高雄醫學大學 108 學年度學士後醫學系招生考試試題

科目：普通生物學及生化概論　　考試時間：100 分鐘

說明：一、選擇題用 2B 鉛筆在「答案卡」上作答，修正時應以橡皮擦擦拭，不得使用修正液(帶)，未遵照正確作答方法而致電腦無法判讀者，考生自行負責。
二、試題及答案卡必須繳回，不得攜出試場。

I.【單選題】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。
1~15 題為普通生物學，16~30 題為生化概論。

1. If a long-day plant has a critical night length of 10 hours, which of the 24-hour cycles would prevent flowering?
(A) 16 hours light/8 hours dark
(B) 13 hours light/11 hours dark
(C) 15 hours light/9 hours dark
(D) 4 hours light/8 hours dark/4 hours light/8 hours dark
(E) 8 hours light/8 hours dark/light flash/8 hours dark

2. Which of the following species is most likely to be a candidate for geographical isolation?
(A) bat (B) land snail (C) squirrel (D) salt-water fish (E) sparrow

3. Which of the following characteristics adds most to vertebrate success in terrestrial environments?
(A) the amniotic egg (B) the ability to maintain a constant body temperature
(C) two pairs of appendages (D) claws
(E) a four-chambered heart

4. Which of the following statements is **not** true for the prophase I of meiosis?
(A) Homologous chromosomes are pairing.
(B) Each homologous chromosome consists of two sister chromatids.
(C) Each chromosome consists of single strand of DNA.
(D) The pairing homologs are joined by the synaptonemal complex.
(E) Chiasmata occur between non-sister chromatids.

5. Which cells in a plant root form a protective barrier to the vascular system where all materials must move through the symplast?
(A) Cortex (B) Pericycle (C) Epidermis (D) Endodermis (E) Exodermis

6. What are the wavelengths of light that chlorophyll absorbs most strongly?
(A) Blue and red (B) Blue and green (C) Green and yellow
(D) UV and infrared (E) UV and blue

7. Which statement about human reproduction is **correct**?
(A) Fertilization occurs in the uterus.
(B) In humans, spermatogenesis and oogenesis function best at normal, core body temperatures.
(C) A human oocyte completes meiosis after a sperm penetrates it.
(D) The earliest stages of spermatogenesis are found closest to the lumen of the seminiferous tubule.
(E) Sertoli cells produce testosterone under FSH stimulation.

8. Which of the following hormones is the most useful for promoting the growth of the root after plant cuttings?
(A) Abscisic acid (B) Auxins (C) Cytokinins (D) Gibberellins (E) Oligosaccharins

9. Given the parents TTEECc × TteeCc, assume simple dominance for each trait and independent assortment. What proportion of the progeny will be expected to phenotypically resemble the first parent (TTEECc)?
(A) 1/4 (B) 1/8 (C) 3/4 (D) 3/8 (E) 1

10. A genetic change that caused a certain Hox gene to be expressed along the tip of a vertebrate limb bud instead of further back made possible the evolution of the tetrapod limb. This type of change is an illustration of _____.
(A) heterochrony, a change in the timing of developmental events
(B) allopolyploidy, an increase in chromosome number
(C) paedomorphosis, or retention of ancestral juvenile structures in an adult organism
(D) a change in a homeotic developmental gene that altered the spatial organization of body parts
(E) allopatric speciation

11. The conversion of fibrinogen to fibrin _____.
    (A) occurs when fibrinogen is released from broken platelets
    (B) occurs within red blood cells
    (C) is linked with hypertension and may damage artery walls
    (D) is likely to occur too often in an individual with hemophilia
    (E) is the final step of a clotting process that involves multiple clotting factors

12. Which of the following type of leukocyte would play a role as "antigen presenting cells" and trigger the MHC class II mediated immune response?
    (A) Basophils (B) Eosinophils (C) T lymphocytes
    (D) Macrophages (E) Neutrophils

13. The components of the endomembrane system of cells **don't** include _____.
    (A) nuclear envelope (B) endoplasmic reticulum (C) vacuoles
    (D) plasma membrane (E) mitochondrion

14. Which area of the human brain contains the rhythmic breathing control center?
    (A) Neocortex (B) Hippocampus (C) Thalamus
    (D) Medulla (E) Cerebellum

