

國立清華大學命題紙

98 學年度 生醫工程與環境科學 系(所) 甲組(分子生醫光電組) 碩士班入學考試

科目 生物化學 科目代碼 2302 共 7 頁第 1 頁 *請在【答案卷卡】內作答

單一選擇題：25 題，每題 2 分，答錯到扣 0.5 分；簡答題：5 題，每題 10 分。

A: 單一選擇題：(*務必使用電腦答案卡作答，否則不與計分)

1. Which of the following is correct concerning the dissociation constant, K_d , of a drug X?
 - A) A larger K_d implies tighter target to drug binding.
 - B) The K_d corresponds to the concentration of drug that binds to 90% of the target.
 - C) The K_d will appear to increase in higher concentrations of the true substrate of the target.
 - D) The apparent K_d increases as the K_m of the true substrate increases.
 - E) The apparent K_d decreases as the K_m of the true substrate increases.
2. Which of the following is **not** commonly conjugated to a xenobiotic?
 - A) glucuronic acid
 - B) sulfate group
 - C) glutathione
 - D) salicylic acid
 - E) carbonate group.
3. A compound that inhibits HMG-CoA Reductase has potential use as a drug that
 - A) reduces inflammation and can be used to treat arthritis.
 - B) reduces stomach acid production and can be used to treat ulcers
 - C) reduces blood cholesterol and can be used to treat atherosclerosis.
 - D) increases the concentration of cGMP and can be used to treat erectile dysfunction.
 - E) Increases dopamine and can be used to treat schizophrenia.
4. Bacterial motors differ from eukaryotic ones in that the bacterial motor
 - A) moves along a polymeric track.
 - B) moves when ATP is hydrolyzed.
 - C) spins around a central axis.
 - D) a and b.
 - E) a, b, and c.
5. Diversity in variable regions of L and H chains of antibody is generated by
 - A) selective proteolysis of pre-immunoglobulin proteins
 - B) synthesis of multiple transcripts in each lymphocyte.
 - C) the splicing together of several V genes within the pre-mRNA
 - D) gene rearrangement during cell differentiation.
 - E) mutations

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科目 生物化學 科目代碼 2302 共 7 頁第 2 頁 *請在【答案卷卡】內作答

單一選擇題：25 題，每題 2 分，答錯到扣 0.5 分；簡答題：5 題，每題 10 分。

6. What biochemical conditions indicated the role of G proteins in olfactory systems?
 - A) Rat cilia were found to be ATP deficient.
 - B) The levels of ATP and cAMP were critical.
 - C) The receptors required GDP for activity.
 - D) The participation of cAMP and GTP in the process.
 - E) The receptors were localized in membranes.
7. Histone binding and wrapping of DNA reduces the DNA length by
 - A) 2-fold.
 - B) 7-fold.
 - C) 20-fold.
 - D) 100-fold.
 - E) 1000-fold.
8. Enhancer sites are often located
 - A) Near the poly A tail site.
 - B) Within introns.
 - C) At a distance from the transcription start site.
 - D) a and b
 - E) a and c
9. A key reaction in gene repression is the deacetylation of this (these) amino acids in histones.
 - A) serine.
 - B) threonine.
 - C) arginine.
 - D) lysine.
 - E) tyrosine.
10. What is the order of the tRNA binding sites on the 70S ribosome with respect to the 5'-3' direction of the mRNA?
 - A) E P A
 - B) P A E
 - C) A E P
 - D) E A P
 - E) E A P
11. RNA modification in prokaryotes includes the following:
 - A) cleavage and modification of nascent RNA
 - B) addition of nucleotides.
 - C) spliceosome-mediated splicing of the nascent RNA.
 - D) a and b.
 - E) a, b, and c.
12. Actinomycin interferes with transcription by
 - A) binding to the RNA polymerase.
 - B) disrupting the DNA-RNA duplex.
 - C) binding to the DNA helix and preventing its use as an RNA template.
 - D) a and b.
 - E) a, b, and c.

