

112學年度 學士後醫學系招生考試

普通生物及生化概論試題封面

考試開始鈴響前，請勿翻閱本試題！

★考試開始鈴響前，請注意：

- 一、除准考證、應考文具及一般手錶外；行動電話、穿戴式裝置及其他物品均須放在臨時置物區。
- 二、請務必確認行動電話已取出電池或關機，行動電話及手錶的鬧鈴功能必須關閉。
- 三、就座後，不可擅自離開座位或與其他考生交談。
- 四、坐定後，雙手離開桌面，確認座位號碼、答案卡號碼與准考證號碼相同，以及抽屜中、桌椅下或座位旁均無非考試必需用品。如有任何問題，請立即舉手反應。
- 五、考試開始鈴響前，不得翻閱試題本或作答。
- 六、考試全程不得吃東西、喝水及嚼食口香糖。
- 七、違反上述規定，依「筆試規則及違規處理辦法」議處。

★作答說明：

- 一、考試時間：100 分鐘。
- 二、本試題（含封面）共 17 頁，如有缺頁或毀損，應立即舉手請監試人員補發。
- 三、本試題共 90 題，皆為單選題，共計 150 分；每題答錯倒扣，不作答不計分。
- 四、答題依題號順序劃記在答案卡上，寫在試題本上無效；答案卡限用 2B 鉛筆劃記，若未按規定劃記，致電腦無法讀取者，考生自行負責。
- 五、試題本必須與答案卡一併繳回，不得攜出試場。

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Choose one best answer for the following questions

【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，16~30 題為生化概論。

- Which of the following organs is found in bryophytes?
(A) Roots (B) Leaves (C) Seeds
(D) Flagellated sperm (E) Lignified cell walls
- Which evolutionary process has led to the development of analogous wings in both mammals and birds?
(A) Mutation (B) Convergent evolution (C) Divergent evolution
(D) Homology (E) Shared ancestry
- What phenomenon occurs when the electron transport chain in photosynthesis passes through protein complexes associated with photosystem I?
(A) Release of O₂ (B) Synthesis of ADP (C) Release of H₂O
(D) Release of CO₂ (E) Reduction of NADP⁺ to NADPH
- What is the role of DNA methylation in eukaryotes?
(A) To aid in silencing transcription.
(B) To protect the DNA from restriction endonucleases.
(C) To prevent nucleosome formation on that region of DNA.
(D) DNA methylation does not occur in eukaryotes, only histones are methylated.
(E) To distinguish the active X chromosome from the inactive X chromosome in counting.
- In next-generation sequencing (NGS), all of the following are true EXCEPT:
(A) NGS technologies use Sanger sequencing.
(B) It is cheaper to sequence a genome with NGS than using original sequencing technologies.
(C) Genomes are sequenced in very small snippets (“reads”).
(D) An *E. coli* genome can be sequenced overnight with NGS.
(E) Assemble sequences piece together (“assembly”) as final read.
- A low value of which of the following factors is an important predictive indicator for the development of coronary atherosclerosis and coronary heart disease?
(A) Total cholesterol (B) Triglycerides
(C) High-density lipoprotein (D) Low-density lipoprotein
(E) Mean corpuscular hemoglobin

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7. The body's automatic tendency to maintain a constant internal environment is termed _____.
(A) torpor (B) physiological chance
(C) homeostasis (D) static equilibrium
(E) estivation
8. What does a frequency of recombination of 50% indicate?
(A) Independent assortment is hindered.
(B) All of the offspring have combinations of traits that match one of the two parents.
(C) The genes are located on sex chromosomes.
(D) Abnormal meiosis has occurred.
(E) The two genes are likely to be located on different chromosomes.
9. Which of the following brain structures serves as the biological clock?
(A) Pons (B) Hippocampus (C) Medulla oblongata
(D) Hypothalamus (E) Pituitary gland
10. Which of the following statements describes pepsin?
(A) It is manufactured by the pancreas.
(B) It helps stabilize fat-water emulsions.
(C) It splits maltose into monosaccharides.
(D) It begins the hydrolysis of proteins in the stomach.
(E) It is denatured and rendered inactive in solutions with low pH.
11. Which of the following cycles involves the weathering of rocks?
(A) Nitrogen cycle (B) Phosphorus cycle (C) Carbon cycle
(D) Oxygen cycle (E) Sulfur cycle
12. When your cat hears the sound of you opening a can, it runs toward you. Which mechanism could be causing this behavior?
(A) Classical conditioning (B) Imprinting (C) Operant conditioning
(D) Social learning (E) Spatial learning
13. _____ will develop into seeds, and _____ will develop into fruits.
(A) Ovaries, carpels (B) Carpels, ovules (C) Ovaries, ovules
(D) Ovules, ovaries (E) Ovules, carpels
14. Which of the following antibodies can cross from mother to fetus?
(A) IgM (B) IgD (C) IgG (D) IgA (E) IgE

