

國立中山大學 113 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

—作答注意事項—

考試時間：100 分鐘

- 考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。請先檢查答案卡之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，後果由考生自負。
- 答案卡應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 不可使用計算機，並不得攜帶書籍、紙張(應考證不得做計算紙書寫)、具有通訊、記憶、傳輸或收發等功能之相關電子產品或其他有礙試場安寧、考試公平之各類器材入場。
- 試題及答案卡請務必繳回，未繳回者該科成績以零分計算。
- 試題採雙面列印，考生應注意試題頁數確實作答。
- 違規者依本校招生考試試場規則及違規處理辦法處理。

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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. The umami receptors in the taste cells primary detect

- (A) sodium.
- (B) fatty acid.
- (C) glucose.
- (D) glutamate.
- (E) glycine.

Ans:(D)

2. Signal transduction is composed of three steps including:

- (A) reception, transcription, and translation.
- (B) reception, translation, and response.
- (C) reception, transduction, and response.
- (D) reception, neurotransmission, and reaction.
- (E) signal, translation, and response.

Ans:(C).

3. When a virus enters the lysogenic stage:

- (A) the viral DNA is replicated outside the host cell.
- (B) it enters the host cell and kills the host immediately.
- (C) it enters the host cell, picks up host DNA, and leaves the cell unharmed.
- (D) it sits on the host cell plasma membrane with which it covers itself and the leaves the cell.
- (E) the viral DNA integrates into the host genome.

Ans:(E)

4. The region(s) in the antibody that recognize the specific antigen is/are located at:

- (A) light chain constant region.
- (B) light chain variable region.
- (C) heavy chain constant region.
- (D) heavy and light chain variable region.
- (E) heavy and light chain constant region.

Ans:(D)

5. Glial cells in the nervous system perform multitude of functions except

- (A) providing framework for neuron migration.
- (B) forming blood-brain barrier.
- (C) recycling neurotransmitter.
- (D) increasing the maximum depolarization potential of action potential.
- (E) removing waste produced by neurons.

Ans:(D)

6. In the fish gills:

- (A) blood and water flow in opposite directions.
- (B) blood and water flow in the same direction.
- (C) blood flowing in the gills reverses direction with every heartbeat.
- (D) water flowing over the gills reverses direction with every inhalation.
- (E) blood and water are separated by a thick polysaccharide barrier.

試題請隨卷繳回，請留意背面是否有題。

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Ans:(A)

7. Which of the following descriptions best demonstrates the term “saltatory conduction”?
- (A) It inhibits direct neurotransmitter release.
 - (B) It transmits the action potential at the nodes of Ranvier and thus speeds up impulses on myelinated axons.
 - (C) It increases neurotransmitter release at the presynaptic membrane.
 - (D) It decreases neurotransmitter uptake at chemically gated postsynaptic channels.
 - (E) It removes neurotransmitters from the synaptic cleft.

Ans:(B)

8. You are able to resist infection by a specific pathogen after being vaccinated against it. This is an example of:
- (A) innate immunity.
 - (B) an allergy.
 - (C) a response with defensins.
 - (D) an autoimmune reaction.
 - (E) immunological memory.

Ans:(E).

9. All of the following are essential nutrients in humans **except**:

- (A) vitamin B.
- (B) calcium.
- (C) glycogen.
- (D) linoleic acid.
- (E) vitamin K.

Ans:(C)

10. Which of the following is true soon after a meal?

- (A) Both glucagon and insulin are released.
- (B) The total amount of insulin in the blood decreases.
- (C) Glucagon is released but not insulin.
- (D) Neither glucagon nor insulin is released.
- (E) Insulin is released but not glucagon.

Ans:(E)

11. Ovulation is the response of the matured follicle(s) to a burst secretion of

- (A) estrogen.
- (B) luteinizing hormone.
- (C) progesterone.
- (D) prolactin.
- (E) oxytocin.

Ans:(B)

12. The perception of the sound pitch is mediated by

- (A) the generation of the waves in the cochlear fluid by the specific corresponding region of the oval window.
- (B) the vibration of the specific corresponding part on the tympanic membrane.
- (C) the vibration of the specific corresponding region on the basilar membrane.
- (D) the sequence of sound wave traveling through the auditory ossicles.

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(E) the music training of listeners.

Ans:(C)

13. The midpiece of a sperm cell is to

(A) fuse with the jelly coat of the egg cell.

(B) carry the sperm's nucleus.