15. _____ absorb products of photosynthesis from living host plants.
    (A) Epiphytes (B) Carnivorous plants (C) Xerophytes
    (D) Halophytes (E) Parasitic plants

16. An enzyme with a high turnover number has_____.
    (A) a low K_m (B) a high k_{cat} (C) a high V_{max} (D) a high k_{cat}/K_m (E) a high K_m

17. Which of the following descriptions for myoglobin is **correct**?
    (A) Myoglobin contains four subunits.
    (B) The binding of O_2 with myoglobin shows cooperative kinetic.
    (C) O_2 binds with Fe^{3+} of heme group in myoglobin.
    (D) 2,3-BPG does not affect the binding of O_2 with myoglobin.
    (E) Myoglobin and hemoglobin are not evolutionarily related.

18. Which of the following parts of the IgG molecule are **not** involved in binding to an antigen?
    (A) Heavy chain (B) Light chain (C) Fab (D) Fc (E) Variable domain

19. Aspirin is well-known as an inhibitor of_____.
    (A) lipoxygenase (B) hormone sensitive lipase (C) cyclooxygenase
    (D) fatty acid synthase (E) acetyl-CoA carboxylase

20. Which is **not** derived from arachidonic acid?
    (A) lipoxin (B) prostaglandin (C) thromboxane (D) leukotriene (E) prednisone

21. In fatty acid synthesis, acetyl group is shuttled out of mitochondria as:
    (A) pyruvate (B) oxaloacetate (C) α-ketoglutarate (D) glutamine (E) citrate

22. Which of the metabolites in the urea cycle is linked to the citric acid cycle?
    (A) Citrulline (B) Argininosuccinate (C) Arginine (D) Ornithine (E) Urea

23. Which of the following amino acids is the crucial precursor for the biosynthesis of melatonin?
    (A) Phenylalanine (B) Methionine (C) Lysine (D) Tryptophan (E) Tyrosine

24. Which is **not** an electron acceptor in the mitochondrial respiratory chain?
    (A) FMN (B) FAD (C) Fe^{3+} (D) Cu^{2+} (E) Coenzyme A

25. Which is the active sugar in glycogen synthesis in animal?
    (A) CDP-glucose (B) GDP-glucose (C) UDP-glucose
    (D) Glucose 6-phosphate (E) Glucose 1-phosphate

26. Which of the following compounds is **not** a product of the enzymatic steps in the citric acid cycle?
    (A) Acetyl-CoA (B) α-ketoglutarate (C) Succinate (D) Fumarate (E) Malate

27. Gout is caused by aberrant degradation of purine, leading to accumulation of uric acid. Allopurinol inhibits_____, leading to reduce the production of uric acid.
    (A) purine nucleoside phosphorylase
    (B) xanthine oxidase
    (C) nucleotidase
    (D) urease
    (E) hypoxanthine-guanine phosphoribosyltransferasse

28. Which of the following enzymes **cannot** catalyze the formation of a phosphodiester bond?
(A) RNA polymerase (B) DNA polymerase (C) Ligase
(D) Endonuclease (E) Reverse transcriptase

29. Histones are found in eukaryotic cell nuclei that package and order the DNA into structural units called nucleosomes. They are usually rich in _____, and they interact with DNA via _____.
(A) lysine and arginine; ionic bonds
(B) glutamic acid and aspartic acid; hydrogen bonds
(C) alanine and glycine; ionic bonds
(D) lysine and arginine; hydrogen bonds
(E) glutamic acid and aspartic acid; ionic bonds

30. The binding of _____ with *lac* repressor can activate the transcription of *lac* operon.
(A) arabinose (B) isopropyl β-thiogalactoside (C) tryptophan
(D) β-galactosidase (E) mannose

Ⅱ.【單選題】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。
31~60 題為普通生物學，61~90 題為生化概論。

31. Phenylketonuria is an autosomal recessive inheritable disease. If the incidence of the disease is about 1/10000, what is the frequency of the phenylketonuria recessive disease allele (a) and the (Aa) genotype frequency of the person carrying the recessive gene in the population?
(A) 0.1% and 0.99% (B) 0.1% and 1.98% (C) 1% and 3.96%
(D) 1% and 1.98% (E) 0.1% and 3.198%