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15. There are 20 different amino acids. What makes one amino acid different from another?
- (A) Different carboxyl groups attached to an alpha (α) carbon
(B) Different amino groups attached to an alpha (α) carbon
(C) Different side chains (R groups) attached to an alpha (α) carbon
(D) Different alpha (α) carbons
(E) Different asymmetric carbons
16. When oxidative damage occurred in cell inside, which molecule in mitochondrion effluxes to cytosol and participates the apoptosis?
- (A) cytochrome a (B) cytochrome a3 (C) cytochrome b
(D) cytochrome b1 (E) cytochrome c
17. Regarding to prion hypothesis, what kind of abnormal protein structures in misfolded prion protein molecules commonly lead to large protein aggregation?
- (A) α -helix (B) β -sheet (C) type II β turn
(D) loops (E) triple helix
18. As a coenzyme, thiamin pyrophosphate can _____.
- (A) convert glucose to glucuronic acid
(B) convert pyruvate to oxaloacetate
(C) participate the transamination
(D) convert homocysteine to methionine
(E) participate the decarboxylation of α -keto acids
19. Which of the following biological molecules is NOT derived from tyrosine?
- (A) melanin (B) serotonin (C) dopamine
(D) epinephrine (E) norepinephrine
20. Which amino acid residue must be tagged on by covalent linkage of ubiquitin when proteins are targeted for proteasomal degradation?
- (A) arginine (B) lysine (C) histidine
(D) methionine (E) cysteine
21. The binding change mechanism of ATP synthesis predicts that each 360-degree rotation of the γ subunit can generate how many ATP molecules?
- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
22. What is the net charge of the following peptide at pH 7.0?
Tyr-Glu-Ser-Arg-Met-Thr-Asp-Asn-Tyr-His
- (A) +2 (B) +1 (C) 0 (D) -1 (E) -2
-

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23. Which of the following molecules can generate the highest yield of ATP in the process from glycolysis to lactate?
- (A) sucrose (B) fructose
(C) glucose 6-phosphate (D) dihydroxyacetone phosphate
(E) glyceraldehyde 3-phosphate
24. Which method is used to predict the amino acid sequence of tryptic fragments by bioinformatic approaches?
- (A) sodium dodecyl sulfate polyacrylamide gel electrophoresis
(B) Edman degradation
(C) tandem mass spectrometry
(D) two-dimensional polyacrylamide gel electrophoresis
(E) gel-filtration chromatography
25. Which step of the mitochondrial electron transport chain does rotenone inhibit?
- (A) NADH → coenzyme Q (B) Cyt b → Cyt c1
(C) Cyt c1 → Cyt c (D) Cyt c → Cyt (a+a3)
(E) Cyt c → O₂
26. Regarding the chemiosmotic theory of the respiratory chain, which statement is TRUE?
- (A) Oxidative phosphorylation occurs in the outer mitochondrial membrane.
(B) The proton (H⁺) concentration is the same on both sides of the inner mitochondrial membrane.
(C) ATP synthase plays no role in the chemiosmotic theory.
(D) Mitochondrial inner membrane is permeable for proton.
(E) ATP synthesis is related to proton-motive force.
27. Which of the following sets of amino acids are directly involved in the biosynthesis of creatine?
- (A) tyrosine, glycine, and glutamine (B) glutamate, cysteine, and glycine
(C) glycine, arginine, and methionine (D) aspartate, glycine, and cysteine
(E) proline, alanine, and leucine
28. Hydropathy plot is commonly used for _____.
- (A) predicting the quaternary structure of membrane proteins
(B) measuring the water content of native proteins
(C) estimating the actual molecular weight of membrane proteins
(D) predicting whether a known protein amino acid sequence contains a membrane-spanning segment
(E) analyzing protein secondary structure