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科目 生物化學 科目代碼 2302 共 7 頁第 3 頁 *請在【答案卷卡】內作答

單一選擇題：25 題，每題 2 分，答錯到扣 0.5 分；簡答題：5 題，每題 10 分。

13. One function of the two metal cations that are required by DNA polymerases is
- A) to stabilize the negative charge of the transition state.
 - B) to bind ATP.
 - C) to complex with a tyr residue in the active site.
 - D) b and c.
 - E) a, b, and c.
14. The function(s) of glycolysis include(s)
- A) degrading glucose to provide ATP.
 - B) providing carbon skeletons for biosynthesis.
 - C) providing NADH for lactate reduction.
 - D) a and b.
 - E) a, b, and c.
15. The LDL receptors on the plasma membrane are localized in *coated pits* that contain the receptors of which of the following proteins?
- A) clathrin
 - B) lipoprotein B-100
 - C) adrenodoxin
 - D) Apo B-100
 - E) SREBP, sterol regulatory element binding protein
16. How many ATP molecules are necessary to make carbamoyl phosphate by carbamoyl phosphate synthetase (CPS)?
- A) 1 B) 2 C) 3 D) 4 E) 5
17. Chorismate is a precursor to the amino acids
- A) tryptophan, tyrosine, and phenylalanine.
 - B) tryptophan and phenylalanine.
 - C) tyrosine and phenylalanine
 - D) tryptophan, tyrosine, phenylalanine, and serine.
 - E) tryptophan and serine.

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科目 生物化學 科目代碼 2302 共 7 頁第 4 頁 *請在【答案卷卡】內作答

單一選擇題：25 題，每題 2 分，答錯到扣 0.5 分；簡答題：5 題，每題 10 分。

18. In the urea cycle, the second nitrogen of urea enters the cycle in the form of which of the following metabolites?
- A) alanine
 - B) glutamine
 - C) ornithine
 - D) aspartate
 - E) arginine
19. What types of reactions do cobalamin enzymes catalyze?
- A) intramolecular rearrangements
 - B) methylations
 - C) reduction of ribonucleotides to deoxyribonucleotides
 - D) a and c
 - E) a, b, and c
20. What physiological conditions render phosphorylase b less active?
- A) high ATP, high AMP, and glucose 6-phosphate levels
 - B) high ATP and low calcium ion levels
 - C) high ATP and high glucose 6-phosphate levels
 - D) a and c
 - E) a, b, and c
21. In the Calvin cycle, 3-phosphoglycerate is converted into which hexose phosphate?
- A) glucose 1-phosphate
 - B) glucose 6-phosphate
 - C) fructose 6-phosphate
 - D) a and b
 - E) a, b, and c
22. Light absorption induces electron transfer from P680 to
- A) Pheophytin.
 - B) QH₂.
 - C) cytochrome c.
 - D) chlorophyll PP
 - E) ferredoxin

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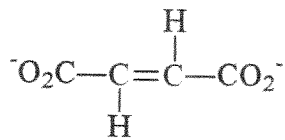
科目 生物化學 科目代碼 2302 共 7 頁第 5 頁 *請在【答案卷卡】內作答

單一選擇題：25 題，每題 2 分，答錯到扣 0.5 分；簡答題：5 題，每題 10 分。

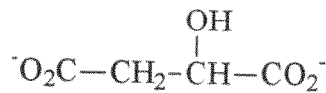
23. What is the chemical effect of oligomycin on aerobic metabolism?
- A) The flow of electrons from NADH to CoQ is blocked
 - B) The flow of electrons from Cyt a-a₃ to oxygen is blocked.
 - C) Oligomycin blocks the proton transfer through F₀ of ATP synthase and therefore blocks the phosphorylation of ADP to form ATP.
 - D) The transport of ATP out of and ADP into the mitochondria is blocked.
 - E) Oxidative phosphorylation is uncoupled from electron transport and all the energy is lost as heat.

