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並不得書寫、畫記、作答。

國立清華大學 112學年度學士後醫學系單招試題

系所班組別：學士後醫學系  
自然科學組

科目代碼：0102

考試科目：生物與生化

### —作答注意事項—

1. 請核對答案卡上之准考證號、科目名稱是否正確。
2. 作答中如有發現試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
3. 答案卡限用 2B 鉛筆畫記；如畫記不清（含未依範例畫記）致光學閱讀機無法辨識答案者，其後果一律由考生自行負責。
4. 其他應考規則、違規處理及扣分方式，請自行詳閱簡章附錄上「**國立清華大學試場規則及違規處理辦法**」，無法因本試題封面作答注意事項中未列明而稱未知悉。

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[單選題]每題 2.5 分，共計 150 分。答錯一題倒扣 0.625 分，未作答，不給分亦不扣分。

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1. To define a species, the biological species concept would require information related to
  - (A) Genome sequence
  - (B) Sexual reproduction
  - (C) Phylogenetic tree
  - (D) Living environment
  - (E) Morphology
2. Which of the following characteristics is unlikely due to sexual selection?
  - (A) Frog singing
  - (B) Sperm competition
  - (C) Courtship dance
  - (D) Flower fragrance
  - (E) Chameleon Camouflage
3. Visual pigment rhodopsin is a(n)
  - (A) Ion channel
  - (B) Enzyme
  - (C) Chaperone
  - (D) G protein-coupled receptors
  - (E) None of above
4. Microglia functions in
  - (A) circulating cerebrospinal fluid
  - (B) structural support for neurons
  - (C) axon myelination
  - (D) immune responses
  - (E) All of above
5. The "fight or flight" responses are mainly induced by \_\_\_\_\_ system.
  - (A) Autonomic
  - (B) Somatic
  - (C) Sympathetic
  - (D) Parasympathetic
  - (E) Enteric
6. Which hormone is induced by neonatal suckling and triggers release of milk from the mammary glands?

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- (A) Oxytocin
  - (B) Vasopressin
  - (C) Serotonin
  - (D) Insulin
  - (E) Estrogen
7. Which of the following hormone is not released from the pituitary gland?
- (A) Antidiuretic hormone
  - (B) Follicle-stimulating hormone
  - (C) Prolactin
  - (D) Adrenocorticotrophic hormone
  - (E) Thyroid hormone
8. Which of the following is not a main function of kidney
- (A) Ion balance
  - (B) Blood pressure control
  - (C) pH balance
  - (D) Thermal balance
  - (E) Hormone production
9. The offspring of horse and donkey is viable but sterile. This belongs to which of the following reproductive barriers?
- (A) Prezygotic barrier, gametic isolation
  - (B) Prezygotic barrier, reduced hybrid fertility
  - (C) Prezygotic barrier, hybrid breakdown
  - (D) Postzygotic barrier, gametic isolation
  - (E) Postzygotic barrier, reduced hybrid fertility
10. Which of the following descriptions about phosphorus cycle is **NOT** correct?
- (A) Over-enrichment of phosphate in both fresh and inshore marine waters can cause massive algae blooms that lead to eutrophication.
  - (B) In terrestrial systems, bioavailable phosphorus mainly comes from weathering of phosphorus-containing rocks
  - (C) Microbial and plant growths depend on the degradation rate of organic phosphorus to free inorganic phosphate by various enzymes such as phosphatases, nucleases and phytase.
  - (D) Human interference in the phosphorus cycle occurs by overuse or careless use of phosphorus fertilizers.
  - (E) Using animal manure in poorly drained soils to improve the soil fertility helps phosphorus cycle.