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29. What substance(s) can affect the concentration of calcium ions inside the cell, an important secondary messenger?
- (A) Phosphatidylcholine and phospholipase A
 - (B) Phosphatidylcholine and phospholipase C
 - (C) Phosphatidylinositol and phospholipase A
 - (D) Phosphatidylinositol and phospholipase C
 - (E) Calmodulin
30. Which statement is TRUE?
- (A) A higher K_m value indicates a higher substrate specificity.
 - (B) A higher K_m value indicates a higher substrate affinity.
 - (C) The unit for K_m is $M^{-1}s^{-1}$.
 - (D) k_{cat} is the specificity constant.
 - (E) k_{cat}/K_m is a measure of enzyme efficiency.
- 【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，61~90 題為生化概論。
31. Which description about interaction between species is NOT true?
- (A) Predation: An individual of one species, the predator, kills and eats an individual of the other, the prey.
 - (B) Parasitism: The parasite obtains its nourishment from a second organism, its host.
 - (C) Competition: Individuals of different species each use a limited resource, reducing the survival or reproduction of both individuals.
 - (D) Commensalism: Members of both species benefit from the interaction.
 - (E) Herbivory: An herbivore eats part of a plant or alga.
32. Fungal cells can reproduce asexually by undergoing mitosis, followed by cytokinesis. Many fungi can also reproduce sexually by undergoing _____.
- (A) cytokinesis followed by karyokinesis
 - (B) binary fission followed by cytokinesis
 - (C) plasmolysis followed by karyotyping
 - (D) plasmogamy followed by karyogamy
 - (E) sporogenesis followed by gametogenesis
33. Which is a TRUE statement concerning genetic variation?
- (A) It is created by the direct action of natural selection.
 - (B) It arises in response to changes in the environment.
 - (C) It must be present in a population before natural selection can act upon the population.
 - (D) It tends to be reduced by the processes involved when diploid organisms produce gametes.
 - (E) A population that has a higher average heterozygosity has less genetic variation than one with a larger average heterozygosity.

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34. Why do RNA viruses appear to have higher rates of mutation?
- (A) RNA viruses are more sensitive to mutagens.
 - (B) RNA viruses can incorporate a variety of nonstandard bases.
 - (C) RNA viruses replicate faster.
 - (D) Replication of their genomes does not involve the proofreading steps of DNA replication.
 - (E) RNA nucleotides are more unstable than DNA nucleotides.
35. To prevent irreversible tragedies, the CDC urges the public not to use blood donation as a means of Human immunodeficiency virus (HIV) testing, as there is a ____ period for HIV infection.
- (A) prophase
 - (B) infectious
 - (C) latency
 - (D) anaphase
 - (E) telophase
36. Which of the following characters is NOT a terrestrial adaptation of plants?
- (A) Waxy stomata to reduce water loss
 - (B) Vascular tissue in most plants to transport water/sugar within the plant
 - (C) Specialization within the plant with root/shoot
 - (D) Spore/seed for dispersal
 - (E) Flagellated sperm
37. Which of the following genetic changes of K-Ras is detected in over 90% of human pancreatic cancers?
- (A) Translocation
 - (B) Mutation
 - (C) Promoter methylation
 - (D) Amplification
 - (E) Transposition
38. In the process of human gametogenesis, which cell is haploid?
- (A) Spermatogonium
 - (B) Primary spermatocyte
 - (C) Primary oocyte
 - (D) Early spermatid
 - (E) Oogonium
39. In humans, the phenylalanine hydroxylase gene is 90,000 bases (90 kb) long, yet the mRNA is only 2,400 bases (2.4 kb). What explains this difference?
- (A) RNA editing
 - (B) Code for poly A tail that is removed in mRNA
 - (C) Loss of stability without a 5' cap
 - (D) Removal of exons in the final mRNA
 - (E) Presence of introns in DNA
40. Which of the following organelles CANNOT be found in animal cells?
- (A) Lysosome
 - (B) Central vacuole
 - (C) Mitochondrion
 - (D) Peroxisome
 - (E) Centriole

