

第一大題選擇題(1-30, 60%) · 答案請劃記於答案卡 · 未劃記於答案卡將不予計分

1. A hydropathy plot is used to:
  - A. Determine the water-solubility of a protein
  - B. Deduce the water content of a native protein
  - C. Estimate for the true molecular weight of a membrane protein
  - D. Deduce the quaternary structure of a membrane protein
  - E. Predict whether a given protein sequence contains membrane-spanning segments
2. Prosthetic groups in the class of proteins known as glycoproteins are composed of:
  - A. Lipids
  - B. Flavin nucleotides
  - C. Carbohydrates
  - D. Metals
  - E. Phosphates
3. Cyanide is a potent inhibitor of cell respiration that prevents the oxidation of all nutrients. Cyanide will therefore definitely reduce the cellular concentration of :
  - A. Heme groups
  - B.  $\text{FADH}_2$
  - C. CoA
  - D. ATP
  - E. SAM
4.  $\beta$ -sheets are stabilized by which of the force?
  - A. Hydrophobic interaction
  - B. Vanderwall force
  - C. Hydrogen bonds between the (CO) and the (NH) units in the peptide backbone
  - D. Hydrogen bonding between the R groups.
  - E. Hydrogen bonds between adjacent segments of polypeptide chains
5. Sickle cell anemia is a molecular disease of hemoglobin. The altered properties of hemoglobin S result from a single amino acid mutation. The following statement which is right?
  - A. a Leu instead of an Asp residue
  - B. an Ile instead of an Asn residue
  - C. a Val instead of a Glu residue
  - D. a Leu instead of a Gln residue
  - E. a Met instead of a Asn residue
6. Protein kinases phosphorylate proteins only at certain hydroxyl groups on amino acid side chains. Which of the following groups of amino acids all contain side-chain hydroxyl groups?
  - A. Aspartate, glutamate, and serine
  - B. Serine, threonine, and tyrosine
  - C. Threonine, phenylalanine, and arginine
  - D. Lysine, arginine, and proline
  - E. Alanine, asparagine, and serine
7. The oxygen-binding curve of hemoglobin is sigmoidal because
  - A. The binding of oxygen to a heme group increases the oxygen affinities of the other heme groups
  - B. The solubility of the hemoglobin molecule changes with its oxidation state

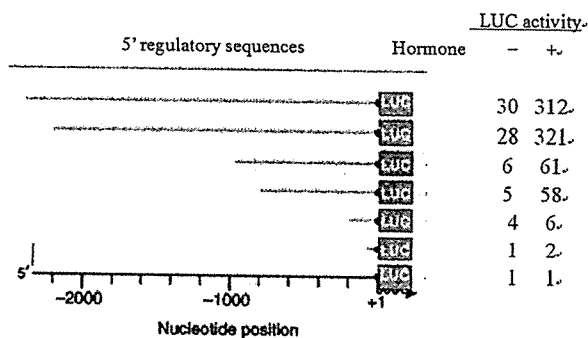
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- C. The subunits are held in place by interchain disulfide bonds  
D. The distal histidine allows the hemoglobin molecule to change its conformation in response to an elevated carbon dioxide concentration.  
E. None of the above
8. A protein has one transmembrane domain composed entirely of  $\alpha$ -helical secondary structure. Which of the following amino acids would you expect to find in the transmembrane domain?  
A. Proline  
B. Glutamate  
C. Lysine  
D. Leucine  
E. Arginine
9. Which peptide has greater absorbance at 280 nm ?  
A. Gln-Leu-Glu-Phe-Thr-Leu-Asp-Gly-Tyr  
B. Ser-Val-Trp-Asp-Phe-Gly-Tyr-Trp-Ala  
C. Asp-Ile-Asn-Pro-Thr-Arg-Asp-Val-Phe  
D. Asn-Phe-Gln-Met-Thr-Leu-Tyr-Lys-Tyr  
E. Ala-Val-Met-Thr-Thr-Leu-Val-Arg-Ser
10. Which of the following proteins eluted first from the DEAE ion-exchange column in an elution buffer of pH 8.0  
A. Pepsin (pI 1.0)  
B. Myoglobin (pI 7.0)  
C.  $\alpha$ -lactoglobulin (pI 5.8)  
D. Cytochrome C (pI 10.7)  
E. Ovalbumin (pI 4.6)
11. Which of the following best describes the function of the sigma ( $\sigma$ ) subunit in the RNA polymerase?  
A. UDP-glucose synthetase    B. phosphoglucose uridylyltransferase    C. UDP-glucose dehydrogenase  
D. UDP-glucose peroxidase    E. UDP-glucose pyrophosphorylase.
12. DNA and RNA synthesis differ in several important ways, which of the following statements is true?  
A. A primer is involved in RNA synthesis as RNA polymerases have the ability to initiate synthesis de novo.  
B. Deoxyribonucleotides are used in RNA synthesis rather than ribonucleotides.  
C. In a given cell, the entire genome are vigorously transcribed or copied into RNA.  
D. There is no highly active, efficient proofreading function during RNA transcription.  
E. All are true.
13. Which of the following compounds is an intermediate in the pathway of ketogenesis?  
A. acetoacetate    B. D-3-hydroxybutyrate    C. acetone  
D. 3-hydroxy-3-methylglutaryl-CoA    E. None of them.
14. Which of the following statements concerning nucleotides is true?  
A. The sugar derivatives UDP-glucose and UDP-galactose participate in sugar interconversions and in the biosynthesis of starch and glycogen.  
B. Nucleoside-lipid derivatives such as CDP-acylglycerol are intermediates in lipid biosynthesis.  
C. The cyclic nucleotides cAMP and cGMP serve as the second messengers in hormonally regulated events.  
D. GTP and GDP play key roles in the cascade of events that characterize signal transduction pathways.  
E. All of them.