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11. Which of the following descriptions about nitrogen cycle is **NOT** correct?
- (A) The nitrogenous wastes in animal urine are broken down by denitrifying bacteria.
  - (B) Nitrous oxide ( $\text{N}_2\text{O}$ ), carbon dioxide and methane are greenhouse gases that contribute to global warming.
  - (C) Nitrous oxide ( $\text{N}_2\text{O}$ ) has risen in the atmosphere as a result of agricultural fertilization, biomass burning, cattle and feedlots, and industrial sources.
  - (D) Atmospheric ammonia and nitrous oxides contribute to smog and acid rain, damage plants and increase nitrogen inputs to ecosystems.
  - (E) Nitrogen cannot be utilized by phytoplankton as nitrogen gas ( $\text{N}_2$ ) so it must undergo nitrogen fixation which is performed predominately by cyanobacteria.
12. Which of the following descriptions about red algae is **NOT** correct?
- (A) They are abundant in the warm coastal waters of tropical oceans.
  - (B) They contain phycoerythrin as their photosynthetic pigment to absorb red and blue light.
  - (C) We eat one of multicellular red algae, *Porphyra* (Japanese “nori”) as a wrap for sushi.
  - (D) Unlike other algae, they do not have flagellated gametes.
  - (E) They depend on water currents for fertilization.
13. Which of the following diseases is **NOT** insect borne?
- (A) Polio
  - (B) Japanese encephalitis
  - (C) Dengue
  - (D) Zika virus fever
  - (E) Sleeping sickness
14. Which of the following structures is **NOT** found in plant cells?
- (A) Plasmodesmata
  - (B) Middle lamella
  - (C) Phragmoplast
  - (D) Gap junction
  - (E) Tonoplast
15. Which of the following descriptions about COVID-19 virus is **NOT** correct?
- (A) The RNA-dependent RNA polymerase is a primary target for anti-COVID-19 virus drug remdesivir.
  - (B) Antigenic drift is a kind of genetic variation that can result in a new strain of COVID-19 virus particles.

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- (C) Coronaviruses are prone to undergo antigenic shift by combining two different viruses to make a novel strain.
  - (D) COVID-19 mRNA vaccines contain the instructions for making the SARS-CoV-2 spike protein
  - (E) COVID-19 mRNA vaccines require to be stored at an ultra-cold freezer at temperatures between  $-80^{\circ}\text{C}$  and  $-60^{\circ}\text{C}$  for up to 6 months.
16. Which of the following descriptions about lipopolysaccharides is **NOT** correct?
- (A) They are found in the outer membrane of Gram-negative bacteria
  - (B) They are secreted as part of the normal physiological activity of membrane vesicle trafficking
  - (C) They can induce defense responses in animals and plants.
  - (D) The biological activity of lipopolysaccharides can be attributed to the chemical structure of the lipid A unit.
  - (E) They increase the positive charge of the cell membrane and helps stabilize the overall membrane structure
17. Which of the following descriptions about V-ATPases is NOT correct?
- (A) They are ATP-dependent proton pumps.
  - (B) They are present in intracellular membranes in all eukaryotes and at the plasma membrane of certain specialized cells.
  - (C) They are involved in acidification of endosomes.
  - (D) They generate the proton motive force as a driving force for primary transporters.
  - (E) They are regulated by reversible dissociation of the  $V_1$  and  $V_0$  domains.
18. Which of the following descriptions about vitamins is **NOT** correct?
- (A) They are generally classified into fat soluble or water soluble
  - (B) Some of them are required as coenzymes to facilitate enzymatic catalysis.
  - (C) Vitamin B1 is found naturally in meats, fish, and whole grains.
  - (D) Vitamin B12 is naturally present in vegetables like carrot and broccoli.
  - (E) Vitamin E is chemically known as  $\alpha$ -tocopherol and enriched in seeds and nuts.
19. Toll-like receptors (TLRs) activate innate immune responses protecting the host from infection by identifying conserved nonself molecules, Which of the following could **NOT** be recognized by TLRs?
- (A) Peptidoglycan
  - (B) Flagellin
  - (C) Galactose
  - (D) Lipopolysaccharide