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41. Which is NOT a source of genetic variation that makes evolution possible?
- (A) Oxidative phosphorylation (B) Formation of new alleles
(C) Sexual reproduction (D) Altering gene number or position
(E) Rapid reproduction
42. Which of the following systems allow arthropods to propel the hemolymph into hemocoel?
- (A) Closed circulatory system (B) Open circulatory system
(C) Respiratory system (D) Reproductive system
(E) Digestive system
43. What is the evolutionary sequence that is believed to have given rise to the chloroplasts of land plants?
- (A) Cyanobacteria → brown algae → land plants
(B) Photosynthetic bacteria → brown algae → green algae → land plants
(C) Diatoms → green algae → land plants
(D) Cyanobacteria → diatoms → green algae → land plants
(E) Cyanobacteria → green algae → land plants
44. Which of the following statements about genetic drift is TRUE?
- (A) Genetic drift is significant in big populations.
(B) Genetic drift can cause allele frequencies to change at random.
(C) Genetic drift results in increased genetic variation within a population.
(D) In very big populations, genetic drift can also cause slightly harmful allele to become fixed.
(E) Genetic drift can preserve alleles in a population.
45. Regarding plant organ and its components, which of the following sets is NOT true?
- (A) Spores vs. sperms (B) Archegonia vs. eggs
(C) Antheridia vs. sperms (D) Ovules vs. eggs
(E) Seeds vs. embryos
46. Which of the following statements about reproductive system and embryonic development is TRUE?
- (A) The mesoderm of embryonic layer forms skeletal and muscular systems.
(B) The primary oocyte is arrested at metaphase of meiosis II.
(C) Follicle stimulating hormone (FSH) stimulates the remaining follicular tissue to form the corpus luteum.
(D) Luteinizing hormone (LH) causes sertoli cells to produce testosterone and other androgens.
(E) Prostaglandins make the uterus more sensitive to oxytocin to initiate labor.

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47. The heterokaryotic phase of a fungal life cycle is _____.
- (A) a stage in which the hyphae contain only one type of haploid nucleus
 - (B) a stage in which the hyphae contain two, genetically different, diploid nuclei
 - (C) a stage in which the hyphae contain two, genetically different, haploid nuclei
 - (D) a stage that is diploid but functions as a gametophyte (like the body of an animal)
 - (E) a triploid stage formed by the fusion of a diploid nucleus with the haploid nucleus of a compatible hypha
48. Regarding the biogeographic factors affecting community diversity and related theories, which is NOT true?
- (A) Plant and animal life are generally more abundant and diverse in the tropics than in other parts of the globe.
 - (B) All other factors being equal, the larger the geographic area of a community, the more species it has.
 - (C) Small islands generally have higher immigration rate.
 - (D) The species richness of plants and animals correlates with measures of evapotranspiration.
 - (E) An island that is closer to the mainland generally has a higher immigration rate and a lower extinction rate than one farther away.
49. Which gene might be associated with the rapid appearance of a vast array of bilaterally symmetrical and structurally diverse animals during the Cambrian explosion?
- (A) BRCA genes
 - (B) Ubx genes
 - (C) Opsin genes
 - (D) STX16 genes
 - (E) Hox genes
50. Assuming that 40 leopard cats, weighing 5 kg each and feeding solely on herbivorous prey, live continuously with their prey in a given area, approximately how much total biomass of plant material would be required?
- (A) 2,222 kg
 - (B) 4,000 kg
 - (C) 20,000 kg
 - (D) 125,000 kg
 - (E) 500,000 kg
51. Which of the following statements about all cells is NOT true?
- (A) They have membrane transport proteins.
 - (B) They synthesize proteins on the ribosome.
 - (C) They replicate their genome by DNA polymerization.
 - (D) They transcribe their genetic information by RNA polymerization.
 - (E) They use RNA as a template for genomic DNA polymerization.
52. Which is NOT included in the key features of the angiosperm life cycle of plants?
- (A) Development of embryo sacs
 - (B) Development of male gametophytes
 - (C) Fruits
 - (D) Zygosporangium
 - (E) Double fertilization