(C) carry the sperm's acrosomal material.

(D) generate fuel that propels the sperm.

(E) carry enzymes that are released to form a hole in the egg's jelly coat when the sperm encounters an egg.

Ans:(D)

14. A fish hobbyist needs to replace a certain amount of water in their fish tanks periodically, mainly because

(A) the accumulation of ammonia.

(B) the accumulation of dirt.

(C) the reduction of oxygen.

(D) the increase in temperature.

(E) the increase in pH.

Ans:(A)

15. Which activity can appear in the ovarian cycle?

(A) FSH stimulates the pituitary to release GnRH.

(B) When FSH and LH levels fall, the corpus luteum shrinks and the uterine lining breaks down.

(C) Luteinizing hormone stimulates the uterus to make progesterone.

(D) Estrogen levels initially have a positive feedback effect on the pituitary, which is followed by higher estrogen levels causing negative feedback.

(E) A fully developed corpus luteum inhibits uterine lining growth.

Ans:(B)

16. An enzyme that breaks DNA, dispels the tension, and reseals the strand ahead of a DNA replication growing fork is called a(n)

(A) topoisomerase.

(B) DNA polymerase.

(C) phosphodiesterase.

(D) aminoacyl-tRNA synthetase.

(E) All of the above.

Ans: (A)

17. One distinction between peptide and steroid hormones is that steroid hormones:

(A) bind to their receptors with low affinity, whereas peptide hormones bind with high affinity.

(B) bind to intracellular receptors, whereas peptide hormones bind to cell surface receptors.

(C) are less stable than peptide hormones.

(D) are generally water-soluble, whereas peptide hormones are water-insoluble.

(E) act through specific receptors, whereas peptide hormones act through nonspecific receptors.

Ans: (B)

18. Iron deficiency in a cell can adversely affect electron transport at which of the following sites:

(A) Cytochrome *b* and cytochrome *c*.

(B) Coenzyme Q and FADH₂.

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- (C) NADH and FADH₂.
 - (D) Coenzyme Q and NADH.
 - (E) All sites in electron transport are affected.
- Ans: (A)

19. Which of the following hormones affects the arcuate nucleus of the hypothalamus and ultimately results in an inhibition of nutrient intake?

- (A) adiponectin
- (B) leptin
- (C) ghrelin
- (D) glucagon
- (E) None of the above

Ans: (B)

20. Which one of the following amino acids is critical for glutathione to function as a redox buffer in cells?

- (A) glycine
- (B) methionine
- (C) glutamine
- (D) glutamate
- (E) cysteine

Ans: (E)

21. Which one is the basic unit for the synthesis of cholesterol?

- (A) Malonyl-CoA
- (B) Serine
- (C) Palmitoyl-coA
- (D) Isoprene
- (E) L-glycerol 3-phosphate

Ans: (D)

22. There is no codon for the amino acid hydroxyproline, but this amino acid is a prominent feature of collagen structure. Which of the following is a likely explanation?

- (A) Hydroxyproline is substituted for proline after translation by a cut and patch mechanism.
- (B) Proline is covalently modified to give hydroxyproline after translation.
- (C) There is an alternative mechanism for synthesis of proteins that contain hydroxyproline.
- (D) All of the above are likely explanations.
- (E) It is not possible to form a hypothesis from the information given.

Ans: (B)

23. Which metabolite levels determine whether acetyl-CoA derived from fatty acids can enter the citric acid cycle?

- (A) Citrate
- (B) Succinyl CoA
- (C) Oxaloacetate
- (D) α -Ketoglutarate
- (E) None of the above

Ans: (C)

24. In one turn of the citric acid cycle, how many steps in the metabolism of oxaloacetate and acetyl-CoA involve net carboxylic acid oxidation?

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(A) 0

(B) 1

(C) 2

(D) 3

(E) 4

Ans:(C)

25. Atherosclerosis is a condition characterized by poor metabolism of cholesterol, which is conveyed by lipoproteins. Please indicate the lipoproteins causing the development of this disease:

(A) LDL

(B) HDL

(C) VLDL

(D) Chylomicrons

(E) Triglycerides

Ans:(A)

26. Gluconeogenesis is induced in the liver after severe physical activity. Which chemical is largely used in gluconeogenesis in this case?