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- (E) Unmethylated CpG motifs
20. Patent Foramen Ovale (PFO), also known as a **Hole In The Heart**. Which of the following statements about PFO is **Not** true?
- (A) In the womb, the blood flows from the high-pressure right side of the heart to the lower-pressure left side keeps the foramen ovale open.
  - (B) At birth, the reversal of pressure gradients caused by the clamping of the placenta could physiologically cause the foramen ovale to snap closed.
  - (C) In a heart with PFO, venous blood leaks from the right atrium into the left atrium, then out to the body, bypassing the pulmonary circulation.
  - (D) PFO is a condition with modifiable and non-modifiable risk factors.
  - (E) Around 25% of the general population has PFO and is typically asymptomatic.
21. The CRISPR-Cas9 system is a powerful new technique for gene editing. Which of the following descriptions about the CRISPR-Cas9 system is **Not** true?
- (A) CRISPR is a natural immune system occurring in bacteria to prevent attack by virus.
  - (B) Bacterial Cas9 cuts off the viral DNA sequence and destroys the virus.
  - (C) *Streptococcus pyogenes* produces Cas nuclease.
  - (D) The CRISPR-Cas9 system can identify upto 20 base long sequence in target DNA.
  - (E) The CRISPR-Cas9 system is now deemed a safe method for treating incurable diseases.
22. Electrocardiogram, abbreviated as ECG or EKG, is a biological test used to convert the activities of the heart into electrical signals, including P wave, QRS complex, and T wave. Which part of the ECG represents the beginning of ventricle repolarization?
- (A) P wave
  - (B) Interval between P wave and QRS complex
  - (C) QRS complex
  - (D) Interval between QRS complex to T wave
  - (E) T wave
23. Which of the following cell organelles is **NOT** correctly matched with its function?
- (A) Centrosomes - organizing the microtubule and Cell division
  - (B) Golgi Apparatus - secretion and intracellular transport
  - (C) Peroxisome - the metabolism of lipids and catabolism of long-chain fatty acids



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- (D) Endoplasmic Reticulum - responsible for the cell's metabolic activities.  
(E) Lysosomes - the digestion and removes wastes
24. Hydrangeas provide beauty and color to landscapes. Hydrangeas of the same genotype are planted in a large flower yard, which blooms different colored flowers. This phenomenon is caused by \_\_\_\_\_  
(A) Environmental factors such as aluminum content and soil pH  
(B) The alleles being codominant  
(C) Darwin's explanation of the natural selection  
(D) The fact that the mutation occurred  
(E) Virus infection causes color-breaking
25. Most of the Carbon dioxide being transported by blood:  
(A) is carried in the form of bicarbonate ( $\text{HCO}_3^-$ )  
(B) is attached to glucose  
(C) is reversibly bound to hemoglobin  
(D) is dissolved in plasma  
(E) is used to provide energy for the heartbeat
26. T cell activation requires the formation of a transient cell-cell contact called immunological synapse between T cell and dendritic cells (DCs). Activated T cells synthesize and secrete interleukin-2 (IL-2) for the proliferation and differentiation of T cells. What is this is an example of?  
(A) synaptic signaling  
(B) autocrine signaling  
(C) endocrine signaling  
(D) paracrine signaling  
(E) juxtacrine signaling
27. The nucleotide sequences of the p53 gene showed a single amino acid change in the tumor mass, which compromised the protein's function. Which of the following would be true?  
(A) Mutant p53 promotes adaptive responses to cancer-related stress conditions to support tumor progression.  
(B) Mutant p53 facilitates the establishment of a pro-oncogenic tumor microenvironment.  
(C) Mutant p53 enhances cancer cell survival under oxidative and genotoxic stress conditions.  
(D) Mutant p53 induces G1 arrest and transcripts p21 after DNA damage.  
(E) Mutant p53 imparts stem-like properties to cancer cells.