32. Which of the following features belong to the coral?
1. a gastrovascular cavity
2. a polyp stage
3. a medusa stage
4. cnidocytes
5. a pseudocoelom
(A) 1 and 4 (B) 2 and 3 (C) 2, 3, and 4 (D) 1, 2, 3, and 4 (E) all five of these

33. What is the **correct** sequence of the following steps during the human excretory system?
(A) excretion → filtration → secretion → reabsorption
(B) filtration → reabsorption → secretion → excretion
(C) excretion → filtration → reabsorption → secretion
(D) excretion → filtration → secretion
(E) filtration → excretion → reabsorption → secretion

34. In which of the following conditions, asexual reproduction results in greater reproductive success than does sexual reproduction?
(A) When pathogens are rapidly diversifying.
(B) When a species has accumulated numerous deleterious mutations.
(C) When there is some potential for rapid overpopulation.
(D) When a species is expanding into diverse geographic settings.
(E) When a species is in stable and favorable environments.

35. Which of the following does **not** tend to promote speciation?
(A) The founder effect (B) Gene flow (C) Natural selection
(D) Polyploidy (E) Disruptive selection

36. What is the response a plant would react to an attack from herbivores?
(A) Leaf abscission to prevent further loss of tissue.
(B) Early flowering to reproduce before being eaten.
(C) Production of chemical compounds for defense or to attract predators of the herbivores.
(D) Production of physical defenses, such as thorns.
(E) Production of thicker bark and cuticle to make it more difficult to eat.

37. A healthy young man ingests a large volume of distilled water and 50 min later a study is undertaken. In which of the following parts in his kidneys would the liquid with the greatest osmolarity be found?
(A) Proximal tubule
(B) The bottom of the loop of Henle of the cortical nephron
(C) The bottom of the loop of Henle of the juxtamedullary nephron
(D) Distal tubule of the juxtamedullary nephron
(E) The innermost medullary collecting duct

38. Which of following statements about human digestive function is **incorrect**?
(A) When food bolus enters the stomach, gastrin is secreted into the gastric lumen.
(B) Secretin released from duodenum inhibits the secretion of gastric juice.
(C) CCK released from duodenum stimulates the secretion of pancreatic enzymes.
(D) The vagus nerve activates the parietal cells of stomach when a bite of food enters the mouth.
(E) Increased sympathetic activity would slow down the motility of digestive tract.

39. Which of the following statements about human respiration is **true**?
(A) Most of the carbon dioxide in the blood is bound to hemoglobin.
(B) Increased pH level decreases affinity of hemoglobin for O_2 and improves the unloading reaction.
(C) At normal systemic venous P_{O2}, about 25% of the hemoglobin is in the form of oxyhemoglobin.
(D) Surfactants can increase the surface tension of the lungs.
(E) During an unforced exhalation, alveolar pressure is greater than atmospheric pressure.

40. Which event occurs after the first heart sound and before the second heart sound in human cardiac cycle?
(A) Ventricular relaxation (B) Aortic systolic pressure (C) AV valves open
(D) P wave of the ECG (E) Blood volume in ventricle increases

41. In a neuroscience lab, a student increased the concentration of K^+ outside a neuron from 5 mM to 10 mM, while maintaining other ion concentrations as they were. What would happen to the neuron's membrane potential?
(A) The membrane potential would become more negative.
(B) The membrane potential would become less negative.
(C) The membrane potential would remain the same.
(D) The membrane potential would be closer to the K^+ equilibrium potential.
(E) There would be no potential difference across the membrane.

42. Which of the following is **not** true about helper T cells?
(A) They function in both cell-mediated and humoral immune responses.
(B) They bear surface CD4 molecules.
(C) They recognize polysaccharide fragments presented by infected cells.
(D) They are subject to infection by HIV.
(E) When activated, they secrete cytokines that stimulate other lymphocytes.

43. Which of the following statements about vision is **not** true?
(A) Rods are more light-sensitive than cones and are responsible for night vision.
(B) Color vision results from the presence of three subclasses of cones in the retina.
(C) Perception of visual information takes place in the cerebral cortex.
(D) All information from the left eye goes to the right visual cortex and all information from the right eye goes to the left visual brain.
(E) The ciliary muscles relax if you look away from this page and focus your eyes on a distant object and the lens is flattened.

