)
5. Diapedesis occurs at:
 - (A) vasa vasorum
 - (B) arteries
 - (C) capillaries
 - (D) postcapillary venules
 - (E) inferior vena cava
 Ans: (D)
6. Oxygen crosses a plasma membrane by
 - (A) osmosis.
 - (B) active transport.
 - (C) pinocytosis.

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- (D) passive transport.
 (E) receptor mediated endocytosis.
 Ans: (D)

7. _____ helps the maintenance of membrane fluidity of animal cells in cold environments.

- (A) PIP2
 (B) Glycerol
 (C) Cholesterol
 (D) Phospholipid
 (E) Fibronectin
 Ans: (C)

8. Which of the following is not the derivatives of mesoderm in vertebrates?

- (A) Skeletal systems
 (B) Circulation and lymphatic systems
 (C) Dermis of skin
 (D) Adrenal cortex
 (E) Thymus
 Ans: (E)

9. The destination of ubiquitinated proteins in cytosol is _____.

- (A) lysosome
 (B) autophagosome
 (C) proteosome
 (D) spliceosome
 (E) peroxisome
 Ans: (C)

10. Which of the following genotypes due to nondisjunction of sex chromosomes is lethal?

- (A) XXX
 (B) OY
 (C) XXY
 (D) XO
 (E) None of the above
 Ans: (B)

11. What do hagfishes and lampreys have in common with the extinct conodonts?

- (A) Lungs
 (B) The jawless condition
 (C) Bony vertebrae
 (D) Their mode of feeding
 (E) Swim bladders
 Ans: (B)

12. A polymerase chain reaction must have:

- | | | |
|-----------------|-------------------|---------------------|
| I. DNA template | II. DNA primers | III. RNA polymerase |
| IV. dNTPs | V. DNA polymerase | VI. RNA primers |
- (A) I, II, III, IV
 (B) I, II, IV, V
 (C) I, III, IV, VI

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- (D) I, II, V
 (E) I, IV, V, VI
 Ans: (B)

13. The major inhibitory neurotransmitter of the human brain is _____.

- (A) acetylcholine
 (B) epinephrine
 (C) endorphin
 (D) nitric oxide
 (E) GABA

Ans: (E)

14. What do fungi and arthropods have in common?

- (A) Both groups are commonly coenocytic.
 (B) The haploid state is dominant in both groups.
 (C) Both groups are predominantly heterotrophs that ingest their food.
 (D) The protective coats of both groups are made of chitin.
 (E) Both groups have cell walls.

Ans: (D)

15. Short-term memory information processing usually causes changes in the

- (A) brainstem.
 (B) medulla.
 (C) hypothalamus.
 (D) hippocampus.
 (E) cranial nerves.

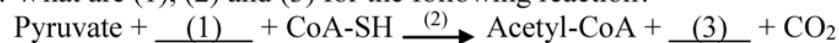
Ans: (D)

16. The cyclic adenosine monophosphate (cAMP) is synthesized by _____, and it is degraded by _____.

- (A) adenylate cyclase; phosphodiesterases
 (B) phosphodiesterases; adenylate cyclase
 (C) adenylate cyclase; phosphoesterases
 (D) phosphoesterases; adenylate cyclase
 (E) None of the above is correct

Ans: (A)

17. What are (1), (2) and (3) for the following reaction?



- (A) NADH, pyruvate decarboxylase, NAD^+
 (B) NADH, pruvate dehydrogenase, NAD^+
 (C) NAD^+ , pyruvate decarboxylase, NADH
 (D) NAD^+ , pruvate dehydrogenase, NADH
 (E) None of the above is correct

Ans: (D)

18. Each round of the Tricarboxylic Acid Cycle (TCA cycle) produces _____.

- (1) two molecules of carbon dioxide
 (2) one molecule of ATP
 (3) two molecules of NADH

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- (4) one molecule of FADH_2
 (A) (1) and (2)
 (B) (2) and (3)
 (C) (1) and (4)
 (D) (3) and (4)
 (E) All of the above are correct
 Ans: (C)

19. Which of the following molecule can cross cell membranes freely?

- (A) Carbon dioxide
 (B) Na^+
 (C) K^+
 (D) All of the above
 (E) None of the above
 Ans: (A)

20. The allosteric enzyme PFK-1 (Phosphofructokinase-1) catalyzes the committed step of glycolysis. Which of the following statements about PFK-1 is correct?

- (A) It is inhibited by ADP and stimulated by AMP.
 (B) It is inhibited by high pH.
 (C) It is stimulated by citrate.
 (D) It is stimulated by insulin but is inhibited by epinephrine in muscle cells.
 (E) It is stimulated by insulin and inhibited by glucagon in liver cells.
 Ans: (E)

21. Which of the following pairs of amino acids could form a charge-charge interaction through their R-groups (side chains)?

- (A) serine and glutamic acid
 (B) glutamine and lysine
 (C) methionine and histidine
 (D) lysine and arginine
 (E) aspartic acid and lysine
 Ans: (E)

22. NADPH is synthesized mainly in which of the following pathways?

- (A) Glycolysis
 (B) Pentose Phosphate Pathway
 (C) TCA cycle
 (D) Urea cycle
 (E) Gluconeogenesis
 Ans: (B)

23. The isoelectric point of tyrosine is _____. ($\text{pK}_1 = 2.2$; $\text{pK}_2 = 9.11$; $\text{pK}_a = 10.07$ of the side chain)

- (A) 5.66
 (B) 6.135
 (C) 7.126
 (D) 9.11
 (E) 9.59
 Ans: (A)

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24. The disease gout is a disease of the joints, usually in males, caused by an elevated concentration of _____ in the blood and tissues.
 (A) heme
 (B) xanthine
 (C) hypoxanthine
 (D) uric acid
 (E) inosine
 Ans: (D)
25. Which of the following amino acids does not belong to glucogenic amino acid?
 (A) Ala
 (B) Arg
 (C) Cys
 (D) Glu
 (E) Leu
 Ans: (E)
26. Which is not an enzyme required for glycolysis?
 (A) Hexokinase
 (B) Phosphofructokinase
 (C) Triosephosphate isomerase
 (D) Cyclin-dependent kinase
 (E) Pyruvate kinase
 Ans: (D)
27. Which of the following is not a post-translational modification of a protein?
 (A) Methylation
 (B) Phosphorylation
 (C) Alternative splicing
 (D) Disulfide bond
 (E) Acetylation
 Ans: (C)
28. Lecithin is composed of _____.
 (A) Glycerol + Fatty acid + Phosphoric acid + Serine
 (B) Glycerol + Fatty acid + Phosphoric acid + Ethanolamine
 (C) Glycerol + Fatty acid + Phosphoric acid + Betaine
 (D) Glycerol + Fatty acid + Phosphoric acid + Choline
 (E) None of the above
 Ans: (D)
29. Amino acid residues which are predominantly involved in the protein-DNA interaction are _____.
 (A) positively charged
 (B) negatively charged
 (C) proline
 (D) alanine
 (E) glycine
 Ans: (A)
30. What are bile salts?