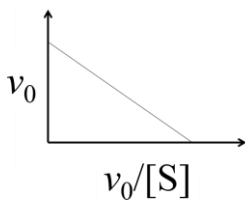
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53. Which of the following statements about photosynthesis is TRUE?
- (A) The light reaction in the thylakoids makes NADP^+ to the Calvin cycle.
 - (B) Phosphoenolpyruvate (PEP) carboxylase has a higher affinity for CO_2 than rubisco does.
 - (C) The oxygen is produced by the electron transfer system of photosystem I (PS I).
 - (D) Photosystem II (PS II) is called P700 because of its reaction-center chlorophyll that absorbs light with a wavelength of 700 nm.
 - (E) C4 plants only use rubisco for carbon fixation.
54. Which of the following statements about viruses is TRUE?
- (A) Prions replicate using host's translation machinery.
 - (B) Reverse transcriptase in retroviruses converts host cell RNA into viral DNA.
 - (C) A phage that reproduces only by the lytic cycle is called a temperate phage.
 - (D) Human immunodeficiency virus (HIV) are double-stranded DNA virus.
 - (E) Herpesvirus has single stranded RNA that acts as a template for DNA synthesis.
55. About the ABC hypothesis of flowering, which set(s) of organ and gene expression is NOT true?
- (A) Sepals – A gene activity
 - (B) Petals – A + B gene activity
 - (C) Loss of A gene results in mutation of sepals and petals
 - (D) Carpels – C gene activity
 - (E) Stamens – A + C gene activity
56. What would account for increased urine production as a result of drinking alcoholic beverages?
- (A) Increased aldosterone production
 - (B) Increased blood pressure
 - (C) Inhibition of antidiuretic hormone secretion (ADH)
 - (D) Increased reabsorption of water in the proximal tubule
 - (E) The osmoregulator cells of the brain increasing their activity
57. Which of the following statements about transport in vascular plants is TRUE?
- (A) The apoplast consists of everything internal to the plasma membranes of living cells.
 - (B) The symplastic route for water and solutes is from outside cells through cell walls and extracellular spaces.
 - (C) When K^+ leaves the guard cells, stomata becomes open.
 - (D) Na^+ is typically cotransported rather than H^+ for transport of sucrose in plant cells.
 - (E) The movement of fluid in phloem is multidirectional in plants.

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58. When an individual is subject to short-term starvation, most available food is used to provide energy (metabolism) rather than building blocks (growth and repair). Which hormone would be particularly active during food shortage?
- (A) Epinephrine (B) Glucagon (C) Oxytocin
(D) Antidiuretic hormone (E) Insulin
59. The observation that the acetylcholine released into the junction between a motor neuron and a skeletal muscle binds to a sodium channel and opens it is an example of _____.
- (A) a voltage-gated sodium channel
(B) a voltage-gated potassium channel
(C) a ligand-gated sodium channel
(D) a second-messenger-gated sodium channel
(E) a chemical that inhibits action potential
60. Which statement below about mating behavior is NOT true?
- (A) Some aspects of courtship behavior may have evolved from agonistic interactions.
(B) Courtship interactions ensure that the participating individuals are non-threatening and of the proper species, sex, and physiological condition for mating.
(C) The degree to which evolution affects mating relationships depends on the degree of prenatal and postnatal input the parents are required to make.
(D) The mating relationship in most mammals is monogamous, to ensure the reproductive success of the pair.
(E) Polygamous relationships most often involve a single male and many females, but in some species, this is reversed.
61. Enzymes are classified into 7 different major classes. Which enzyme class does the following reaction belong to?
- Pyruvate + H⁺ → acetaldehyde + CO₂
- (A) Oxidoreductases (B) Transferases (C) Hydrolases
(D) Lyases (E) Ligases
62. Which of the following statements about the enzyme regulation by covalent-modification is NOT true?
- (A) Phosphorylation means the transfer of phosphate group from ATP to proteins.
(B) Adenylylation means the transfer of an adenylate moiety from ATP to proteins.
(C) ADP-ribosylation means the transfer of an ADP-ribosyl moiety from ATP to proteins.
(D) Acetylation means the transfer of an acetyl group from acetyl-CoA to proteins.
(E) Phosphatases can remove phosphate group from proteins.