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28. Which amino acids absorb ultraviolet radiation between 250 - 280 nm?  
(1) His; (2) Tyr; (3) Trp; (4) Pro; (5) Phe  
(A) (1)(2)  
(B) (2)(3)(5)  
(C) (2)(5)  
(D) (1)(4)  
(E) (1)(3)(5)
29. Pyruvate kinase is allosterically regulated by several effectors. Which of the following statements is **true**?  
(A) Phenylalanine does not change the conformation of pyruvate kinase  
(B) AMP decreases the catalytic efficiency of pyruvate kinase  
(C) ATP increases the catalytic efficiency  
(D) Fructose 1,6-bisphosphate decreases the  $K_M$  of pyruvate kinase  
(E) Acetyl-coA increases the  $k_{cat}$  of pyruvate kinase
30. Glycosaminoglycans are involved in many extracellular functions. Which glycosaminoglycan is a natural anticoagulant?  
(A) Dermatan sulfate  
(B) Heparin  
(C) Hyaluronate  
(D) Keratan sulfate  
(E) Chondroitin-4-sulfate
31. Researchers found a large and polar metabolite X is highly enriched in the extracellular matrix and has a low concentration inside cells. New evidence suggests that the metabolite X is transported from the cell to the extracellular matrix. Based on these findings, what is the possible transport mechanism?  
(A) passive transport  
(B) facilitated transport driven by ATP hydrolysis  
(C) primary active transport powered by an ion gradient  
(D) secondary active transport and the same transporter transports proton into the cell  
(E) secondary active transport and the same transporter transports sodium out of the cell
32. Eukaryotic proteins are targeted for proteasome mediated degradation by the ubiquitin system. Which of the following statement about the ubiquitin system is FALSE?  
(A) Ubiquitin is attached to the target protein via an isopeptide bond.

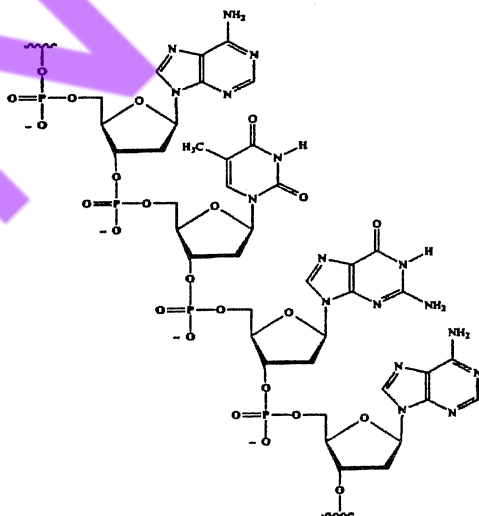


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- (B) E1 enzyme is attached to ubiquitin by consuming ATP.  
(C) Ubiquitin is transferred from E1 to a lysine residue on E2.  
(D) E3 ligase determines the substrate specificity.  
(E) Proteins with N-terminal aspartic or glutamic acid show a tRNA requirement for degradation.
33. If the following peptide sequences can form an alpha-helix, which sequence forms an amphipathic helix with basic residues on one side?
- (A) KRWMKVAKRILKRWMHP  
(B) ADVGSLVAADVQNRAP  
(C) DNLLSTNCRDLLVYWSS  
(D) DEVEDLVEELADEIDDP  
(E) STDRLKWAALKHSCEDK
34. Which of the following antibiotics does not act as a protein synthesis inhibitor?
- (A) streptomycin  
(B) puromycin  
(C) ricin  
(D) vancomycin  
(E) cyclohesimide
35. Which kind of inhibitor increases the apparent affinity of the enzyme for the substrate?
- (A) competitive inhibitor  
(B) pure noncompetitive inhibitor  
(C) uncompetitive inhibitor  
(D) irreversible inhibitor  
(E) reversible inhibitor
36. Is this a single-stranded RNA or DNA? And what is the sequence?