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- (A) Charged phospholipid
 - (B) Esterified cholesterol
 - (C) Hydrolyzed forms of triacylglycerol
 - (D) Amphipathic cholesterol analogs with detergent properties
 - (E) All of the above
- Ans: (D)

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. Where are the aged red blood cells captured and recycled in healthy adults?
- (A) Periarterial lymphoid sheath (PALS)
 - (B) Splenic sinusoids
 - (C) Bone marrow
 - (D) Kidney
 - (E) Splenic white pulp
- Ans: (B)
32. The _____ provides the luminal lining of large-diameter conducting airway.
- (A) ciliated stratified cuboidal epithelium
 - (B) simple columnar epithelium
 - (C) stratified squamous epithelium
 - (D) ciliated pseudostratified columnar epithelium
 - (E) transitional epithelium
- Ans: (D)
33. Which of the following is absent from the wall of small-diameter (~ 1 mm) bronchioles?
- (A) Epithelium
 - (B) Cartilage
 - (C) Smooth muscle
 - (D) Blood vessels
 - (E) Elastic fiber
- Ans: (B)
34. What is the general sequential steps of human urine production?
- (A) Filtration → secretion → reabsorption → excretion
 - (B) Secretion → filtration → reabsorption → excretion
 - (C) Secretion → reabsorption → filtration → excretion
 - (D) Filtration → reabsorption → secretion → excretion
 - (E) Filtration → excretion → secretion → reabsorption
- Ans: (D)
35. The sudden surge of _____ a few hours before ovulation changes the enzymatic activities of theca externa cells and alters the tunica albuginea on the Graafian follicle, leading to the eventual ovulation.
- (A) FSH
 - (B) inhibin
 - (C) estradiol
 - (D) LH

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(E) testosterone

Ans: (D)

36. Forward left heart failure will cause which of the following?

- (A) Reduced cardiac output
- (B) Pulmonary edema
- (C) Reduced urine output
- (D) Edema at lower limbs
- (E) All of the above

Ans: (E)

37. When you accidentally drip-infused an additional 250 mL of normal saline to a healthy individual, his body removed the additional fluid via the activation of:

- (A) Atrial natriuretic peptide system
- (B) Renin-angiotensin-aldosterone system
- (C) Antidiuretic hormone system
- (D) Sympathetic system
- (E) None of the above

Ans: (A)

38. After stabilizing this patient via the emergency trauma surgeries, which of the following in this patient could be expected in the next 24-48 hours?

- (A) Increase in basophil percentage beyond 5%
- (B) Increase in eosinophil percentage beyond 10%
- (C) Increase in reticulocytes percentage beyond 3.5%
- (D) Megakaryocytes would be detected in the peripheral blood
- (E) Macrophages could be detected in the peripheral blood

Ans: (C)

39. After the emergency surgeries, the plasma potassium level of this patient appeared slightly higher than the normal level of 5.5 mEq/L. What might this patient experience most noticeably?

- (A) Muscle weakness
- (B) Tachycardia
- (C) Bradycardia
- (D) Diarrhea
- (E) GERD

Ans: (B)

40. A man fell from a 1.5 m high platform and bumped the right side of his head directly against the concrete floor. Shortly after the incident, he appeared confused, unsure of his location, time of the day, and the events leading to his fall. He also complained about headaches on his right side. The horizontal CT scan of his head showed a lens-shaped radiopaque inside the right temporal cranium. This patient likely suffered from:

- (A) skin abrasion
- (B) subcutaneous bruises
- (C) epidural hematoma
- (D) subdural hematoma
- (E) subarachnoid hemorrhage

Ans: (C)

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41. Which of the following statements about MHC I proteins is true?
 (A) They are found primarily on immune system cells.
 (B) They protect a developing fetus from the immune system of mother.
 (C) They are found on the surface of most mammalian cells.
 (D) They are antibodies.
 (E) All of the above are true.
 Ans: (C)
42. Which of the following is the visual evidence of genetic recombination during meiosis?
 (A) Centromeres
 (B) Synaptonemal complexes
 (C) Chiasmata
 (D) Secondary constrictions
 (E) Mitotic spindle
 Ans: (C)
43. Mammals are homeostatic for all of the following EXCEPT
 (A) Body temperature
 (B) Blood glucose concentration
 (C) Blood pH
 (D) Metabolic rate
 (E) Blood calcium concentration
 Ans: (D)
44. Which of the following is true for the phenomenon of “epistasis” in genetics?
 (A) It is a type of gene interaction in which the phenotype expression of one gene alters that of another independently inherited gene.
 (B) It is the inheritance of traits transmitted by mechanisms that do not involve the nucleotide sequence.
 (C) It only occurs in mammals.
 (D) It is the mechanism for the inheritance of organelles.
 (E) It controls the early development of *Drosophila*.
 Ans: (A)
45. The nontemplate strand of a portion of a gene reads: 5'-TTCAGTGGTTCA. What is the sequence of the resulting transcript (RNA) for this portion?
 (A) 5'-AAGUGACCAAGU
 (B) 5'-UGAACCAGUGAA
 (C) 5'-UUCACUGGUUCA
 (D) 5'-ACUUGGUCACUU
 (E) 5'-TGAACCAAGTGAA
 Ans: (C)
46. During protein synthesis, which of the following proteins interacts via its *N*-terminal sequence with the signal recognition particle (SRP)?
 (A) Nuclear matrix protein
 (B) Lysosomal protein
 (C) Ribosomal protein
 (D) Mitochondrial protein
 (E) Chloroplast protein

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Ans: (B)

47. The main function of the atrioventricular (A-V) node is to

- (A) initiate the heartbeat.
- (B) set the rhythm of the heartbeat.
- (C) relay the signal for the heart to contract from the left ventricle to the left atrium.
- (D) relay a signal for the ventricles to contract.
- (E) detect the vibration of heart.

Ans: (D)

48. Which of the following statements about fungi is true?

- I. They are eukaryotic.
- II. They all have rigid cell walls.
- III. Most are filamentous.
- IV. Some are photosynthetic.
- V. They are capable of only asexual reproduction.

- (A) I, II, V
- (B) I, II, III
- (C) I, II, IV
- (D) I, II, IV, V
- (E) I, II, III, IV

Ans: (B)

49. Which of the following is present in double-stranded cDNA but absent in the corresponding genomic DNA of eukaryotic cells?

- (A) Promoter sequences
- (B) A homopolymeric sequence of A:T base pairs
- (C) Intron sequences
- (D) 5' and 3' UTRs
- (E) Exon sequences

Ans: (B)

50. Which of the followings are the RNA-protein complex:

- I. Ribosome II. Nucleosome III. Lysosome IV. Spliceosome V. Telomerase

- (A) I, II, IV
- (B) I, II, III, IV
- (C) I, III, IV, V
- (D) I, IV, V
- (E) I, II, III, IV, V

Ans: (D)

51. Which of the following is incorrect for the function of glia in the CNS of adult vertebrates?

- (A) Ependymal cells help form the blood-brain barrier.
- (B) Astrocytes can act as stem cells.
- (C) Oligodendrocytes myelinate axons in the CNS.
- (D) Microglia are immune cells in the CNS.
- (E) Astrocytes promote blood flow to neurons.