15. Which of the following amino acids can **NOT** be converted to acetoacetyl-CoA?  
 A. Arg B. Lys C. Phe D. Trp E. Tyr.

Questions 16~19

Researchers studied the regulation of a hormone-responsive gene and isolated a DNA fragment (approximately 2 kb of 5'-flanking DNA and cognate promoter) bearing regulatory *cis*-elements from the gene. The fragment was ligated into a plasmid vector that contains a suitable reporter gene, the enzyme firefly luciferase, abbreviated LUC. To define the sequences involved in the regulation of this gene, they made a series of deletions containing various lengths of the 5' regulatory sequences and cloned the truncated DNA fragments upstream of the LUC gene as shown in the figure below. These constructs were introduced into mammalian cells and the LUC enzyme activity was assayed in the presence (+) and absence (-) of hormone. An additional reporter Renilla luciferase was co-introduced into cells to serve as a transfection efficiency control, and the figure below gives the results after data analysis.



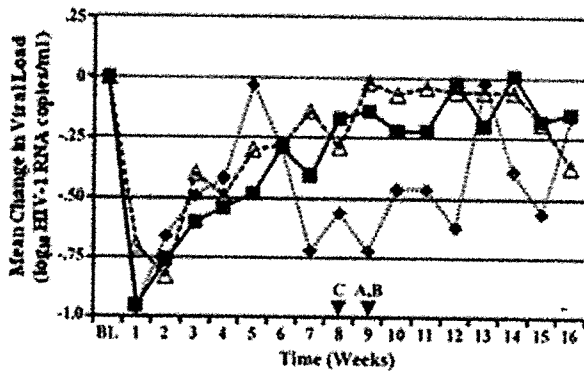
16. If there is a single hormone-responsive regulatory element in this gene, the element is located between  
 A. -2200 and -2100 B. -2100 and -1000 C. -1000 and -900 D. -900 and -100 E. -100 and +1
17. The maximal stimulation of LUC activity due to the addition of hormone is about?  
 A. 2-fold B. 5-fold C. 10-fold D. 100-fold E. 300-fold
18. A new construct was generated that began at -2200 and was identical to that shown in the figure except that the sequences between -1000 and -900 were inverted. Which of the following data are closest to the expected LUC activities in the absence and presence of hormone, respectively?  
 A. 25, 250 B. 250, 250 C. 25, 25 D. 25, 5 E. 5, 25
19. If there are hormone-independent regulatory elements in this gene, the elements are most likely located between  
 A. -2200 and -2100 B. -2100 and -1000 C. -1000 and -900 D. -900 and -100 E. None of them
20. Glucose-6-phosphatase (glucose 6-P) deficiency causes type I glycogen storage disease. The enzyme catalyzes  
 A. glucose 6-P to glucose 1-P B. glucose 6-P to ribose 5-P C. glucose 6-P to fructose 6-P  
 D. glucose 6-P to ribose E. glucose 6-P to glucose.