44. Which of the following sensory receptors is **incorrectly** paired with its category?
(A) Photoreceptor — rod cell in retina
(B) Nociceptor — muscle spindle
(C) Chemoreceptor — taste receptor in tongue
(D) Mechanoreceptor — hair cell in cochlea
(E) Electroreceptor — hair cell in ampulla of Lorenzini

45. Within a few weeks of treatment with the drug 3TC, a patient's HIV population consists entirely of 3TC-resistant viruses. What is the best explanation?
(A) HIV has the ability to change its surface proteins and resist vaccines.
(B) The patient must have become reinfected with 3TC-resistant viruses.
(C) HIV began making drug-resistant versions of reverse transcriptase in response to the drug.
(D) A few drug-resistant viruses were present at the start of treatment, and natural selection increased their frequency.
(E) Some viruses developed drug resistance and then passed their function.

46. A founder event favors microevolution in the founding population mainly because _____.
(A) mutations are more common in a new environment
(B) a small founding population is subject to extensive sampling error in the composition of its gene pool
(C) the new environment is likely to be patchy, favoring diversifying selection
(D) gene flow increases
(E) members of a small population tend to migrate

47. Which of the following descriptions are **correct**?
1. Green algae — closest relative of green plants
2. Brown algae — includes the largest seaweeds
3. Diatoms — examples of stramenopiles
4. Dinoflagellates — glass, two-part shells
5. Red algae — has no flagellated stages in life cycle

(A) 1234 (B) 2345 (C) 1245 (D) 1235 (E) 2345

48. Which of the following is an example of an opportunistic pathogen that can cause a mycosis?
(A) *Claviceps pururea*, which produces ergots on rye that can cause serious symptoms in humans if milled into flour
(B) *Ophiostoma ulmi*, which causes Dutch elin disease
(C) the ascomycetes that causes ringworm
(D) *Candida albicans*, which causes vaginal yeast infections
(E) the mold Penicillium, an ascomycete that is now grown in liquid culture to produce antibiotics

49. Which of the following hormones is produced by adipose cells that helps to control appetite?
(A) Insulin (B) Neuropeptide Y (C) Glucagon
(D) Leptin (E) Ghrelin

50. The high osmolarity of the renal medulla is maintained by all of the following **except** _____.
(A) diffusion of salt from the ascending limb of the loop of Henle
(B) active transport of salt from the upper region of the ascending limb
(C) the spatial arrangement of juxtamedullary nephrons
(D) diffusion of urea from the collecting duct
(E) diffusion of salt from the descending limb of the loop of Henle

51. When light strikes the pigment rhodopsin in a rod cell, retinal dissociates from opsin, initiating a signal-transduction pathway that _____.
(A) depolarizes the neighboring bipolar cells and initiates an action potential in a ganglion cell
(B) depolarizes the rod cell, causing it to release the neurotransmitter glutamate, which excites bipolar cells
(C) hyperpolarizes the rod cell, reducing its release of glutamate, which excites some bipolarcells and inhibits others
(D) hyperpolarizes the rod cell, reducing its release of glutamate, which excites amacrine cells but inhibits horizontal cells
(E) converts cGMP to GMP, opening sodium channels and hyperpolarizing the membrane, causing the rhodopsin to become bleached

52. The transduction of sound waves to action potentials takes place _____.
(A) within the tectorial membrane as it is stimulated by the hair cells
(B) when hair cells are bent against the tectorial membrane, causing them to depolarized and release neurotransmitter molecules that stimulate sensory neurons
(C) as the basilar membrane becomes more and depolarizes, initiating an action potential in a sensory neuron
(D) as the basilar membrane vibrates at different frequencies in response to the varying volume of sounds
(E) within the middle ear as the vibrations are amplified by the malleus, incus, and stapes

53. Which one of the following hormones could raise the level of basal metabolic rate (BMR)?
(A) Calcitonin (B) Thyrocalcitonin (C) Triiodothyronine
(D) Dexamethasone (E) Parathyroid hormone

54. Which of the following amino acid and the derivative is **not** proved to be a neurotransmitter?
(A) Glycine (B) Glutamic acid (C) Aspartic acid
(D) Gamma-aminobutyric acid (E) Histamine