Ans: (A)

52. Which plant hormone is incorrectly paired with its function?

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- (A) Auxin - promotes stem growth through cell elongation
 - (B) Cytokinins - initiate programmed cell death
 - (C) Gibberellins - stimulate seed germination
 - (D) Absciscic acid - promotes seed dormancy
 - (E) Ethylene - inhibits cell elongation
- Ans: (B)

53. Which of the following vitamins is correctly associated with its use?

- (A) Vitamin C - curing rickets
- (B) Vitamin A - incorporated into the visual pigment of the eye
- (C) Vitamin D - calcium removal from bone
- (D) Vitamin E - protection of skin from cancer
- (E) Vitamin K - production of white blood cells

Ans: (B)

54. The MHC (Major Histocompatibility Complex) is important in a T cell's ability to _____.

- (A) distinguish self from nonself
- (B) recognize specific parasitic pathogens
- (C) identify specific bacterial pathogens
- (D) identify specific viruses
- (E) recognize differences among types of cancer

Ans: (A)

55. Which combination of hormones helps a mother to produce milk and nurse her baby?

- (A) Prolactin and calcitonin
- (B) Oxytocin and prolactin
- (C) Follicle-stimulating hormone and luteinizing hormone
- (D) Luteinizing hormone and oxytocin
- (E) Oxytocin, prolactin, and luteinizing hormone

Ans: (B)

56. Dog breeders maintain the purity of breeds by keeping dogs of different breeds apart when they are fertile. This kind of isolation is most similar to which of the following reproductive isolating mechanisms?

- (A) Reduced hybrid fertility
- (B) Hybrid breakdown
- (C) Mechanical isolation
- (D) Habitat isolation
- (E) Gametic isolation

Ans: (D)

57. Photosynthesis ceases when leaves wilt, mainly because _____.

- (A) the chlorophyll of wilting leaves breaks down
- (B) flaccid mesophyll cells are incapable of photosynthesis
- (C) stomata close, preventing CO₂ from entering the leaf
- (D) photolysis, the water-splitting step of photosynthesis, cannot occur when there is a water deficiency
- (E) accumulation of CO₂ in the leaf inhibits enzymes

Ans: (C)

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58. Which of the following pathways is most likely taken by newly synthesized histones?
 (A) Rough endoplasmic reticulum → Golgi complex → secretory vesicle
 (B) Rough endoplasmic reticulum → Golgi complex → nucleus
 (C) Rough endoplasmic reticulum → smooth endoplasmic reticulum → nucleus
 (D) Cytoplasm → nucleus
 (E) Cytoplasm → rough endoplasmic reticulum → Golgi complex → nucleus
 Ans: (D)
59. In the communication link between a motor neuron and a skeletal muscle, which of the following descriptions is right?
 (A) The motor neuron is considered the presynaptic cell and the skeletal muscle is the postsynaptic cell.
 (B) The motor neuron is considered the postsynaptic cell and the skeletal muscle is the presynaptic cell.
 (C) Action potentials are possible on the motor neuron but not the skeletal muscle.
 (D) Action potentials are possible on the skeletal muscle but not the motor neuron.
 (E) The motor neuron fires action potentials but the skeletal muscle is not electrochemically excitable.
 Ans: (A)
60. In nerves, vesicles can move the length of an axon at a rate that far exceeds that which would be predicted for simple diffusion. Which of the following models best explains vesicular movement in these cells?
 (A) Depolymerization of actin microfilaments attached to vesicles pulls the vesicles toward the site of depolymerization.
 (B) Vesicles are propelled by fluid movement generated by changes in osmotic potential within the cells.
 (C) Vesicles are moved by alternate contraction and relaxation of actin-myosin "muscle" complexes.
 (D) Vesicles, by virtue of their net negative charge, are attracted to positively charged regions of the cell.
 (E) Vesicles are attached to the protein kinesin, which slides along microtubules by an ATP dependent process.
 Ans: (E)
61. Which kinds of the following nucleic acid can form viral genome?
 (1) double-stranded DNA
 (2) single-stranded DNA
 (3) single-stranded RNA
 (A) (1) only
 (B) (1) and (2)
 (C) (1) and (3)
 (D) None of the above is correct
 (E) All of the above are correct
 Ans: (E)
62. Retroviral vectors are more popular for somatic gene therapy than other viral vectors because:
 (A) They replicate faster than most other viruses.
 (B) They contain several copies of their DNA genome in the virus particle.
 (C) They can integrate themselves into the host cell DNA.
 (D) Their replication is more accurate than that of most other viruses.
 (E) Their DNA has extensive sequence homology with normal cellular DNA.

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Ans: (C)

63. cAMP regulates the transcription of many genes. What is the major mechanism for this action?

- (A) It induces the phosphorylation of transcription factors.
- (B) It binds directly to cAMP response elements in promoters and enhancers.
- (C) It mediates this effect by increasing the calcium concentration in the cytoplasm and the nucleus.
- (D) It binds directly to nuclear transcription factors.
- (E) It induces the phosphorylation of STAT proteins, thus enabling them to translocate into the nucleus.

Ans: (A)

64. Which of the following statements regarding circulating immunoglobulins is correct?

- (1) They are produced by B-cell-derived plasma cells.
 - (2) Their diversity is generated by gene rearrangements in the developing B cells.
 - (3) Each immunoglobulin producing cell generates only one kind of immunoglobulins.
- (A) (1) and (2)
 - (B) (1) and (3)
 - (C) (2) and (3)
 - (D) None of the above is correct
 - (E) All of the above are correct

Ans: (E)

65. During long-term fasting, the liver produces acetyl-CoA by the β -oxidation of fatty acids. What is the major metabolic fate of this acetyl-CoA?

- (A) Fatty acid biosynthesis
- (B) Gluconeogenesis
- (C) Amino acid biosynthesis
- (D) Ketogenesis
- (E) Oxidation in the TCA cycle

Ans: (D)

66. On a high-carbohydrate, low-fat diet, carbohydrates are converted into fat through a series of reactions listed below. What is the correct sequence of these reactions?

- (1) esterification
- (2) glycolysis
- (3) fatty acid biosynthesis

- (A) (1), (2), (3)
- (B) (1), (3), (2)
- (C) (2), (3), (1)
- (D) (2), (1), (3)
- (E) (3), (2), (1)

Ans: (C)

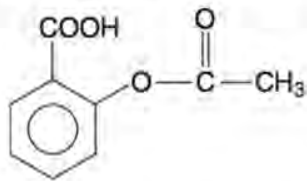
67. The molecule shown here is acetylsalicylic acid (aspirin). What kind of electrical charge does aspirin carry in the stomach at a pH value of 2 and in the small intestine at a pH value of 7?

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- (A) Negatively charged in the stomach; positively charged in the intestine
 (B) Negatively charged both in the stomach and the intestine
 (C) Uncharged in the stomach; negatively charged in the intestine
 (D) Uncharged both in the stomach and the intestine
 (E) Uncharged in the stomach; positively charged in the intestine

Ans: (C)

68. The brain produces most of its energy by the oxidation of glucose; during long-term fasting, however, it can cover more than half of its energy needs from _____.