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63. Which of following statements regarding glycogen metabolism is TRUE?
- (A) Glycogen degradation starts from reducing end to non-reducing end.
 - (B) Amylo-(1,4 → 1,6)-transglycosylase is used in glycogen synthesis.
 - (C) Glucose-1-phosphate is the substrate of glycogen synthase.
 - (D) The regulation mechanism of glycogen phosphorylase *b* includes both allosteric control and covalent-modification.
 - (E) Protein kinase C triggers the glycogen breakdown cascade.
64. Which of the followings is NOT required for the transportation of NADH from cytosol into mitochondria?
- (A) malate
 - (B) α -ketoglutarate
 - (C) citrate
 - (D) oxaloacetate
 - (E) aspartate
65. X uses a Y to link cofactor, Z. Which one of the followings is NOT true?
- (A) X: Pyruvate dehydrogenase; Y: lysine residue; Z: lipoamide
 - (B) X: Aconitase; Y: cysteine residue; Z: iron-sulfur center
 - (C) X: Pyruvate carboxylase; Y: lysine residue; Z: biotin
 - (D) X: Acyl carrier protein; Y: cysteine residue; Z: pantothenate
 - (E) X: Aminotransferase; Y: lysine residue; Z: pyridoxal phosphate
66. Which of following statements is NOT true regarding the lysozyme's Phillips mechanism?
- (A) Glu 35 acts as both "general acid" and "general base" catalysis.
 - (B) The active site of lysozyme can take six residues of monosaccharides.
 - (C) The D ring of monosaccharide is distorted into boat form conformation.
 - (D) The oxonium ion transition state is stabilized by Asp 52.
 - (E) The optimal pH of this reaction is between 4 and 6.
67. Enzyme X follows Michaelis-Menten kinetics. As shown in the figure, its value of V_{max} and K_m can also be obtained by using Eadie-Hofstee plot. The initial reaction rate is v_0 with the substrate concentration $[S]$. What is the intercept on $v_0/[S]$ axis?
- 
- (A) V_{max}/K_m
 - (B) $1/K_m$
 - (C) K_m
 - (D) V_{max}
 - (E) $1/V_{max}$
68. Among 9 different molecules below, X of them can cleave disulfide bond, and Y of them can react with the amino group of L-amino acids. Therefore, $X + Y = \underline{\hspace{2cm}}$.
cyanogen bromide; iodoacetate; phenylisothiocyanate; β -mercaptoethanol; performic acid;
9-fluorenylmethoxycarbonyl chloride; dithiothreitol;; guanidinium hydrochloride; urea.
- (A) 2
 - (B) 3
 - (C) 4
 - (D) 5
 - (E) 6

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69. How many of the followings are ketogenic amino acid in human?

Asp; Phe; Arg; Val; His; Thr; Lys.

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

70. How many items of the followings have the activity of proof-reading to reduce the error rate in biosynthesis?

DNA polymerase; RNA polymerase II; amino-acyl tRNA synthetase; Initiation Factor-1; polyketide synthase; Elongation Factor-Tu; Klenow fragment.