(A) alanine

(B) glucose

(C) glutamate

(D) lactate

(E) pyruvate

Ans:(D)

27. An enzyme that follows standard Michaelis-Menten kinetics was assayed for reaction velocity at various substrate concentrations. The data are shown below:

Substrate added (mmol/L)	V_0 ($\mu\text{mol/min}$)
0.5	150
1.0	245
2.0	300
6.0	375
500	500

Based on these kinetic data for the enzyme, what would be the closest estimate of the enzyme's K_m value?

(A) 2.0 mM

(B) 1.0 mM

(C) 250 mM

(D) 0.5 mM

(E) 3.0 mM

Ans:(B)

28. Orotate is converted to what two nucleotides which are used in nucleic acid synthesis?

(A) AMP and GMP

(B) TMP and CMP

(C) UMP and AMP

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(D) GMP and CMP

(E) CMP and AMP

Ans: (B)

29. How many different reactions involve substrate-level phosphorylation during glycolysis?

(A) 2

(B) 3

(C) 4

(D) 5

(E) 0

Ans: (A)

30. Uncoupling in mitochondria refers to:

(A) Stopping electron flow but not stopping ATP synthesis.

(B) Stopping ATP synthesis but not stopping electron flow.

(C) Blocking the electrons from NADH from entering the electron transport system.

(D) Interruption of electron flow.

(E) None of the above.

Ans: (B)

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. Which of the following description of membrane potential is **false**?

(A) Resting potential in neurons means when membrane potential became 0 mV.

(B) Postsynaptic potentials are graded, and action potentials are all-or-none.

(C) Hyperpolarization means membrane potential became more negative.

(D) Under physiological condition, Na^+ ions entering cells will cause depolarization.

(E) Membrane potential is the result of differential ion concentration across plasma membrane of the cell.

Ans: (A)

32. Which of following is **false** for alternative RNA splicing?

(A) removes different exon(s) to produce different mRNA

(B) can allow the production of mRNA of different sizes from a single gene

(C) is produced in nucleus

(D) can allow the production of proteins of different sizes from a single gene

(E) is processed by spliceosome with just snRNA

Ans: (E)

33. Enzymes are proteins that can

(A) change the specificity of reactants.

(B) lower the energy barriers of reactions.

(C) slow down the reactions.

(D) not affect the reactions.

(E) None of the above.

Ans: (B)

34. During cell communication, specificity is a key determinant for correct signaling. Which of the following determines the specificity?

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- (A) environment
 - (B) ligand-receptor interaction
 - (C) receptor activation
 - (D) induction of effector proteins
 - (E) None of the above
- Ans:(B)

35. Which of the following demonstrates the characteristics of a respiratory surface?

- (A) a surface consisting of multiple layers of epithelial cells
- (B) the exoskeleton of an insect
- (C) the nasal passages of a mammal
- (D) a thin surface consisting of a single layer of epithelial cells
- (E) the outer membrane of a mitochondrion

Ans:(D)

36. Which event will occur when food enters the stomach?

- (A) stomach release ghrelin
- (B) adipose tissue release leptin
- (C) stomach release gastrin
- (D) bicarbonate is released to reduce pH in the stomach
- (E) None of the above

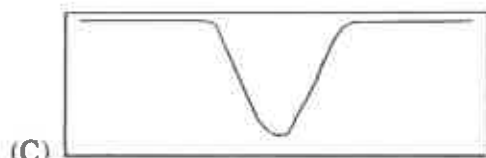
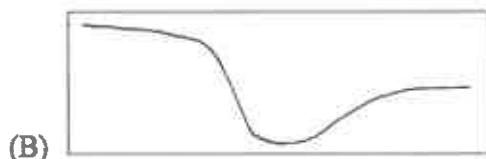
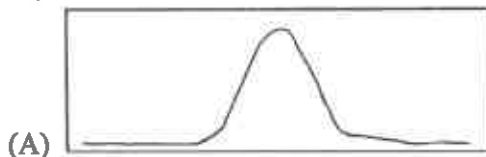
Ans:(C)

37. Which muscle types are striated under the microscopic observation?

- (A) skeletal muscles only
- (B) cardiac muscles only
- (C) skeletal muscles and cardiac muscles
- (D) smooth muscles only
- (E) skeletal muscles and smooth muscles

Ans:(C)

38. Which of the following correctly depicts the blood velocity in humans as it flows from the aorta → arteries → arterioles → capillaries → venules → veins → venae cavae (y-axis; velocity; x-axis: regions of blood vessels):