- (A) anaerobic glycolysis
 (B) oxidation of its stored glycogen
 (C) oxidation of free fatty acids
 (D) oxidation of amino acids
 (E) oxidation of ketone bodies

Ans: (E)

69. Which of the following reactions is not the reversible reaction in glycolysis?

- (A) Glucose 6-phosphate to fructose 6-phosphate
 (B) Fructose 6-phosphate to fructose 1,6-bisphosphate
 (C) Glyceraldehyde 3-phosphate to 1,3-bisphosphoglycerate
 (D) 3-Phosphoglycerate to 2-phosphoglycerate
 (E) 2-Phosphoglycerate to phosphoenolpyruvate

Ans: (B)

70. Which amino acid is the common donor for methyl transfer?

- (A) Met
 (B) Ala
 (C) Gly
 (D) Ser
 (E) Lys

Ans: (A)

71. Which of the following best describes the metabolic outcome of glycolysis for the degradation of glucose?

- (A) 2 Pyruvate, 4 ATP, 4 NADH
 (B) 2 Pyruvate, 2 ATP, 2 NADH
 (C) 2 Pyruvate, 4 ATP, 2 NADH
 (D) 4 Pyruvate, 2 ATP, 4 NADH
 (E) 4 Pyruvate, 4 ATP, 2 NADH

Ans: (B)

72. Which step of the TCA cycle can generate GTP directly?

- (A) Citrate to isocitrate

國立中山大學 112 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)

共 17 頁第 14 頁

- (B) Isocitrate to α -ketoglutarate
 - (C) α -Ketoglutarate to succinyl-CoA
 - (D) Succinyl-CoA to succinate
 - (E) Succinate to fumarate
- Ans: (D)

73. Fatty acids with 14 or high carbons require _____ for transport into mitochondria.

- (A) glycerol-3-phosphate shuttle
- (B) carnitine shuttle
- (C) clathrin
- (D) citrate shuttle
- (E) malate-aspartate shuttle

Ans: (B)

74. The mutation that occurs in sickle cell anemia belongs to _____.

- (A) silent mutation
- (B) missense mutation
- (C) nonsense mutation
- (D) frameshift mutation
- (E) insertion mutation

Ans: (B)

75. Which of the following is with the same binding site as O_2 in hemoglobin?

- (A) CO
- (B) CO_2
- (C) NO_2
- (D) 2,3-BPG
- (E) 1,3-BPG

Ans: (A)

76. The synthesis of 1 molecule of cholesterol requires _____ molecules of isopentenyl pyrophosphate, with each molecule of isopentenyl pyrophosphate requiring _____ molecules of acetyl-CoA.

- (A) 4; 2
- (B) 5; 2
- (C) 6; 2
- (D) 5; 3
- (E) 6; 3

Ans: (E)

77. Which of the following nucleoside analogs is used against HIV?

- (A) 2',3'-Dideoxycytidine (ddC)
- (B) 3'-Azido-2',3'-dideoxythymidine (AZT)
- (C) 2',3'-Dideoxyinosine (ddI)
- (D) 3'-Thiacytidine (3TC)
- (E) 2',3'-Didehydro-3'-deoxythymidine (d4T)

Ans: (B)

78. The process of "sugar modification" to proteins starts in the _____?

- (A) endoplasmic reticulum
- (B) Golgi complex

國立中山大學 112 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

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(C) mitochondria

(D) nucleolus

(E) vacuole

Ans: (A)

79. Very low-density lipoprotein (VLDL) is a lipoprotein produced by the liver and circulated in the blood. Which of the following is not the main component of its initial stage?

(A) Triglycerides

(B) Cholesterol

(C) Apolipoprotein C

(D) Apolipoprotein B

(E) Pyridoxal phosphate

Ans: (E)

80. In protein structure, disulfide bonds are formed by two _____.

(A) Ser

(B) Tyr

(C) Cys

(D) Asp

(E) His

Ans: (C)

81. Sphingomyelinase catalyzes the conversion of sphingomyelin into _____.

(A) ceramide and acetylcholine

(B) ceramide and phosphatidylinositol

(C) ceramide and phosphatidylserine

(D) ceramide and phosphocholine

(E) ceramide and pyrophosphate

Ans: (D)

82. Dietary polysaccharides are metabolized by _____ to monosaccharides; intracellular carbohydrate store, as glycogen, are metabolized by _____ to monosaccharides.

(A) hydrolysis; hydrolysis

(B) hydrolysis; phosphorylation

(C) phosphorylation; hydrolysis

(D) phosphorylation; phosphorylation

(E) hydrolysis; glycolysis

Ans: (B)

83. What is the major purpose of the pentose phosphate pathway?

(A) Generate NAD^+ for oxidative biosynthesis(B) Generate NADH for reductive biosynthesis(C) Generate FADH_2 for reductive biosynthesis

(D) Generate ribose-5-phosphate for nucleotide biosynthesis

(E) Generate ATP for energy biosynthesis

Ans: (D)

84. Within the electron transport chain, complex _____ represents the entry point for electrons from NADH while complex _____ represents the entry point for electrons from FADH_2 .

(A) I; II

國立中山大學 112 學年度學士後醫學系招生考試試題

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共 17 頁第 16 頁

- (B) II; III
(C) III; IV
(D) I; III
(E) II; IV
Ans: (A)

85. People who can have relatively high level of pyruvate in their blood due to ____; what enzyme that contains this cofactor is inactivated? ____

- (A) Vitamin B deficiency; pyruvate carboxylase
(B) Vitamin C deficiency; pyruvate kinase
(C) Thiamine deficiency; pyruvate dehydrogenase
(D) Alcohol intake; pyruvate dehydrogenase
(E) PLP deficiency; pyruvate transaminase
Ans: (C)

86. What cofactors are in acyl-CoA dehydrogenase?

- (A) FAD
(B) ATP
(C) Mg^{2+}
(D) NADH
(E) cAMP
Ans: (A)

87. Protein three-dimensional structures can NOT be determined by ____.

- (A) X-ray crystallography
(B) NMR
(C) cryo-electron microscopy
(D) high performance liquid chromatography
(E) small angle X-ray scattering
Ans: (D)

88. Intrinsic fluorescence of GFP is contributed by ____.

- (A) cyclization and oxidation of residues: Ser - Trp - Gly
(B) cyclization and oxidation of residues: Ser - Tyr - Gly
(C) cyclization and oxidation of residues: Ser - Tyr - Ala
(D) cyclization and oxidation of residues: Thr - Tyr - Gly
(E) cyclization and oxidation of residues: Gly - Trp - Ser
Ans: (B)

89. Several classes of hydrolases are localized in ____.

- (A) Golgi vesicle
(B) lysosomes
(C) late endosome
(D) mitochondria
(E) nucleus
Ans: (B)

90. Match the co-enzyme in List I severing as the transient carrier with the specific item or functional group in List II:

List I	List II
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國立中山大學 112 學年度學士後醫學系招生考試試題

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共 17 頁第 17 頁

A. Coenzyme A	I. Aldehyde groups
B. Thiamine pyrophosphate	II. Amino groups
C. Pyridoxal phosphate	III. Hydrogen atoms
D. Coenzyme Q10	IV. Acyl groups
E. Flavin adenine dinucleotide	V. Quinone group

(A) A - III, B - I, C - II, D - V, E - IV

(B) A - IV, B - I, C - II, D - V, E - III

(C) A - I, B - II, C - III, D - IV, E - V

(D) A - II, B - V, C - III, D - IV, E - I

(E) A - I, B - V, C - III, D - IV, E - II

Ans: (B)