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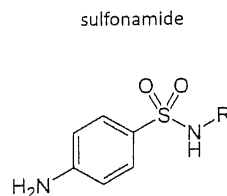
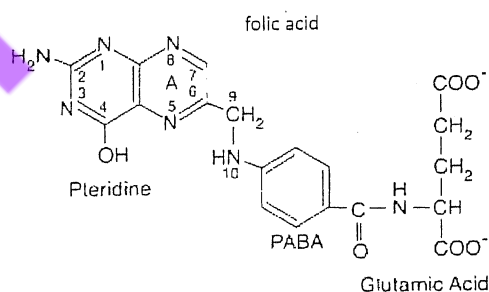
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- (A) DNA, 5' ATGA 3'  
(B) RNA, 5' AUGA 3'  
(C) DNA, 5' GTCG 3'  
(D) RNA, 5' GUAG 3'  
(E) DNA, 5' AGTA 3'
37. Which of the following phospholipases and their cleavage products are correctly paired?
- (1) Phospholipase A1, diacylglycerol  
(2) Phospholipase A2, lysophosphatidic acid  
(3) Phospholipase C, inositol phosphate  
(4) Phospholipase D, diacylglycerol  
(5) Sphingomyelinase, ceramide
- (A) 13  
(B) 34  
(C) 25  
(D) 235  
(E) 134
38. GTPases have a slow nucleotide hydrolysis rate. Which of the following statements about GTPases is TRUE?
- (A) Guanine nucleotide exchange factor (GEF) proteins promote GTP dissociation from GTPases.  
(B) Ras GTPase activating proteins (GAP) reduce the  $k_{cat}$  of Ras.  
(C) G protein coupled receptor (GPCR) proteins prefer binding to the GTP-bound  $G_{\alpha\beta\gamma}$ .  
(D) Regulator of G protein signaling (RGS) proteins stabilize the transition state of  $G_{\alpha}$  to enhance GTP hydrolysis.  
(E) Ras GTPase activating proteins (GAP) increase the  $K_M$  of Ras.
39. Which of the following statements about steroid hormones is **incorrect**?
- (A) Some steroid hormones can bind to receptors on the cell membrane to regulate ion channels.  
(B) There are two -OH groups in androgen and only one -OH in estrogen.  
(C) Steroid hormones are mainly derived from cholesterol.  
(D) Many steroid hormones enter the cell and act as a transcriptional regulator.  
(E) Steroid hormones are important regulators of inflammation, sexual function, as well as water and salt balance.

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40. Which of the following statements about Shine-Dalgarno sequence is **correct**?
- (A) It is the RNA polymerase binding site in the promoter of eukaryotic genes.
  - (B) This sequence is complementary to the sequence at the 3' end of 16S rRNA.
  - (C) This sequence usually contains the translation initiation codon.
  - (D) It is the site of ribosome release after translation is complete.
  - (E) It is the name of one of the three termination codons in mRNA.
41. Which of the following statements about AMP-activated protein kinase (AMPK) is **incorrect**?
- (A) AMPK activity is allosterically regulated by AMP and ATP.
  - (B) Binding of AMP to AMPK promotes the phosphorylation of the enzyme, and thus enhances the enzyme activity.
  - (C) Regulation of AMPK activity involves a pseudosubstrate sequence, which is a molecule structurally related to AMP.
  - (D) Metformin, an anti-diabetic drug, exerts its effects through AMPK activation.
  - (E) One of the effects of AMPK activation is stimulation of fatty acid oxidation.
42. Misfolded proteins in the cell are commonly sent to the proteasome for degradation. Which of the following statements about proteasome is **correct**?
- (A) In the cell, the proteasome is usually encapsulated in the lysosome.
  - (B) The 26S proteasome of eukaryotic cells is better at breaking down proteins with less than 4 ubiquitins than those with more ubiquitins.
  - (C) The core part of the 26S proteasome is the 20S tubular structure, which is responsible for catalyzing the breakdown reaction of proteins.
  - (D) The 20S component also possesses an ATPase activity, which is used to provide the catalytic energy required for decomposing the target protein.
  - (E) The 19S portion of the 26S proteasome is responsible for adding ubiquitin to the protein to be broken down.
43. Folic acid is required for nucleotide synthesis. Which of the following statements about folic acid is **incorrect**?