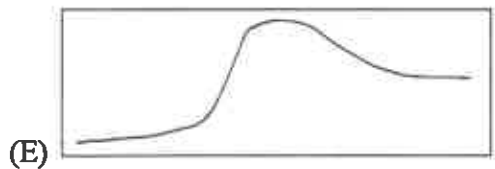
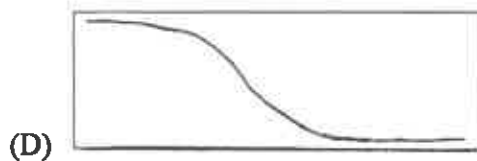


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Ans:(B)

39. The "hemoglobin O₂ dissociation curve":

- (A) reflects about 50% saturation of hemoglobin in the alveoli.
 - (B) shifts to the left when the pH decreases.
 - (C) demonstrates that hemoglobin holds less O₂ when the pH is higher.
 - (D) proves lack of dependence on CO₂ levels.
 - (E) explains how hemoglobin can bind O₂ at high pH in the lungs and release it at lower pH in tissue.
- Ans:(E)

40. Which of the following statement is correct in a resting skeletal muscle fiber?

- (A) Sarcomeres are regions between two H zones.
- (B) Discs of M line proteins called the A band separate the thick filaments.
- (C) I bands are composed of the same thick filaments seen in the A bands.
- (D) Z lines are adjacent to H zones, which attach thick filaments.
- (E) Dark A bands contain overlapping thick and thin filaments with a central thin H zone composed only of thick filaments.

Ans:(E)

41. Which of the following reactions produces the highest amount of ATP?

- (A) glycolysis
- (B) oxidative phosphorylation
- (C) pyruvate oxidation
- (D) citric acid cycle
- (E) None of the above

Ans:(B)

42. Which of the following gradient drives the ATP synthase for the production of ATP?

- (A) hydrogen
- (B) sodium
- (C) potassium
- (D) chloride
- (E) None of the above

Ans:(A)

43. Which of the following organelle contents has the lowest pH?

- (A) Golgi apparatus
- (B) mitochondrion

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- (C) nucleus
- (D) endoplasmic reticulum
- (E) lysosome
- Ans:(E)

44. Calcium is one of the critical ions required for the cellular functions. Which of the following is true regarding calcium?

- (A) Calcium can trigger cell death.
- (B) Calcium is critical for the activation of different proteins.
- (C) The free calcium concentration in the cytosol is very low.
- (D) The endoplasmic reticulum contains a high amount of calcium.
- (E) All of the above.

Ans:(E)

45. DNA subjective to genetic mutation or environmental lesion can have point mutations, but those mutations may not affect physiological functions by the proteins because:

- (A) the mutations do not change the amino acid encoded.
- (B) the mutations change the encoded amino acids that are not critical for the functions of proteins.
- (C) the mutations do affect the functions of proteins, but other proteins compensate for their functions.
- (D) None of the above.
- (E) All of the above.

Ans:(E)

46. How does the sensory neurons transmit stimulation strength to the central nervous system?

- (A) duration of the depolarization phase in the action potential.
- (B) the frequency of its action potentials.
- (C) the peak of the depolarization phase of an action potential.
- (D) how fast is neurotransmitter released from one action potential.
- (E) the lowest point of the hyperpolarization of an action potential.

Ans:(B)

47. Which of the following is not the mechanism that stops the action of neurotransmitters?

- (A) recycle by the pre-synaptic neuron
- (B) recycle by glia
- (C) digestion enzyme in the synaptic cleft
- (D) recycle by macrophages
- (E) All of the above are used to quickly stop neurotransmitter's function

Ans:(D)

48. Which statement about the gut microbiota is false?

- (A) It can help digesting food.
- (B) It can increase risk of peptic ulcers.
- (C) It can generate specific metabolites such as short chain fatty acids.
- (D) It can influence neuronal development.
- (E) It remains the same for each person through aging.

Ans:(E)

49. Which description about complement system is incorrect?

- (A) requires antibody to target pathogen

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- (B) can attract phagocytic leukocyte
 - (C) normal body cells continuously produce proteins that inactivate complement
 - (D) activation of one complement protein can trigger the enzymatic cleavage of another complement protein
 - (E) is part of the innate immunity system
- Ans:(A)

50. Lateral inhibition via amacrine cells in the mammalian retina:

- (A) recycles neurotransmitter molecules
- (B) prevents bleaching in bright light
- (C) is required for color vision to occur
- (D) enhances visual contrast
- (E) underlies habituation of vision

Ans:(D)

51. The enhancer is located distant from the transcriptional start site. How can an enhancer change transcription?

- (A) An enhancer cannot change transcription.
- (B) Activators bind to the enhancer and bring the bound activators closer to the promoter to trigger transcription.
- (C) An enhancer can only change the transcription of another gene.
- (D) None of the above.
- (E) All of the above.