24. Which of these compounds is oxidized by a multienzyme complex that requires five different coenzymes?

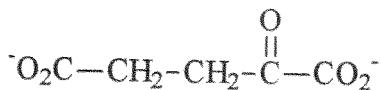
A)



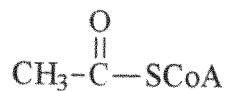
D)



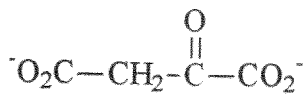
B)



E)



C)



25. What reaction is catalyzed by aldolase?

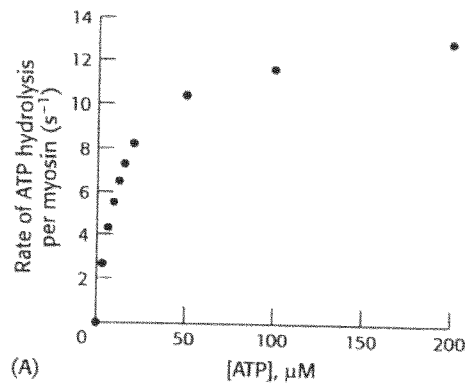
- A) isomerization of DHAP to GAP
- B) ligation of GAP and DHAP
- C) reversible cleavage of F-1,6-BP to DHAP and GAP
- D) cleavage of DHAP to GAP
- E) irreversible aldol condensation of DHAP and GAP

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B: 簡答題:

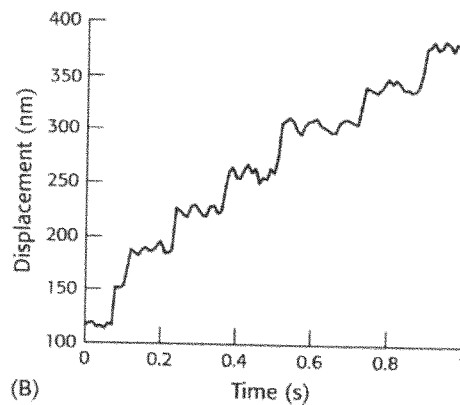
1. An abundant myosin-family member, myosin V is isolated from brain tissues. This myosin has a number of unusual properties. First, on the basis of its amino acid sequence, each heavy chain has six tandem binding sites for calmodulin-like light chains. Finally, unlike almost all other myosin-family members, myosin V is highly processive.

The rate of ATP hydrolysis by myosin has been examined as a function of ATP concentrations, as shown in graph A.



- (a) Estimate the values of k_{cat} and K_M for ATP.

With the use of optical-trap measurements, the motion of single myosin V dimmers could be followed, as shown in graph B.



- (b) Estimate the step size for myosin V.

The rate of ADP release from myosin V is found to be approximately 13 moles s^{-1} .

- (c) Combine the observations about the amino acid sequence of myosin, the observed step size, and the kinetics results to propose a mechanism for the processive motion of myosin V.

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2. The standard free energy of binding of F_{ab} derived from an antiviral IgG is -29 kJ mol^{-1} (-7 kcal mol^{-1}) at 25°C .
 - (a) Calculate the dissociation constant of this interaction.
 - (b) Predict the dissociation constant of the intact IgG, assuming that both combining sites of the antibody can interact with viral epitopes and that the free-energy cost of assuming a favorable hinge angle is 12.6 kJ mol^{-1} (3 kcal mol^{-1}).
3. Describe the mechanism by which *N*-linked sugars are synthesized and attached to proteins.
4. To determine if two proteins are homolog, sequence alignments are frequently used.
 - (a) How are sequence alignments made?
 - (b) What is the difference between a simple scoring system for alignment and the Blosum-62 matrix?
5. What is the 26S proteasome?