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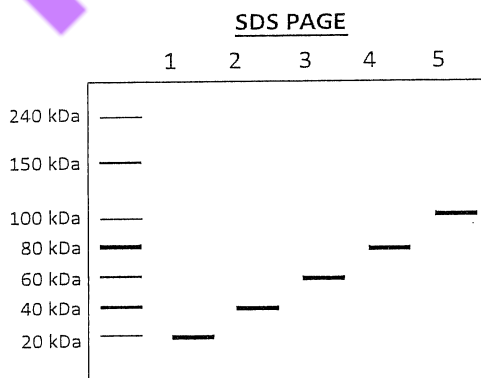
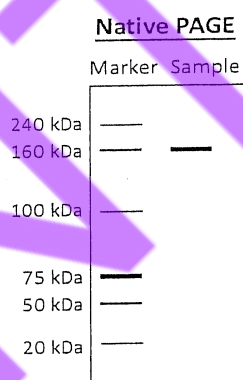
- (A) Folic acid is a cofactor in many metabolic reactions involving one-carbon (methyl-, methylene-, formyl-) functional groups.
  - (B) These one-carbon functional groups are usually modified at the N5 or N10 position of folic acid.
  - (C) Sulfonamide inhibits bacterial growth by inhibiting the formation of para-amino benzoic acid (PABA), a precursor of folic acid.
  - (D) Tetrahydrofolate is the activated form of folic acid. The hydrogens are normally added to N5, C6, C7, and N8 of folic acid.
  - (E) The cancer chemotherapeutic drug methotrexate is similar in structure to folic acid and can inhibit the synthesis of tetrahydrofolate.
44. Which of the following statements about glycogen synthesis is **incorrect**?
- (A) The initiation of glycogen synthesis is the attachment of the first glucose to the OH group of a tyrosine on a protein named glycogenin.
  - (B) A chain of about seven  $\alpha(1 \rightarrow 4)$  linked glucose molecules are typically formed by glycogenin.
  - (C) Glycogen synthase uses UDP-glucose as a substrate and transfers the glucosyl residue onto the non-reducing end of the glycogen chain.
  - (D) Branches of glycogen are made by an amylo-transglycosylase that catalyzes the transfer of a string of seven  $\alpha(1 \rightarrow 4)$  linked glucosyl units of a glycogen chain to the C-2 position on a glucose of the same or a neighboring glycogen chain.
  - (E) UDP-glucose is synthesized from UTP and glucose-1-phosphate by enzyme glucose-1-phosphate uridylyltransferase.
45. The  $G\alpha$  subunit of GTP-binding proteins in G protein-coupled receptors (GPCRs) commonly has the following characteristics, except
- (A) Hormone binding to its target GPCR can stimulate  $G\beta\gamma$  to release  $G\alpha$  into the cytoplasm.
  - (B) GDP binding to the  $G\beta\gamma$  components is essential for the release of  $G\alpha$ .
  - (C) Certain types of  $G\alpha$  subunit can bind to adenylate cyclase and activate this enzyme to produce cAMP.
  - (D)  $G\alpha$  subunits typically possess relatively weak GTP hydrolysis activity.
  - (E) GTP hydrolysis results in dissociation of  $G\alpha$ -adenylate cyclase complex.
46. Many enzyme-catalyzed reactions involved the formation of low-barrier hydrogen bonds (LBHB). Which of the following statements about LBHB is **incorrect**?
- (A) The hydrogen atom is equally distributed between the two heteroatoms (oxygen).

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- (B) The bond order approaches 0.5 for both O-H interactions.
- (C) As the distance between the heteroatoms gets smaller, the H bonds become weaker.
- (D) The barriers that must be overcome to exchange hydrogen atoms for oxygen become lower.
- (E) The pKa values of the two heteroatoms should be similar.
47. The protonated form of the side chain in \_\_\_\_\_ has a pKa of approximately 6.0 and therefore the amino acid is often used in general acid-base catalysis.
- (A) Arginine
- (B) Aspartate
- (C) Glutamate
- (D) Lysine
- (E) Histidine
48. The most rapid method to regenerate ATP molecules during exercise is through the breakdown of:
- (A) glucose
- (B) glycogen
- (C) fatty acid
- (D) phosphocreatine
- (E) triacylglycerol
49. The native PAGE for a purified protein sample is shown below. Which lanes are likely to be the SDS PAGE profile for this protein?