55. Which of the following chemicals from plants has been using as an indicator to measure the glomerular filtration rate (GFR) in clinical, because it cannot be re-absorbed and secreted in nephron tubules.
(A) Creatinin (B) Inulin (C) Digitalis
(D) Colchicine (E) Alkaloids

56. Which of the following statements is **true**?
(A) In Crassulacean acid metabolism (CAM) plants, carbon fixation and the Calvin cycle occur in the same cells at different times. The Calvin cycle of CAM plants occurs during the night, so that the Calvin cycle is also named the dark reaction.
(B) Pineapples are CAM plants.
(C) For C_4 plants, the Calvin cycle is mainly carried out in the mesophyll cells.
(D) C_3 plants are more resistant to drought than C_4 plants.
(E) Photorespiration occurs when stomata of C_3 plants are fully open during the day.

57. Which of the following traits is shared by charophytes and land plants?
(A) Alternation of generations
(B) Walled spores produced in sporangia
(C) Multicellular gametangia
(D) Formation of phragmoplast
(E) Apical meristems

58. Which of the following statements for characteristics of monocots and eudicots is **not** true?
(A) Veins of monocots are usually parallel; veins of eudicots are usually netlike.
(B) Stem vascular tissues of monocots are usually scattered; stem vascular tissues of eudicots are usually arranged in ring.
(C) The root system of monocots are usually fibrous (no main root); taproots are usually present in the root system of eudicots.
(D) There are three openings on every pollen grain of monocots; there is one opening on every pollen grain of eudicots.
(E) Floral organs of monocots are usually in multiples of three; floral organs of eudicots are usually in multiples of four or five.

59. In the process of double fertilization, one sperm nucleus undergoes fusion with the egg nucleus and the other with the _____nuclei.
(A) integument (B) polar (C) endosperm
(D) funiculus (E) nucellus

60. Which of the following statements for cellular respiration and photorespiration is **false**?
(A) Both of these two reactions consume O_2.
(B) CO_2 is among the final products of these two reactions.
(C) Adenosine triphosphates (ATPs) are consumed in the processes of these two reactions.
(D) ATP is among the final products of these two reactions.
(E) All vascular plants are able to conduct cellular respiration, while photorespiration mainly happen to C_3 plants.

61. A mixture of four amino acids is separated by using a cation exchanger with an elution gradient of increasing NaCl solution. What is the correct elution sequence?
(A) Asp, Lys, Arg, Ser (B) Asp, Ser, Lys, Arg (C) Asp, Arg, Ser, Lys
(D) Ser, Asp, Arg, Lys (E) Lys, Arg, Ser, Asp

62. For an α-helix has the sequence : $^{+}H_3N$-Asp-Trp-Gln-Leu-His-Val-Phe-Ala-Lys-Val-Glu-COO^{-}, the carbonyl oxygen (in the peptide bond) of the histidine residue is hydrogen bonded to the amide nitrogen of _____.
(A) Trp (B) Lys (C) Val (D) Gln (E) Leu

63. The carbohydrate moiety is always attached to glycoproteins through _____.
(A) aspartate, glutamate or tyrosine (B) tryptophan, glutamine or alanine
(C) cysteine, phenylalanine or histidine (D) asparagine, serine or threonine
(E) valine, leucine or isoleucine

64. Which of the backbone repeated units of polysaccharides is **not** correct?
(A) Amylose: (α1-4) Glc (B) Dextran: (α1-6) Glc (C) Glycogen: (α1-4) Glc
(D) Cellulose: (β1-4) Glc (E) Chitin: (β1-4) Glc

65. Taking one mole of glucose through glycolysis and the citric acid cycle generates:
(A) 6 CO_2, 8 $NADH/H^+$, 1 $FADH_2$ and 1 ATP
(B) 6 CO_2, 8 $NADH/H^+$, 1 $FADH_2$ and 2 ATP
(C) 6 CO_2, 8 $NADH/H^+$, 2 $FADH_2$ and 4 ATP
(D) 6 CO_2, 10 $NADH/H^+$, 2 $FADH_2$ and 2 ATP
(E) 6 CO_2, 10 $NADH/H^+$, 2 $FADH_2$ and 4 ATP