Ans:(B)

52. In vertebrate animals, spermatogenesis and oogenesis differ in that

- (A) oogenesis ends at menopause, whereas spermatogenesis is finished before birth.
- (B) oogenesis produces four haploid cells, whereas spermatogenesis produces only one sperm.
- (C) oogenesis begins at the onset of sexual maturity, whereas spermatogenesis begins during embryonic development.
- (D) cytokinesis is unequal in oogenesis, whereas it is equal in spermatogenesis.
- (E) spermatogenesis is not completed until after fertilization occurs, but oogenesis is completed after ovulation.

Ans:(D)

53. Calcium ion initiates skeletal muscle contraction by:

- (A) breaking the actin-myosin cross-bridges
- (B) transmitting action potentials across the neuromuscular junction
- (C) spreading action potentials through the T tubules
- (D) initiating ATP generation
- (E) binding to the troponin complex that subsequently displaces tropomyosin from the myosin binding sites

Ans:(E)

54. The equilibrium potential for the specific ion is correlated to the ion's polarity and

- (A) the voltage difference across the membrane.
- (B) the concentration ratio of this ion across the membrane.
- (C) how many ion channels are on the plasma membrane.
- (D) the direction of ion movement through the membrane.
- (E) All of the above.

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Ans:(B)

55. The action potential depolarizes the cell membrane and transiently bring the membrane potential above 0 mV, then rapidly repolarizes with an undershoot, yet the membrane potential eventually returns to the resting membrane potential at ~ -70 mV. Which ion channel mediates the rapid repolarization?

- (A) Ca^{2+} channel
- (B) Na^{+} channel
- (C) K^{+} channel
- (D) ATP channel
- (E) All of the above

Ans:(C)

56. Humans can smell many different kinds of odorant molecules via receptors on the olfactory neurons. These receptors belong to a class of receptors that can induce cAMP production to mediate the downstream responses. These odorant receptors are:

- (A) EGF receptor
- (B) TGF beta receptor
- (C) G-protein-coupled receptor
- (D) Tyrosine kinase receptor
- (E) All of the above

Ans:(C)

57. Which of the following correctly describes a part of kidney function?

- (A) Collecting ducts dilute urine because they are permeable to salt but not water.
- (B) In the ascending loop of Henle, Na^{+} and Cl^{-} move into the tubules because the osmolarity of the filtrate is increased.
- (C) The descending loop of Henle receives filtrate from the ascending loop.
- (D) The distal convoluted tubule pumps water into the tubule by active transport.
- (E) The renal pelvis receives urine from the collecting ducts and carries it to the ureters.

Ans:(E)

58. Which of the following exposure scheme of a foreign antigen to an animal will result in the highest titer of the induced antibody?

- (A) right after antigen introduction
- (B) a few days after antigen introduction
- (C) a few days after the second exposure to the same antigen
- (D) a few days after the exposure to another antigen
- (E) None of the above

Ans:(C)

59. The generation of antibody diversity includes:

- (A) joining of V to C to J segments to make a functional light chain gene.
- (B) choice from several different types of C segments to make a functional light chain gene.
- (C) deletion of the J segment to make a functional light chain gene.
- (D) joining of V to J to C segments to make a functional light chain gene.
- (E) initial generation of IgG followed later by IgM on a given cell.

Ans:(D)

60. Which type of stem cell has the widest potential to give rise to other cell types?

試題請隨卷繳回，請留意背面是否有題。

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- (A) totipotent embryonic stem cells
 - (B) pluripotent embryonic stem cells
 - (C) unipotent stem cells
 - (D) multipotent stem cells
 - (E) hematopoietic stem cell
- Ans: (A)

61. Nitric oxide (NO) is synthesized from:

- (A) lysine
- (B) citrulline
- (C) spermine
- (D) spermidine
- (E) arginine

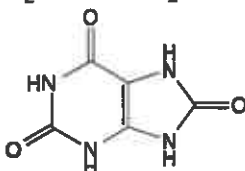
Ans: (E)

62. In the binding of oxygen to hemoglobin, the relationship between the concentration of oxygen and the fraction of binding sites occupied can be best described as:

- (A) hyperbolic
- (B) linear with a negative slope
- (C) linear with a positive slope
- (D) random
- (E) sigmoidal

Ans: (E)

63. Which one is the essential ingredient for biosynthesis of fatty acid?

- (A) $\text{-O}_2\text{C-CH}_2\text{-C(=O)-CoA}$
- (B) $\text{-O}_2\text{C-CH}_2\text{-C(=O)-CH}_3$
- (C) $\text{-O}_2\text{C-CH}_2\text{-CH(OH)-CH}_3$
- (D) $\text{H}_2\text{N-C(=O)-NH}_2$
- (E) 

Ans: (A)

64. The urea cycle and citric acid cycle are linked by

- (A) citrulline and fumarate.
- (B) citrulline and ornithine.
- (C) citrulline and argininosuccinate.
- (D) ornithine and arginine.
- (E) fumarate and aspartate.

Ans: (E)

65. Which one is **not** a derivative of cholesterol?

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- (A) cortisol
- (B) testosterone
- (C) arachidonic acid
- (D) bile acid
- (E) vitamin D₃

Ans: (C)

66. 5-Fluorouracil (5-FU) is used to treat cancers. It is a mechanism-based inhibitor of _____.

- (A) ribonucleotide reductase
- (B) thymidylate synthase
- (C) adenylosuccinate lyase
- (D) GMP synthetase
- (E) xanthine oxidase

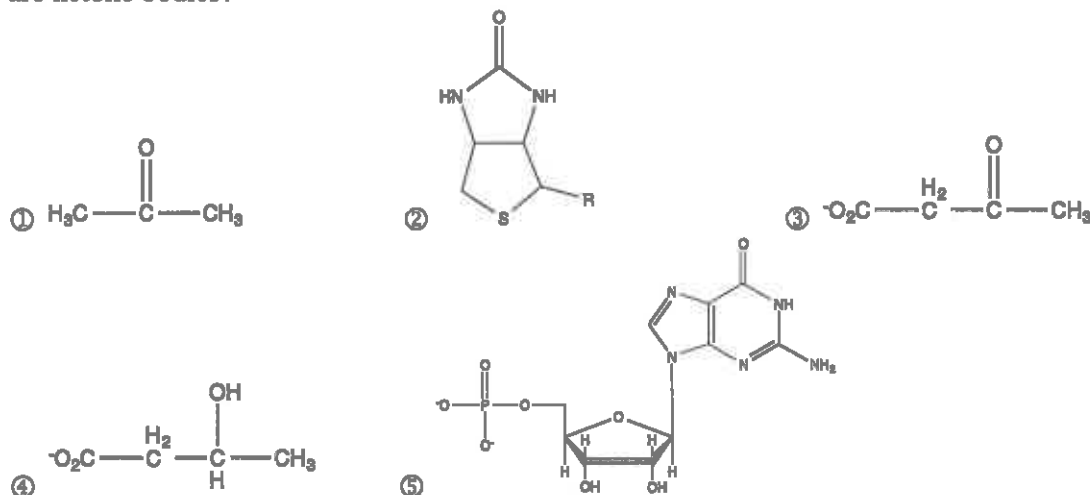
Ans: (B)

67. In amino acid metabolism, threonine is converted into acetyl-CoA and pyruvate while proline is converted into α -ketoglutarate. Classify each of these amino acids.

- (A) Threonine and proline are ketogenic.
- (B) Threonine is ketogenic and glucogenic; proline is ketogenic.
- (C) Threonine is ketogenic; proline is glucogenic.
- (D) Threonine is ketogenic and glucogenic; proline is glucogenic.
- (E) None of the above.

Ans: (D)

68. Ketone bodies are produced by the β -oxidation of an excess of acetyl-CoA. Which of the followings are ketone bodies?



- (A) ①②③
- (B) ①③④
- (C) ②④
- (D) ③④
- (E) ②④⑤

Ans: (B)