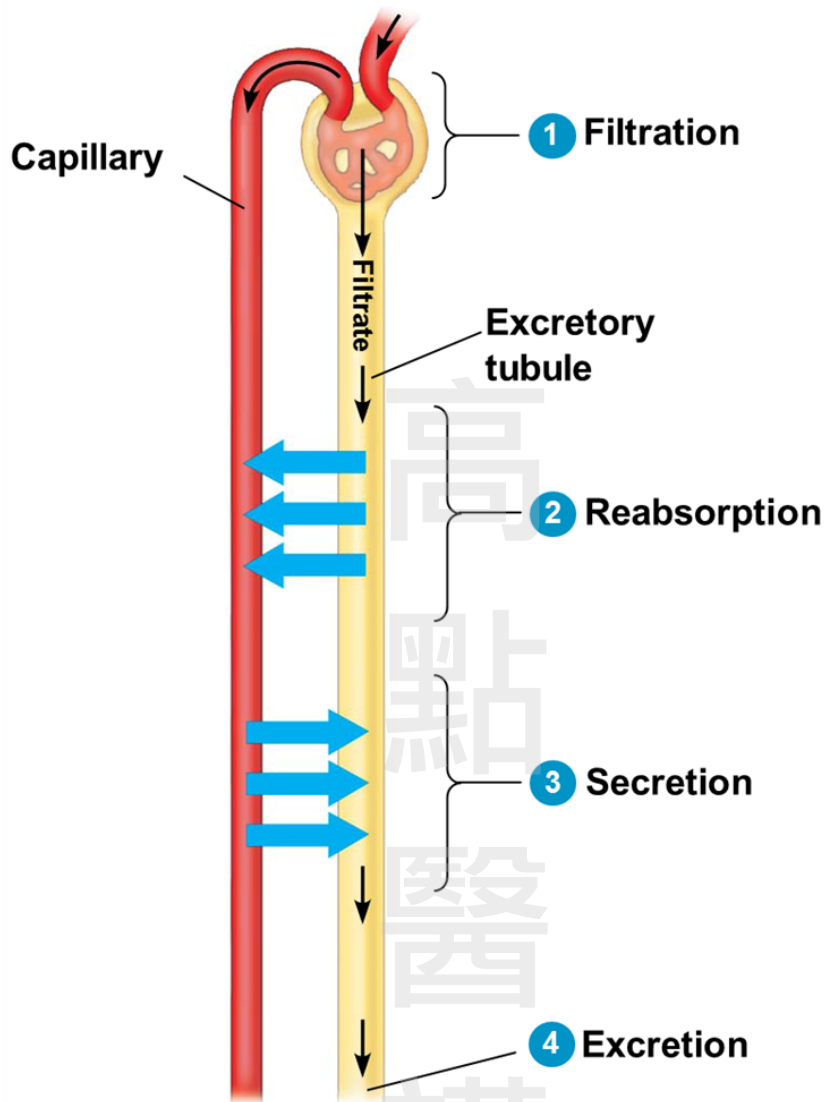
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國立中山大學 112 學年度學士後醫學系招生考試試題答案疑義釋疑公告

科目	題號	釋疑答覆	釋疑結果
普通生物及生化概論	9	細胞質內的可溶性蛋白經泛素化後、最終會被送往 proteasome 降解。胞膜或胞器膜上的非可溶性蛋白或稱 membrane associated protein 會被標上單一泛素後經內膜傳輸系統送進 lysosome 或經由自噬作用經由 autophagosome 與 lysosome 融合後被降解。本題中細胞質內的泛素化蛋白乃指前者，故維持原答案。	維持原公布答案 (C)
	18	Succinyl-CoA synthetase (SCS) catalyzes succinyl-CoA to produce succinate and GTP/ATP. In mammals, SCS is a heterodimer and is located within the mitochondria. Two different isoforms exist: one is ATP-specific (ATPSCS; EC 6.2.1.5) and the other is GTP-specific (GTPSCS; EC 6.2.1.4). Thus, A and C are correct. Reference: Lehninger Principles of Biochemistry 8/e, David L. Nelson; Michael M. Cox; Aaron A.Hoskins, W. H. Freeman, 8version, Nov. 2021, page : 585 Structure of GTP-specific succinyl-CoA synthetase in complex with CoA. Acta Crystallogr F Struct Biol Commun. 2015;71(Pt 8):1067-1071. doi:10.1107/S2053230X15011188	更正原公布答案——本題正確答案為(A)、(C)，選(A)或(C)均給分
	34	請詳見 Biology, A global approach, 12 Ed. Campbell, Urry, Cain, Wasserman, Minorsky, Orr. Chapt 44, pp 1036-1043. Figure 44.8 Key steps of excretory system function:an overview	維持原公布答案 (D)

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- 39 高血鉀引發心律不整(Cardiac arrhythmias)過快或緩慢及肌肉無力。因為題目設定狀況未明，故(A)、(B)、(C)都有可能。因此答案為(A)、(B)、(C)。

更正原公布答案——本題正確答案為(A)、(B)、(C)，選(A)或(B)或(C)均給分

- 48 黴菌主要以異營方式獲取養分維生，該考生列舉之黴菌維生方式是屬於輻射自營性(radiotrophic)，非能行光合作用(photosynthetic)，兩作用為類似(analogus)作用，但定義不同。

維持原公布答案 (B)

- 70 In the “Biochemistry” textbook and several reports as below mentioned that S-adenosyl-L-methionine (SAM) is a universal methyl donor for various molecules, such as DNA, protein, metabolite as shown below. Serine provides methylene group for tetrahydrofolate(THF) to generate N^5, N^{10} -methylene tetrahydrofolate, which serves as a methyl donor for dUMP, Thus, serine is not a common methyl donor.

維持原公布答案 (A)

Reference:

	Biochemistry, by Roger Miesfeld and Megan McEvoy, 2017 (ISBN: 9780393977264), page 331-332, 886-887. 930 (legend of figure 18.33) Nicotinamide N-Methyltransferase Interacts with Enzymes of the Methionine Cycle and Regulates Methyl Donor Metabolism. Biochemistry 2018, 57, 40, 5775–5779 The Role of Methyl Donors of the Methionine Cycle in Gastrointestinal Infection and Inflammation. Healthcare vol. 10,1 61. 29 Dec. 2021,	
77	AZT is the earliest and the most common nucleoside analog for treating patients with HIV. This question does not mention “the earliest and the most common”. Thus, the other nucleoside analogs are correct answers as well.	更正原公布答案 —本題正確答案為(A)、(B)、(C)、(D)、(E)，選(A)或(B)或(C)或(D)或(E)均給分。
78	The most of proteins are synthesized in the rough endoplasmic reticulum and undergo glycosylation. Glycoproteins take place within lumen of endoplasmic reticulum. Some of O-glycosylation occur in the Golgi complex. However, the question asks general “sugar modification of protein starts”. Thus, it should be still in endoplasmic reticulum. Reference: Biochemistry, by Roger Miesfeld and Megan McEvoy, 2017 (ISBN: 9780393977264), page 648	維持原公布答案 (A)
82	Glycogen phosphorylase phosphorylates and removes glucose from non-reducing end of glycogen until it reaches to branch point. Major degradation of glycogen releases Glucose-1-P (~90%), which is phosphorylated “monosaccharide”. Thus, the answer should be (B) Reference: Biochemistry, by Roger Miesfeld and Megan McEvoy, 2017 (ISBN: 9780393977264), page 706-707	維持原公布答案 (B)
85	Pyruvate oxidation to acetyl-CoA is catalyzed by the pyruvate dehydrogenase complex (PDH complex). It is an oxidative decarboxylation, which is virtually irreversible involving three enzymes and five coenzymes. Thiamine pyrophosphate (TPP), one of the cofactor in pyruvate dehydrogenase, participates in decarboxylation of pyruvate, yielding hydroxyethyl-TPP for next step. In clinical study, patients with PDH complex deficiency elevate plasma pyruvate levels. The pyruvate carboxylase reaction requires the vitamin biotin, which is	維持原公布答案 (C)