66. Which of the following is a hetero-polysaccharide?
(A) Cellulose (B) Chitin (C) Glycogen (D) Hyaluronate (E) Starch

67. Glycoaminoglycans consist of a linear chain of repeating disaccharides. Which of the following polysaccharide is **not** glycoaminoglycans?
(A) Chondroitin sulfate (B) Keratan sulfate (C) Dermatan sulfate
(D) Heparin (E) Sialic acid

68. Gluconeogenesis synthesizes glucose, while glycolysis catabolizes glucose. It is evident that gluconeogenesis and glycolysis must be controlled in reciprocal fashion. Which of the following enzymes for glycolysis are **not** used in the gluconeogenic pathway? ① Hexokinase ② Phosphofructokinase ③ Phosphoglycerate kinase ④ Triosephosphate isomerase ⑤ Pyruvate kinase
(A) ①②③ (B) ①②④ (C) ①②⑤ (D) ②③⑤ (E) ③④⑤

69. The potent allosteric activator for phosphofructokinase-1 in glycolysis is _____.
(A) fructose 1,6-bisphosphate (B) citrate (C) ATP
(D) fructose 2,6-bisphosphate (E) acetyl-CoA

70. Which of the following compounds can prevent electron transfer from the Fe-S center to ubiquinone in oxidative phosphorylation process?
(A) Rotenone (B) Cyanide (C) 2,4-Dintrophenol (D) Oligomycin (E) Valinomycin

71. Which of the following fatty acids **cannot** be synthesized by human?
(A) Linoleate [18:2($\Delta^{9,12}$)] (B) Stearate (18:0) (C) Oleate [18:1(Δ^{9})]
(D) Palmitoleate [16:1(Δ^{9})] (E) Arachidonate [20:4($\Delta^{5,8,11,14}$)]

72. Ketone bodies are overproduced in diabetes and during starvation. Which of the following metabolites is **not** an intermediate from two molecules of acetyl-CoA to acetone?
(A) Acetoacetyl-CoA (B) β-hydroxy-β-methylglutaryl-CoA (C) Acetoacetate
(D) β-hydroxybutyrate (E) CoA-SH

73. Which is **not** involved in fatty acid oxidation?
(A) Starts from carboxylate end
(B) Acyl-CoA dehydrogenase
(C) Acyl-CoA hydratase
(D) β-hydroxyacyl-CoA dehydrogenase
(E) Acyl-CoA acetyltransferase

74. Which is the potent inhibitor of carnitine acyltransferase I?
(A) Carnitine (B) Acetyl-CoA (C) Malonyl-CoA (D) Succinyl-CoA (E) Fumarate

75. Flippases are enzymes that flip _____.
(A) phospholipids across to the other side of a membrane
(B) cholesterol from one organelle to another
(C) protons across to the other side of a membrane
(D) D-glucose to L-glucose
(E) L-form amino acids to D-form amino acids

76. Degradation of amino acids can produce the precursors that are used to synthesize glucose or convert to ketone bodies. Which of the following amino acids can convert into precursors for the synthesis of glucose?
① Leucine ② Lysine ③ Cysteine ④ Asparagine ⑤ Methionine
(A) ①②③ (B) ①②④ (C) ②③④ (D) ②④⑤ (E) ③④⑤

77. A deficiency of branched chain α-keto acid dehydrogenease complex causes the defect in metabolism of amino acids. The accumulation of α-keto acid in urine leads to maple syrup urine disease. Which of the following amino acids are metabolized by α-keto acid dehydrogenease complex?
① Methionine ② Leucine ③ Isoleucine ④ Valine ⑤ Alanine
(A) ①②⑤ (B) ①③⑤ (C) ②③④ (D) ②④⑤ (E) ③④⑤

78. Defect in metabolism of phenylalanine causes phenylketounia and alkaptonuria. Which of the following statements are **correct**? ① A person with phenylketonuria will convert phenylalanine to phenylpyruvate. ② A person suffering from phenylketonuria on consumption food containing high phenylalanine may lead to the accumulation of tyrosine. ③ A person with phenylketonuria is advised not to consume aspartame. ④ Alkaptonuria is due to defect in phenylalanine hydroxylase. ⑤ A person suffering from phenylketonuria on consumption food containing high phenylalanine may lead to the accumulation of acetoacetyl-CoA.
(A) ①② (B) ①③ (C) ①④ (D) ②③ (E) ②⑤