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

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50. Hypoxia condition is a common microenvironment within tumor. Hypoxia might attenuate mitochondrial activity resulting to increased production of lactate. Based on your knowledge, which of the following statements can explain the mechanism correlated hypoxia condition and the production of lactate?
- (A) Low ATP production might increase phosphofructokinase activity leading to increase lactate production.
  - (B) Low ATP production promotes glycogen synthesis leading to inactivation of glycolysis.
  - (C) High ATP production promotes the carboxylation of pyruvate leading to gluconeogenesis.
  - (D) High ATP production inactivates hexokinase leading to decreased of glycolysis.
  - (E) None of the above.
51. Pyruvate kinase is one of the regulatory enzymes within glycolytic pathway. However, the genetic deficient of this enzyme might affect the normal function of red blood cells. Which of the following scenarios is likely to be observed for pyruvate kinase deficient?
- (A) The red blood cells contain high level of NADH.
  - (B) The red blood cells contain low level of 2,3-biphosphoglycerate.
  - (C) High lactate concentration in blood.
  - (D) The hemoglobin significantly loss its affinity to bind oxygen.
  - (E) The TCA cycle in blood cells will be significantly activated.
52. Which enzyme in the pentose phosphate pathway uses thiamine pyrophosphate as a cofactor?
- (A) glucose-6-phosphate dehydrogenase
  - (B) gluconolactonase
  - (C) 6-transketolase gluconate dehydrogenase
  - (D) transketolase
  - (E) phosphopentose isomerase
53. Which of the following enzyme is tightly located in the outer mitochondrial membrane?
- (A) succinate dehydrogenase
  - (B) voltage-dependent anion channel
  - (C) carnitine transporter
  - (D) malate dehydrogenase
  - (E) fumarase



國立清華大學 112 學年度學士後醫學系單獨招生試題

考試科目（科目代碼）：生物與生化（0102）

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54. A patient with defect of pyruvate dehydrogenase will expect to suffer which of the following symptom?
- (A) alkalosis
  - (B) low serum alanine
  - (C) low serum pyruvate
  - (D) low serum glutamic-oxaloacetic transaminase
  - (E) high serum lactate
55. Which electron transport chain protein is the inhibitory target of rotenone?
- (A) succinate-coenzyme Q reductase
  - (B) CoQH<sub>2</sub>-cytochrome c reductase
  - (C) NADH ubiquinone oxidoreductase
  - (D) cytochrome c oxidase
  - (E) none of the above
56. Which of the following amino acid shares the same biosynthesis pathway of purine synthesis?
- (A) Glutamate
  - (B) Histidine
  - (C) Phenylalanine
  - (D) Cystine
  - (E) Lysine
57. Lesch-Nyhan syndrome is a rare inherited disorder. This disease leads to increased uric acid in all body fluids. In the view of metabolism, the disease is caused by the deficient of
- (A) xanthine oxidase
  - (B) uricase
  - (C) xanthine oxidoreductase
  - (D) hypoxanthine-guanine phosphoribosyl transferase
  - (E) guanine deaminase
58. Which of the following DNA polymerase can be found in the eukaryotic mitochondria and is essential for mitochondrial replication?
- (A) DNA polymerase II
  - (B) DNA polymerase III
  - (C) DNA polymerase- $\alpha$
  - (D) DNA polymerase- $\beta$
  - (E) DNA polymerase- $\gamma$

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59. All of the following statements regarding prokaryotic ribosome are true EXCEPT:
- (A) Prokaryotic ribosomes are composed of 35% rRNA and 65% ribosomal proteins in weight.
  - (B) Prokaryotes have 70S ribosomes consisting of a 30S subunit and a 50S subunit.
  - (C) Prokaryotic ribosomal proteins can be used for bacterial identification.
  - (D) The small subunit has the decoding function, whereas the large subunit catalyzes the formation of peptide bonds
  - (E) Ribosomal proteins are general basic.
60. Post-translational modification refers to the enzymatic modification of proteins covalently following protein biosynthesis. Which of the following instrument is the most efficiently to be used for post-translational modification detection?
- (A) Nuclear magnetic resonance spectrometry
  - (B) X-ray diffraction
  - (C) Infrared spectroscopy
  - (D) Mass spectrometry
  - (E) Liquid chromatography