	the prosthetic group of the enzyme. But lacking biotin or pyruvate carboxylate does not cause high level of pyruvate in their blood. Reference: Pyruvate dehydrogenase complex deficiency: updating the clinical, metabolic and mutational landscapes in a cohort of Portuguese patients. Orphanet J Rare Dis (2020) 15:298	
89	The question mentions that “Several classes” of hydrolases, does not mean single hydrolase. Lysosomes contain more than 70 hydrolases and are the major location for degradation of both intracellular and extracellular macromolecules, including protein, glycogen, lipid and nucleotides. Reference: Biochemistry, by Roger Miesfeld and Megan McEvoy, 2017 (ISBN: 9780393977264), page 719, 852-853 Current methods to analyze lysosome morphology, positioning, motility and function. Traffic. Vol 23, Issue 5, May 2022, Pages 238-269	維持原公布答案 (B)

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生 物 學

張劍鴻(張芸潔)老師提供

中山大學 112 學年度 學士後醫學系 生物試題命題範疇分析

- ◆ 在本年度的中山大學後醫系 普通生物及生化概論 試題中，90題中，生物領域佔題高達70題。
- ◆ “首見”的組織學或病理學的題目約有七題（二分題），因超過生物學範疇太多，不易得分。
- ◆ 60餘題的生物題並不刁專，要得到八成的高分並不難。

生物各試題命題範疇分析

		第1-30題，每題一分
1	Unit 1 細胞生物學	Endoplasmic reticulum，組織學範疇，不易得分。 正課講義：Chap 1 細胞構造和功能，page 26-30
2	Unit 2 動物生理學	Central nervous system，完全命中 正課講義：Chap 6 神經系統，page 20-27 複習課程：Unit 2 Animal Physiology, page 10-12
3	Unit 1 細胞生物學	Cell junctions，完全命中 正課講義：Chap 1 細胞構造和功能，page 58-59 複習課程：Unit 1 Cell Biology, page 4
4	Unit 2 動物生理學	Action potential，命中 正課講義：Chap 5 神經元和突觸，page 42-50 複習課程：Unit 2 Animal Physiology, page 7
5	Unit 2 動物生理學	Movement of fluid，命中 正課講義：Chap 9 運輸系統，page 75

6	Unit 1 細胞生物學	Diffusion, 完全命中 正課講義: Chap 2 細胞膜, page 28-32 複習課程: Unit 1 Cell Biology, page 9
7	Unit 1 細胞生物學	Active transport, 完全命中 正課講義: Chap 2 細胞膜, page 12-13 複習課程: Unit 1 Cell Biology, page 7
8	Unit 2 動物生理學	Rhodopsin, 完全命中 正課講義: Chap 14 動物發育, page 66-68 複習課程: Unit 2 Animal Physiology, page 57
9	Unit 4 分子生物學	Ubiquitin- proteasomes system, 完全命中 正課講義: Chap 23 基因表現控制, page 58 複習課程: Unit 4 Molecular Biology, page 37
10	Unit 4 分子生物學	Nondisjunction, 完全命中 正課講義: Chap 20 染色體連鎖, page 63-72 複習課程: Unit 4 Molecular Biology, page 17-18
11	Unit 8 演化學	Chordates, 完全命中 正課講義: Chap32 動物多樣性, page 96 and 123 複習課程: Unit 8 Evolution, page 12
12	Unit 5 生物科技	Polymerase chain reaction, 完全命中 正課講義: Chap 24 DNA 科技, page 19-20 複習課程: Unit 5 Biotechnology, page 3
13	Unit 2 動物生理學	Rhodopsin, 完全命中 正課講義: Chap 5 神經元和突觸, page 85 複習課程: Unit 2 Animal Physiology, page 8-9
14	Unit 8 演化學	Sexual selection, 完全命中 正課講義: Chap 31 真菌, page 7 Chap32 動物多樣性, page 58 複習課程: Unit 8 Evolution, page 3 and 10
15	Unit 2 動物生理學	Short-term memory, 完全命中 正課講義: Chap 6 神經系統, page 96-99 複習課程: Unit 2 Animal Physiology, page 12

16	Unit 1 細胞生物學	cAMP, 完全命中 正課講義: Chap 3 細胞訊號傳遞, page 42-43 複習課程: Unit 1 Cell Biology, page 11
17	Unit 3 生物化學	Pyruvate oxidation, 完全命中 正課講義: Chap 16 細胞呼吸, page 31-32 複習課程: Unit 3 Biochemistry, page 10
18	Unit 3 生物化學	TCA cycle, 完全命中 正課講義: Chap 16 細胞呼吸, page 33-37 複習課程: Unit 3 Biochemistry, page 10
19	Unit 1 細胞生物學	Diffusion, 完全命中 正課講義: Chap 2 細胞膜, page 28-32 複習課程: Unit 1 Cell Biology, page 9
20	生化範疇	
21	生化範疇	
22	生化範疇	
23	生化範疇	
24	Unit 2 動物生理學	Gout, 命中 正課講義: Chap 12 排泄系統, page 37
25	生化範疇	
26	生化範疇	
27	Unit 4 分子生物學	Alternative RNA splicing, 完全命中 正課講義: Chap 22 基因表現, page 45 複習課程: Unit 4 Molecular Biology, page 26-27
28	生化範疇	
29	Unit 3 生物化學	Basic amino acids, 完全命中 正課講義: Chap 15 生物巨分子, page 63 複習課程: Unit 3 Biochemistry, page 4
30	Unit 2 動物生理學	Bile salts, 完全命中 正課講義: Chap 11 消化系統, page 62 複習課程: Unit 2 Animal Physiology, page 38

		第31-90題，每題二分
31	Unit 2 動物生理學	Splenic sinusoids，首見的組織學範疇考題
32	Unit 2 動物生理學	Ciliated pseudostratified epithelium，完全命中 正課講義：Chap 4 身體構造和功能，page 13-14 複習課程：Unit 2 Animal Physiology, page 5
33	Unit 2 動物生理學	Bronchioles，首見的組織學範疇考題 正課講義：Chap 9 運輸系統，page 121-122
34	Unit 2 動物生理學	Excretory systems，完全命中 正課講義：Chap 12 排泄系統，page 59-60 複習課程：Unit 2 Animal Physiology, page 44
35	Unit 2 動物生理學	LH surge，完全命中 正課講義：Chap 13 生殖系統，page 47-49 複習課程：Unit 2 Animal Physiology, page 53
36	Unit 2 動物生理學	Heart failure，首見的病理學範疇考題 正課講義：Chap 9 運輸系統，page 25
37	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 99 複習課程：Unit 2 Animal Physiology, page 48
38	Unit 2 動物生理學	Reticulocytes，首見的組織學範疇考題 正課講義：Chap 9 運輸系統，page 93
39	Unit 2 動物生理學	Serum potassium，首見的病理學範疇考題
40	Unit 2 動物生理學	Epidural hematoma，首見的病理學範疇考題 正課講義：Chap 6 神經系統，page 26
41	Unit 6 微生物免疫學	Class I major histocompatibility，完全命中 正課講義：Chap 26 感染之防禦，page 63-65 複習課程：Unit 6 Microbiology and Immunology, page 7
42	Unit 4 分子生物學	Synapsis and crossing over，完全命中 正課講義：Chap 18 減數分裂，page 34-38 複習課程：Unit 4 Molecular Biology, page 7-8