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

71. Which one of followings is NOT used for thymine dimer repair?

- (A) Daughter strand gap repair (B) Base excision repair
(C) Nucleotide excision repair (D) Photolyase
(E) DNA polymerase Eta (Pol η)

72. The pentose phosphate pathway of glucose oxidation produces _____.

- (A) coenzyme Q₁₀ (B) FADH₂ (C) glucose-1-phosphate
(D) NADH (E) ribose-5-phosphate

73. The thickness of endoplasmic reticulum membrane is about 37.5 Å. Which one of the followings is closest to this length?

- (A) alpha-helix with 10 amino acid residues long
(B) alpha-helix with 40 amino acid residues long
(C) alpha-helix with 80 amino acid residues long
(D) B-DNA with 10 base pairs long
(E) B-DNA with 40 base pairs long

74. There are cholesterols and cholesterol esters in LDL. How and where are cholesterol esters generated in a human body?

- (A) Cholesterol esters are generated by lecithin: cholesterol acyltransferase in endothelial cells.
(B) Cholesterol esters are produced by lecithin: cholesterol acyltransferase in macrophages.
(C) Cholesterol esters come from the reaction between free short-chain fatty acids and cholesterols.
(D) Cholesterol esters are generated from the reaction between free long-chain fatty acids and cholesterols.
(E) Cholesterol esters are produced by lecithin: cholesterol acyltransferase in the bloodstream.

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75. Okazaki fragments are _____.
- (A) short DNA pieces that explain how DNA is synthesized on the lagging strand
 - (B) short DNA pieces that explain how DNA is synthesized on the leading strand
 - (C) the remnants of the original strands that are dispersed in the new double stranded DNA molecules
 - (D) RNA primers used for DNA replication
 - (E) Fragments of mRNA that are processed into mature mRNA molecules
76. Which of the followings describes the initial bond formation in the covalent intermediate in the reaction catalyzed by chymotrypsin?
- (A) Serine 195 and the carbonyl carbon in the peptide backbone
 - (B) Serine 195 and the nitrogen in the peptide backbone
 - (C) Histidine 57 and the carbonyl carbon in the peptide backbone
 - (D) Histidine 57 and the nitrogen in the peptide backbone
 - (E) Aspartate 102 and the carbonyl carbon in the peptide backbone
77. Which of the following statements about farnesyl-linked proteins and glycosylphosphatidylinositol (GPI)-linked proteins is TRUE?
- (A) Farnesyl-linked proteins and GPI-linked proteins are randomly distributed in the plasma membrane.
 - (B) Farnesyl-linked proteins and GPI-linked proteins are frequently associated with the outer leaflet of the plasma membrane.
 - (C) Farnesyl-linked proteins and GPI-linked proteins are frequently associated with the inner leaflet of the plasma membrane.
 - (D) Farnesyl-linked proteins are associated with the outer leaflet of the plasma membrane, and GPI-linked proteins are frequently associated with the inner leaflet of the plasma membrane.
 - (E) Farnesyl-linked proteins are associated with the inner leaflet of the plasma membrane, and GPI-linked proteins are frequently associated with the outer leaflet of the plasma membrane.
78. What is an important component(s) to transport ammonia from skeletal muscles and the other tissues to the liver?
- (A) Albumins
 - (B) Alanine from skeletal muscles and glutamine from most tissues
 - (C) Glutamates
 - (D) Alanine from skeletal muscles and glutamate from most tissues
 - (E) Glycine from skeletal muscles and glutamate from most tissues