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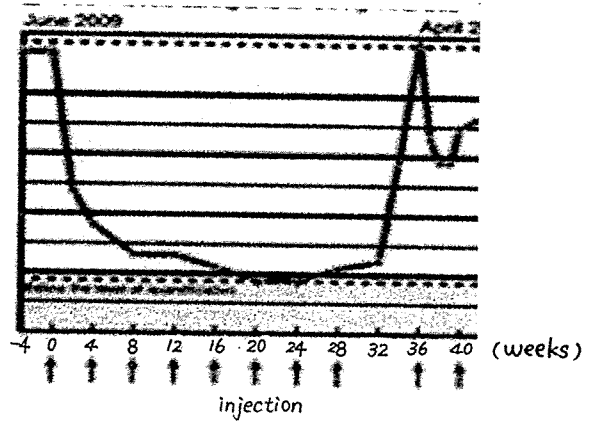
21. the following description about proteoglycans are not correct (複選)
- A. the glycosylation site in the protein core sequence is X-Ser/Thr-X-X
  - B. heparin is the most high density of negative charge molecules in glycosaminoglycans
  - C. heparin and hyluronic acid both are without protein core
  - D. syndecan is basal membrane type proteoglycan
  - E. heparan sulfate found in mast cell granules
22. the following description about selectin are not correct (複選)
- A. a  $Ca^{+2}$  dependent binding ability for its ligand
  - B. a sugar binding protein
  - C. L-selectin is a endothelial cell specific selectin
  - D. Integrin ligand can activate selectin affinity
  - E. Involved in leukocyte rolling on the endothelial cell layer
23. which enzyme is not involved in the trans Golgi oligosaccharides processing (複選)
- A. galactosyl transferase
  - B. N-acetyl glucosaminyltransferase
  - C. sialyltransferase
  - D. Fucosyltransferase
  - E. oligosaccharide:protein transferase
24. which description about O-link glycosylation are correct (複選)
- A. the posttranslational modification for directing glycoprotein transfer from ER to Golgi
  - B. X-Asn-X is the attachment site
  - C. N-acetylgalactosamin(GalNac) is the core sugar link to protein
  - D. X-Ser/Thr-XXX is the attachment site
  - E. all above are correct
25. which integrin can bind laminin connecting to inter-media filaments which connect to nucleus membrane and control gene expression and cell differentiations (複選)
- A.  $\alpha 2\beta 1$  B.  $\alpha 3\beta 1$  C.  $\alpha 6\beta 1$  D.  $\alpha 6\beta 3$  E.  $\alpha 6\beta 4$
26. Integrin can bind to which "two" peptides including the synergistic binding site and give the high affinity binding below? (複選)
- A. ARGDSAA
  - B. AKGEAAA
  - C. AYGSRAA
  - D. AKAEKAA
  - E. AYIGSRAA
27. which are the tumor suppresser protein (複選)
- A. Ras B. Myc C. P53 D. Raf E. Rb
28. which important molecules are in maintaining the normal epithelial cells polarity? (複選)
- A. I-CAM
  - B. E-cadherin
  - C. Gap junction
  - D. integrin
  - E. Occludin junction

29-30

Anti-HIV antibody 007



Anti-HIV antibody 008



The above are the clinical trial for the two anti HIV antibodies, anti-HIV 007 and anti-HIV008  
 Y is the HIV virus (HIV-1RNA) readings and X is the time for post injection of antibodies

After the clinical trial for the anti-HIV antibody 007 and anti-HIV antibody 008  
 The company will submit to USA FDA Orphan drug clinical trial and please answer the questions related to the conditions for designing the protocol of the clinical trial as described below:

29. The descriptions about the two anti-HIV antibodies are correct: (複選)
- A. Both antibodies are life long effective
  - B. Both antibodies show resistant to anti-HIV antibodies
  - C. The efficacy is anti-HIV 008 great than anti-HIV007
  - D. The efficacy is anti-HIV 007 great than anti-HIV008
30. If the submitted FDA USA Orphan drug clinical trial protocol: 20 HIV infected individual were selected and 100~200mg/kg anti-HIV Ab 007 or anti-HIV Ab 008 used to perform the muscle injection and post injection two weeks, the blood virus count were determined and the trials were done in four week period
- Which descriptions are right? (複選)
- A. Post injection two week to count blood virus load can give the best result
  - B. Post injection two week to count blood virus load cannot reflect the resistance for those two antibodies
  - C. Anti HIV 007 show the HIN resistance after 8 weeks
  - D. Anti HIV 008 show the HIN resistance after 32 weeks
  - E. Anti-HIV 007 show longer efficacy than anti-HIV008

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第二大題非選擇題(40%) · 請作答於答案卷

31. How a high catabolic rate of fatty acids affects glycolysis and gluconeogenesis? (4 points)
32. Please explain the important functions of the Cori cycle and glucose-alanine cycle in glucose metabolism? (4 points)
33. What metabolic reactions require UDP-glucuronate? (2 points)
34. Please list three important reactants for the biosynthesis of glycine in human liver cells? (6 points)
35. What are the important organs responsible for heme catabolism? (4 points)
36.
  - A. What is the main biological function of "pyruvate dehydrogenase"? (2%)
  - B. Please write down the names of all the coenzymes that are necessary for the catalytic function of "pyruvate dehydrogenase"? (2%)
  - C. Briefly describe the mechanisms by which "pyruvate dehydrogenase" can be regulated. (4%)
37. Explanation of Terms (名詞解釋，簡答即可)
  - A. covalent catalysis (2%)
  - B. acid-base catalysis (2%)
  - C. prosthetic group (2%)
38. The plot of "initial rate ( $V_0$ )" vs "substrate concentration [S]" is one of the most important experimental approaches in enzyme kinetics. Please describe what information can you obtained from the " $V_0$ -[S]" plot. (6%)

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