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69. Many biomolecules are derived from amino acid precursors. Serotonin and dopamine are synthesized from _____ and _____, respectively.
(A) histidine; tyrosine
(B) phenylalanine; tryptophan
(C) tryptophan; tyrosine
(D) histidine; tryptophan
(E) tryptophan; histidine
Ans: (C)
70. Several nucleotide bases undergo spontaneous loss of their exocyclic amino groups (deamination). Deamination of the nucleotide bases cytosine and 5-methylcytosine yields nucleotide bases:
(A) hypoxanthine and xanthine, respectively.
(B) uracil and thymine, respectively.
(C) uracil only.
(D) uracil and hypoxanthine, respectively.
(E) thymine and uracil, respectively.
Ans: (B)
71. If a cell were unable to synthesize or obtain tetrahydrofolic acid (H_4 folate), it would probably be deficient in the biosynthesis of:
(A) isoleucine
(B) leucine
(C) lysine
(D) methionine
(E) serine
Ans: (D)
72. Which of the following statements explains why allopurinol is able to prevent gout?
(A) It binds to uric acid thus preventing the formation of uric acid crystals.
(B) It acts as a diuretic to increase the elimination of uric acid.
(C) It inhibits the production of uric acid and allows for the more highly soluble xanthine and hypoxanthine to be excreted from the body.
(D) It stimulates the purine salvage pathway, thus eliminating the need for production of uric acid.
(E) None of the above.
Ans: (C)
73. In anaerobic circumstances, the re-oxidation of NADH generated during glycolysis occurs through the following reaction:
(A) fructose 1,6-bisphosphate $\rightarrow$ glyceraldehyde-3P + dihydroxyacetone-P
(B) glyceraldehyde-3P $\rightarrow$ 1,3-DPG
(C) pyruvate $\rightarrow$ lactate
(D) dihydroxyacetone-P $\rightarrow$ glyceraldehyde-3P
(E) malate $\rightarrow$ oxaloacetate
Ans: (C)
74. Asians and Native Americans may experience flushing and discomfort after consuming a small amount of ethanol in alcoholic beverages. This reaction is attributed to genetic variation in an enzyme responsible for metabolizing the liver metabolite of alcohol. What is this metabolite?
(A) methanol
(B) acetone

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- (C) glycerol
- (D) acetaldehyde
- (E) pyruvate
- Ans: (D)

75. Match the correct form of tetrahydrofolate with the corresponding reaction for which it acts as a coenzyme.

- (A) 5,10-methenyl-THF: biosynthesis of purines
- (B) 5-methyl-THF: dUMP → dTMP
- (C) 5,10-methylene-THF: glycine → serine
- (D) 5,10-methenyl-THF: methionine → homocysteine
- (E) All of the above
- Ans: (C)

76. The percentage saturation of hemoglobin by oxygen is increased when one of the following is increased:

- (A) concentration of 2,3 bisphosphoglycerate
- (B) concentration of hydrogen ions
- (C) concentration of Hb
- (D) partial pressure of CO₂
- (E) partial pressure of O₂
- Ans: (E)

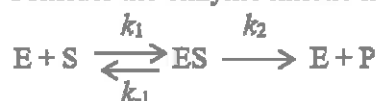
77. Which of the following describes the coenzyme involved with thymidylate synthase?

- (A) 5-methyl-THF serves as the methyl donor.
- (B) 10-methyl-THF serves as the methyl donor.
- (C) 5,10-methylene-THF serves as both methylene donor and reducing agent.
- (D) 5,10-methenyl-THF serves as both methylene donor and reducing agent.
- (E) S-adenosylmethionine serves as the methyl donor.
- Ans: (C)

78. Which statement regarding allosteric regulation of enzyme activity is false?

- (A) Allosteric regulators can either activate or inhibit enzyme function.
- (B) Binding of allosteric effectors induces a conformational change in the enzyme.
- (C) Homotropic allosteric effectors compete with substrate for binding sites.
- (D) Allosteric enzymes usually consist of multiple subunits.
- (E) Sigmoidal kinetic plots are indicative of the presence of allosteric binding sites.
- Ans: (C)

79. Consider the enzyme kinetic model:



Which expression best describes the INITIAL rate of ES formation under the standard Michaelis-Menten quasi steady-state assumption?

- (A) $k_1[E][S]$
- (B) $k_1[E][S] - k_{-1}[ES]$
- (C) $k_1[E][S] - (k_{-1} + k_2)[ES]$
- (D) $k_2[ES]$
- (E) $k_{-1}[ES] + k_2[ES]$

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Ans:(A)

80. In bacteria, the biosynthetic routes for proline and arginine diverge when glutamate is N-acetylated for arginine synthesis. Which of the following explains why acetylation is required for arginine synthesis but not proline synthesis?

- (A) Acetylation alters the pK_a of the amine group.
- (B) Acetylation prevents reduction of the amine group in N-acetylglutamate- δ -semialdehyde.
- (C) Acetylation activates the amine group for synthesis of the guanidine group of arginine.
- (D) Acetylation prevents the cyclization of N-acetylglutamate- δ -semialdehyde.
- (E) None of the above.