79. The *de novo* purine nucleotide synthesis relies upon the conversion of _____ to _____as a primary source of one carbon unit.
(A) alanine; pyruvate (B) phenylalanine; tyrosine (C) serine; glycine
(D) glutamate; α-ketoglutarate (E) aspartate; oxaloacetate

80. Which of the following statements for thermal denatuation of DNA are **false**? ① The absorption of ultraviolet at 260 nm increases. ② The DNA helical structure unwinds. ③ The covalent N-glycosidic bond between the base and the deoxyribose breaks. ④ The melting temperature of DNA with 60% A+T content is lower than that with 20% G+C content. ⑤ The double-helical DNA becomes single-stranded DNA at melting temperature.
(A) ①③⑤ (B) ①③④ (C) ①④⑤ (D) ②③④ (E) ③④⑤

81. Which of the following enzymes does **not** require a template?
(A) RNA polymerase II (B) DNA polymerase
(C) Polyadenylate polymerase (D) Telomerase
(E) Reverse transcriptase

82. Which is **not** a true statement about reverse transcriptase?
(A) The direction of polynucleotide synthesis is 5' → 3'.
(B) It has 3' → 5' exonuclease activity.
(C) It synthesizes DNA complementary to an RNA template.
(D) It synthesizes DNA complementary to a DNA template.
(E) It degrades the RNA strand of the RNA-DNA hybrid.

83. Many proteins are involved in DNA replication of *E. coli*. Which of the following pairs of protein and function are **correct**? ① DNA gyrase, unwinding DNA ② DnaA, helicase ③ DNA polymerase I, excises RNA primer and fills in with DNA ④ DNA polymerase II holoenzyme, 5' → 3' exonuclease ⑤ DNA polymerase III holoenzyme, elongation (DNA synthesis)
(A) ②③⑤ (B) ②③④ (C) ①③④ (D) ①③⑤ (E) ①②⑤

84. Which DNA repair system is likely to be used in repairing DNA with an uracil residue?
(A) Base-excision repair (B) Mismatch repair (C) Direct repair
(D) Nucleotide-excision repair (E) Recombinational DNA repair

85. Aptamers are _____.
(A) double-stranded RNA products of nuclease action on hairpin RNAs
(B) repeat sequence elements at the ends of transposons
(C) small RNA molecules selected for tight binding to specific molecular targets
(D) the RNA primers required for retroviral replication
(E) the short tandem repeat units found in telomeres

86. Which of the following modification elucidates the inhibitory effect of diphtheria toxin on the function of eukaryotic translation factor eEF2?
(A) Phosphorylation (B) Dephosphorylation (C) ADP-ribosylation (D) Prenylation (E) S-Nitrosylation

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

88. Selenocysteine (Sec) and pyrrolysine (Pyl) are recognized as 21st and 22nd amino acids, respectively. $tRNA^{Sec}$ and $tRNA^{Pyl}$ have anticodon pairing with _____ and _____, respectively.
(A) UAA, CUG (B) UGA, UAG (C) UAA, UAG (D) UAG, UGA (E) UAG, UAA

89. Which step about regulation of gene expression by insulin is **not** correct?
(A) Insulin receptor binds insulin and undergoes autophosphorylation.
(B) Insulin receptor binds IRS-1 on its Tyr residues. SH3 domain of Grb2 binds to phosphorylated Tyr of IRS-1.
(C) Sos binds to Grb2, then to Ras, causing GDP release and GTP binding to Ras.
(D) Activated Ras binds and activates Raf-1.
(E) Raf-1 phosphorylates MEK. MEK phosphorylates MAPK, activating it.

90. Which description about β-adrenergic pathway (a G-protein coupling receptor; GPCR) is **not** correct?
(A) The receptor is a 7-transmembrane protein.
(B) Epinephrine binds to a GPCR.
(C) The occupied receptor could cause the replacement of the GDP bound to G_S (stimulatory G protein) by GTP, activating G_S.
(D) $G_{S\beta}$ moves to adenylyl cyclase and activates it to synthesize cAMP.
(E) cAMP activates PKA to trigger cellular response.