43	Unit 2 動物生理學	Homeostasis, 完全命中 正課講義: Chap 4 身體構造和功能, page 33-34 複習課程: Unit 2 Animal Physiology, page 6
44	Unit 4 分子生物學	Epistasis, 完全命中 正課講義: Chap 19 孟德爾, page 63-93 複習課程: Unit 4 Molecular Biology, page 13
45	Unit 4 分子生物學	Genetic code, 完全命中 正課講義: Chap 22 基因表現, page 16-19 複習課程: Unit 4 Molecular Biology, page 23
46	Unit 4 分子生物學	Protein sorting, 完全命中 正課講義: Chap 22 基因表現, page 78-79 複習課程: Unit 4 Molecular Biology, page 31
47	Unit 2 動物生理學	Heart conduction system, 完全命中 正課講義: Chap 9 運輸系統, page 46 複習課程: Unit 2 Animal Physiology, page 24
48	Unit 8 演化學	Fungi life cycles, 完全命中 正課講義: Chap 31 真菌, page 9-13 複習課程: Unit 8 Evolution, page 3-4
49	Unit 5 生物科技	cDNA, 完全命中 正課講義: Chap 24 DNA 科技, page 34-35 複習課程: Unit 5 Biotechnology, page 3
50	Unit 4 分子生物學	RNA-protein complex, 完全命中 正課講義: Chap 21 核苷酸與遺傳, page 47 Chap 22 基因表現, page 42 and 101 複習課程: Unit 4 Molecular Biology, page 22, 27-28
51	Unit 2 動物生理學	Glia cells, 完全命中 正課講義: Chap 5 神經元和突觸, page 13 複習課程: Unit 2 Animal Physiology, page 9
52	Unit 7 植物學	Plant hormones, 完全命中 正課講義: Chap 29 植物訊號和行為, page 22-32 複習課程: Unit 7 Plant Biology, page 16-19
53	Unit 3 生物化學	Vitamins, 完全命中 正課講義: Chap 16 細胞呼吸, page 98-100

54	Unit 6 微生物免疫學	Class I major histocompatibility, 完全命中 正課講義: Chap 26 感染之防禦, page 63-65 複習課程: Unit 6 Microbiology and Immunology, page 7
55	Unit 2 動物生理學	Endocrine signaling, 完全命中 正課講義: Chap 10 內分泌, page 69-63 複習課程: Unit 2 Animal Physiology, page 33
56	Unit 8 演化學	Reproductive isolation, 完全命中 正課講義: Chap 34 物種起源, page 62-55 複習課程: Unit 8 Evolution, page 21
57	Unit 7 植物學	Photosynthesis, 完全命中 正課講義: Chap 29 植物訊號和行為, page 127-139 複習課程: Unit 7 Plant Biology, page 25-28
58	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 25-28 複習課程: Unit 1 Cell Biology, page 2-3
59	Unit 2 動物生理學	Neuromuscular junction, 完全命中 正課講義: Chap 8 運動, page 17-20 複習課程: Unit 2 Animal Physiology, page 8
60	Unit 1 細胞生物學	Microtubules and motor proteins, 首見的細胞生物學 範疇考題 正課講義: Chap 1 細胞構造和功能, page 44-49
61	Unit 6 微生物免疫學	Genome of viruses, 完全命中 正課講義: Chap 27 微生物, page 111 and 118 複習課程: Unit 6 Microbiology and Immunology, page 20
62	Unit 5 生物科技	Retroviruses, 完全命中 正課講義: Chap 24 DNA 科技, page 91
63	Unit 4 分子生物學	Transcription factors, 完全命中 正課講義: Chap 22 基因表現, page 29-31 複習課程: Unit 4 Molecular Biology, page 25
64	Unit 6 微生物免疫學	B cells, 完全命中 正課講義: Chap 26 感染之防禦, page 67-72 複習課程: Unit 6 Microbiology and Immunology, page 9
65	生化範疇	

66	生化範疇	
67	生化範疇	
68	生化範疇	
69	Unit 3 生物化學	Glycolysis, 完全命中 正課講義: Chap 16 細胞呼吸, page 16-23 複習課程: Unit 3 Biochemistry, page 9
70	生化範疇	
71	Unit 3 生物化學	Glycolysis, 完全命中 正課講義: Chap 16 細胞呼吸, page 16-23 複習課程: Unit 3 Biochemistry, page 9
72	Unit 3 生物化學	TCA cycle, 完全命中 正課講義: Chap 16 細胞呼吸, page 33-37 複習課程: Unit 3 Biochemistry, page 10
73	生化範疇	
74	Unit 4 分子生物學	Point mutations, 完全命中 正課講義: Chap 22 基因表現, page 87-88 複習課程: Unit 4 Molecular Biology, page 32
75	Unit 3 生物化學	Irreversible inhibition, 完全命中 正課講義: Chap 15 生物巨分子, page 110 複習課程: Unit 3 Biochemistry, page 8
76	生化範疇	
77	Unit 6 微生物免疫學	HIV, 命中 正課講義: Chap 27 微生物, page 103 複習課程: Unit 6 Microbiology and Immunology, page 23
78	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 27-28 複習課程: Unit 1 Cell Biology, page 2-3
79	生化範疇	
80	Unit 3 生物化學	Disulfide bridges, 完全命中 正課講義: Chap 15 生物巨分子, page 70 複習課程: Unit 3 Biochemistry, page 4

81	生化範疇	
82	生化範疇	
83	生化範疇	
84	Unit 3 生物化學	Electron transport chain, 完全命中 正課講義: Chap 16 細胞呼吸, page 54-59 複習課程: Unit 3 Biochemistry, page 11-12
85	生化範疇	
86	生化範疇	
87	生化範疇	
88	生化範疇	
89	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 29 複習課程: Unit 1 Cell Biology, page 2-3
90	生化範疇	

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生化概論

莊老師(施政安)老師提供

9. Ans: C

[解析] UPS (ubiquitin-proteasome system):

Target protein → polyubiquitinated protein → 26S proteasome

12. Ans: B

[解析] PCR 需以下物資:

1. One pair of **DNA primer (II)**
2. Two **DNA templates** (= 2 ssDNA) **(I)**
3. Taq **DNA polymerase (V)**
4. **dNTP** = (dATP, dGTP, dTTP, dCTP) **(IV)**

17. Ans: D

[解析]

1. Pyruvate + **NAD⁺ (1)** + CoA-SH
 $\downarrow$ **pyruvate dehydrogenase complex (2)**
 Acetyl-CoA + **NADH (3)** + H⁺ + CO₂
2. **(3)** 應是 **NADH + H⁺**才正確

18. Ans: A (釋疑後 A, C 皆可)

[解析]