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79. Which statement about energy metabolism in patients with type I diabetes mellitus and poor blood glucose control is NOT true?
- (A) Ketone bodies are mainly derived from the metabolism of glucose-produced acetyl-CoA.
 - (B) Ketone bodies can replace glucose as a cellular energy source.
 - (C) Intermediate products of the Krebs cycle, such as oxaloacetate, are used in gluconeogenesis, leading to an increase in blood glucose.
 - (D) Due to the lack of oxaloacetate, acetyl-CoA cannot enter the Krebs cycle, resulting in its conversion into ketone bodies.
 - (E) Fatty acids are converted into ketone bodies as an alternative energy source in the absence of glucose.
80. A young boy is unusually tall and presents with joint laxity and retinal detachment. Examination reveals a mutation in the tripeptide repeat of type II collagen, affecting its quaternary structure. Which amino acid is most likely affected by this mutation?
- (A) hydroxylysine (B) hydroxyproline (C) glycine
 - (D) tryptophan (E) proline
81. How is DNA recombination achieved during meiosis?
- (A) Double-strand break recombination (B) Single-strand break recombination
 - (C) Telomere recombination (D) Centromere recombination
 - (E) Homologous recombination
82. What is the main pharmacological action of benzoate and phenylbutyrate, which are used to treat urea cycle disorders?
- (A) It provides intermediates required for the urea cycle to enhance the efficiency of the entire urea cycle.
 - (B) It acts as allosteric activators of carbamoyl phosphate synthase I to enhance the efficiency of the urea cycle.
 - (C) Their metabolites combine with glycine and glutamine, respectively, to form derivatives that are excreted, reducing the burden on the urea cycle.
 - (D) It promotes the synthesis of arginine to prevent arginine deficiency.
 - (E) It increases the activity of ornithine transcarbamylase to facilitate urea synthesis.
83. Which statement about the chain elongation of vertebrate fatty acids is NOT true?
- (A) It occurs on the endoplasmic reticulum.
 - (B) It utilizes malonyl-CoA as a substrate.
 - (C) It elongates palmitoyl-CoA to stearoyl-CoA.
 - (D) It gives a saturated fatty acyl-CoA two carbons longer than the original substrate.
 - (E) It occurs in the cytoplasm.

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84. P53 _____.
- (A) belongs to oncogene
 - (B) regulates the activity of E2F transcription factor
 - (C) cannot interact with DNA
 - (D) repairs DNA damage directly
 - (E) acts as a transcription factor to regulate cell cycle
85. Retinoid acid _____.
- (A) can be converted to retinal in the body
 - (B) participates in the synthesis of β -carotene
 - (C) combines with nuclear receptor that binds to specific DNA sequence
 - (D) can replace vitamin A in the diet
 - (E) acts as a chaperone at post-translational modification
86. What type of DNA will be formed if a DNA segment has one all-pyrimidine strand and one all-purine strand?
- (A) A-DNA formation
 - (B) B-DNA formation
 - (C) G-Quadruplexes
 - (D) H-DNA formation
 - (E) Z-DNA formation
87. How many of the following molecules act as second messengers?
GTP; calcium ion; cGMP; cAMP; inositol-1,4,5-triphosphate; diacylglycerol; ATP; insulin
- (A) 8
 - (B) 7
 - (C) 6
 - (D) 5
 - (E) 4
88. Which of the following endogenous DNA-damaging reactions occurs most frequently in cells?
- (A) depurination
 - (B) ROS oxidation
 - (C) methylation
 - (D) deamination
 - (E) depyrimidination
89. How many pairs in the following are TRUE?
- Iron-sulfur protein – electron flow from FMNH₂ to coenzyme Q
 - Coenzyme Q – lipid soluble electron carrier
 - Cytochrome c – accepts electrons from complex IV
 - Flavin mononucleotide – accepts electron from NADH in complex I
 - Q cycle – funnels electrons from a 2-electron carrier to a 1-electron carrier
 - Catalase – converts reactive oxygen species into hydrogen peroxide
 - Proton-motive force – hydrolysis of ATP
- (A) 3
 - (B) 4
 - (C) 5
 - (D) 6
 - (E) 7

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90. The coupling oxidative phosphorylation means the joint of two reactions including

- ① $\text{glucose} + \text{ATP} \rightarrow \text{pyruvate} + \text{ADP} + \text{P}_i$
- ② $\text{NADH} + 1/2 \text{O}_2 + \text{H}^+ \rightarrow \text{H}_2\text{O} + \text{NAD}^+$
- ③ $\text{ADP} + \text{P}_i + \text{H}^+ \rightarrow \text{ATP} + \text{H}_2\text{O}$
- ④ $\text{oxaloacetate} + \text{NADH} \rightarrow \text{NAD}^+ + \text{malate} + \text{H}^+$

(A) ①③

(B) ②③

(C) ①④

(D) ②④

(E) ③④