Ans: (D)

81. In skeletal muscle, PFK-2 is not subject to regulation by phosphorylation. However, in the liver, what is the effect of dephosphorylation of PFK-2?

- (A) Degradation of fructose-1,6-bisphosphate
- (B) Increased transcription of PFK-2
- (C) Increased turnover of PFK-2
- (D) Reduced production of fructose-2,6-bisphosphate
- (E) Enhanced production of fructose-2,6-bisphosphate

Ans:(E)

82. A researcher wants to isotope label purines with ^{15}N for future spectroscopic studies. Which substrates when labeled with the heavy nitrogen would result in the most ^{15}N -enriched purines through de novo synthesis?

- (A) Glutamine, aspartate, glycine
- (B) Glycine, glutamine, N^{10} -formyl-THF
- (C) Aspartate, glutamine, asparagine
- (D) Glycine, carbamoyl aspartate, glutamine
- (E) Aspartate, glycine, 5-phosphoribosyl- α -pyrophosphate

Ans: (A)

83. Different carbon positions of ^{14}C -labeled glucose are tested within the crude tissue extract containing enzymes from the pentose phosphate pathway. Which specific carbon position will lead to the fastest generation of $^{14}\text{CO}_2$:

- (A) C-6
- (B) C-5
- (C) C-4
- (D) C-3
- (E) C-1

Ans:(E)

84. Which of the following is true regarding the control of pyruvate dehydrogenase?

- (A) It is inhibited by succinyl-CoA.
- (B) It is activated by acetyl-CoA.
- (C) It is inhibited by ATP.
- (D) It is inhibited by NAD^+ .
- (E) None of the above.

Ans:(C)

85. Which of the following is an end product of glucose metabolism via either aerobic or anaerobic

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means?

- (1) fructose
- (2) carbon dioxide
- (3) lactate

- (A) (1) and (2)
- (B) (2) and (3)
- (C) (1) only
- (D) (2) only
- (E) (3) only

Ans:(B)

86. Which is the order of compounds produced in the conversion of glucose to pyruvate?

(PEP = phosphoenolpyruvate)

- (1) fructose-6-phosphate
- (2) 1,3-phosphoglyceric acid
- (3) fructose-bisphosphate
- (4) PEP
- (5) 3-phosphoglyceric acid

- (A) (1), (2), (3), (4), (5)
- (B) (1), (3), (2), (5), (4)
- (C) (2), (3), (1), (4), (5)
- (D) (2), (3), (1), (5), (4)
- (E) (3), (1), (2), (5), (4)

Ans:(B)

87. What will occur when insulin is released?

- (A) Insulin binds to receptors on cell surfaces.
- (B) A protein kinase cascading leads to glycogen synthesis.
- (C) Insulin stimulates the GLUT4 transport protein system in muscle cells.
- (D) Glucose transporters move glucose out of the blood and into the cell.
- (E) All of the above.

Ans:(E)

88. Which of the following is a regulatory enzyme in gluconeogenesis?

- (1) pyruvate kinase.
- (2) pyruvate carboxylase.
- (3) phosphoenolpyruvate carboxykinase.
- (4) glucose-6-phosphatase.

- (A) (1), (2) and (3)
- (B) (1), (2) and (4)
- (C) (2), (3) and (4)
- (D) (2) and (3)
- (E) (1), (2), (3) and (4)

Ans:(C)

89. Which of the following statement is true about lipoic acid?

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- (A) It contains one disulfide group in its reduced form and two sulfhydryl groups in its oxidized form.
- (B) It contains one disulfide group in its oxidized form and two sulfhydryl groups in its reduced form.
- (C) It contains two disulfide groups in its reduced form and one sulfhydryl group in its oxidized form.
- (D) It contains two disulfide groups in its oxidized form and one sulfhydryl group in its reduced form.
- (E) None of the above.

Ans:(B)

90. Which of the following statement regarding electron transport and ATP synthesis is **not** true?

- (1) The synthesis of ATP is directly linked to the oxidation of NADH.
- (2) The synthesis of ATP in mitochondria is driven by a proton or pH gradient.
- (3) The reoxidation of NADH and FADH₂ indirectly creates a proton gradient that is involved in ATP synthesis.

- (A) (1) only
- (B) (2) only
- (C) (3) only
- (D) All are correct
- (E) None is correct.

Ans:(A)