- 1) TCA cycle: acetyl-CoA → **2CO₂ (1)** + 3 (NADH/H⁺) + **FADH₂ (4)** + GTP
 or ATP* (2)
- 2) Two types of succinyl-CoA synthetase in humans*:
 (a) ATP-specific : in heart, muscle, and brain
 (b) GTP-specific : in kidney and liver
 (*Ji Huang *et al.*, Structure of GTP-specific succinyl-CoA synthetase in complex with CoA, Acta Crystallographica F Structural Biology Communications, 2015 Aug ; 71: 1067)

19. Ans: A

[解析]

1. 校方原解為 A
2. 作者認為應選 E: 因 CO₂ 在體內是以 **HCO₃⁻**方式存在, 不能自由穿越細胞膜 (CO₂ + H₂O → HCO₃⁻ + H⁺ by carbonic anhydrase)

20. Ans: E

[解析]

1. Insulin 能降血糖, 故會活化醣解之酵素 PFK-1 (in liver)
2. Glucagon 能升血糖, 故會抑制醣解之酵素 PFK-1 (in liver)

21. Ans: E

[解析]

1. Charge-charge interaction: (+)/(+) or (-)/(-) or (+)/(-) charge
2. 故選 (E): aspartic acid (-) /lysine (+)

22. Ans: B

[解析] NADPH 三大來源:

1. **Pentose phosphate pathway (B)**
2. Malic enzyme
3. Cytosolic isocitrate dehydrogenase

23. Ans: A

[解析]

1. **Acidic or Neutral** amino acids: $pI = \frac{pKa1 + pKa2}{2}$
2. **Tyrosine** 屬 **Neutral** amino acid: $pI = \frac{2.2 + 9.11}{2} = 5.655 \approx \underline{\underline{5.66 (A)}}$

27. Ans: C

[解析] (C) alternative splicing is **one of post-transcriptional** processing.

28. Ans: D

[解析]

Lecithin

= Phosphatidylcholine

= (glycerol + **2 fatty acids** + phosphate + choline)

30. Ans: D

[解析]

1. Bile acid: **amphipathic** compound **(D)**
2. Cholesterol is an amphipathic molecule in plasma membrane.

42. Ans: C

[解析] (C) Chiasmata = Holliday intermediate/junction/structure

46. Ans: B

[解析] 含 signal peptide (in N-terminus)者 (in signal hypothesis):

1. Proteins in ER
2. Proteins in Golgi apparatus
3. **Lysosomal proteins (B)**
4. Plasma membrane proteins
5. Secretory proteins

49. Ans: B

[解析]

1. Mature mRNA 有兩個外掛分子: 5'cap and 3'poly(A)
2. mRNA → cDNA: cDNA 失去 5'cap, 仍保留 3'poly(A)
3. cDNA 之 3'poly(A): poly(A)· poly(T) homo-polynucleotide in double stranded state. 故選 B

50. Ans: D

[解析]

1. DNA-Protein complex: Nucleosome (II)
2. **RNA-Protein complex: Ribosome (I), Spliceosome (IV), Telomerase (V)**
3. Protein-phospholipid: Lysosome (III)
4. Telomerase: (RNA template + Reverse transcriptase/protein)

53. Ans: B

[解析]

題號	修正
(A)	Scurvy
(C)	Calcium absorption
(D)	Antioxidant
(E)	Blood coagulation

58. Ans: D

[解析]

1. **Histone: nuclear protein**
2. Nuclear protein biogenesis: cytosol → nucleus (D)

63. Ans: A

[解析] Hormone
 ↓
 GPCR
 ↓
 Gs protein (heterotrimer = $\alpha s + \beta + \gamma$)
 ↓
 Adenylate cyclase
 ↓
 ATP → cAMP → activated PKA → **phosphorylation of CREB**
 (CREB = cAMP responsive element binding protein: transcription factor)

65. Ans: D

[解析] **Ketogenesis** (D) occurs in **fasting** or starvation and diabetes.

66. Ans: C

[解析] Glucose
 ↓ **glycolysis (2)**
 Pyruvate
 ↓
 Acetyl-CoA
 ↓
 De novo **biogenesis of fatty acid (3)**
 ↓ **esterification (1)** with glycerol
 Triglyceride

68. Ans: E

[解析] Long-term fasting: **ketone bodies (E)** as energy for brain

69. Ans: B

[解析] **Irreversible steps (= not the reversible)** in glycolysis:

Step 1. Hexokinase

Step 3. **Phosphofructokinase-1 (B)** : F-1-P → F-1, 6-BP

Step 10. Pyruvate kinase

70. Ans: A

[解析]

1. Methyl group donors:
 - a. S-adenosyl-methionine (from methionine)
 - b. Methyl-B12
 - c. N⁵-methyl-tetrahydrofolate
 - d. Betaine
2. 本題要選 amino acid as common source: 故選 (A) methionine

73. Ans: B

[解析] **Carnitine shuttle (B)**: transport LCFA (long-chain fatty acid)

76. Ans: E

[解析]

1. **3** Acetyl -CoA → HMG-CoA → Isopentenyl pyrophosphate (IPP) + CO₂
 2. **6** IPP → squalene → cholesterol
- 故選 E

79. Ans: E

[解析]

1. Lipoprotein transport the **hydrophobic** nutrients.
2. **Pyridoxal phosphate(E) is a hydrophilic** coenzyme.

81 Ans: D

[解析] Sphingomyelin
 ↓ sphingomyelinase
 Ceramide + Phosphocholine

82. Ans: B

[解析]

1. 本題原意是:
 - a. 消化作用為水解酶行為: hydrolysis by amylase
 - b. 肝醣分解主要由 glycogen phosphorylase 執行:
 $\text{Glycogen} + \text{Pi} \rightarrow \text{Glucose-1-phosphate (G-1-P)}$
 故選 B

83. Ans: D

[解析] Functions of pentose phosphate pathway:

1. To generate NADPH: for detoxification and biosynthesis
2. To generate **ribose-5-phosphate for RNA or DNA biosynthesis (D)**

85. Ans: C

[解析]

1. The fates of pyruvate:
 - a. Pyruvate → acetyl-CoA (by **pyruvate dehydrogenase**: TPP, FAD, CoA, NAD⁺)
 - b. Pyruvate → lactate (by lactate dehydrogenase: NAD⁺)
 - c. Pyruvate → Alanine (by alanine transaminase)
 - d. Pyruvate → oxaloacetate (by pyruvate carboxylase: PLP)
2. **TPP from vitamin B1 (thiamine)**; PLP from vitamin B6

88. Ans: B

[解析] The chromophore in GTF derived from the tripeptide **Ser⁶⁵-Tyr⁶⁶-Gly⁶⁷**.

90. Ans: B

[解析]

1.

題號	配對	解析
A. CoA	(IV) Acyl group	Acyl-CoA
B. TPP	(I) Aldehyde	Pyruvate decarboxylase
C. PLP	(II) Amino group	Transaminase
D. CoQ	(V) quinone	CoQ also called ubiquinone
E. FAD	(III) H atom	FAD → FADH ₂

2. TPP to activate acetaldehyde in pyruvate decarboxylase (acetaldehyde 是屬 aldehyde group), 更正確說法為 Hydroxyethyl-TPP* intermediate in pyruvate decarboxylase (*Van Hold *et al.* Biochemistry, 4th edition, 2013, p.537)