

國立中興大學

109 學年度

碩士班考試入學招生

試 題

學系：生物科技學研究所

科目名稱：生物化學

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請於答案卷作答

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單選題，每題 2 分，共 30 題 60 分

1. Which of the following is a covalent bond?
(A) ionic bond
(B) hydrogen bond
(C) disulfide bond
(D) hydrophobic bond
2. Which amino acid is positively charged at pH 9?
(A) Cys
(B) Tyr
(C) Asp
(D) Arg
3. Which of the following amino acids in a protein molecule CAN NOT be modified by a protein kinase?
(A) Tyr
(B) Trp
(C) Thr
(D) Ser
4. How many amino acid residues are minimally required to make a transmembrane alpha-helix? (The thickness of lipid bilayer is about 45 angstrom.)
(A) 15
(B) 30
(C) 45
(D) 60
5. Which one is NOT a protein?
(A) abzyme
(B) ribozyme
(C) lysozyme
(D) isomerase

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6. Which one is NOT a protein?
- (A) integrin
 - (B) pectin
 - (C) actin
 - (D) lectin
7. Which of the following statements regarding enzyme-catalyzed reactions is FALSE?
- (A) Enzymes form complexes with their substrates.
 - (B) Enzymes change the K_{eq} for chemical reactions.
 - (C) Enzymes lower the activation energy of chemical reactions.
 - (D) Reactions occur at the "active site" of enzymes, where a precise 3D orientation of amino acids is an important feature of catalysis.
8. Which of the following monosaccharide is a ketose?
- (A) ribose
 - (B) glucose
 - (C) fructose
 - (D) galactose
9. Which of the following metabolic pathway provides NADPH for fatty acid biosynthesis?
- (A) oxidative phosphorylation
 - (B) pentose phosphate pathway
 - (C) TCA cycle
 - (D) β -oxidation
10. Which organ in your body can metabolize all of the amino acids?
- (A) kidney
 - (B) liver
 - (C) intestine
 - (D) muscle
11. The free ammonia formed in peripheral tissues must be transferred to the liver via ___ for conversion to urea.
- (A) glutamate
 - (B) glutamine
 - (C) alanine
 - (D) pyruvate

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12. β -oxidation occurs in which of the following organelle in eukaryotes?
- (A) cytosol
 - (B) peroxisome
 - (C) mitochondria
 - (D) endoplasmic reticulum
13. A so-called nonsense mutation is a mutation that -
- (A) no observable effect can be seen on the organism's phenotype.
 - (B) also known as anonymous mutation.
 - (C) results in a premature stop codon.
 - (D) All of the above
14. Prokaryotic mRNA that contain several open reading frames are -
- (A) synonymous
 - (B) encoding polyprotein
 - (C) polycistronic
 - (D) highly active
15. Epigenetic changes -
- (A) can lead to phenotype or gene expression changes.
 - (B) may remain through cell divisions.
 - (C) may pass on to progenies.
 - (D) All of the above.
16. Which program is used to search nucleotide databases using protein queries?
- (A) blastn
 - (B) blastp
 - (C) blastx
 - (D) tBlastn
17. Bacteria produce many restriction endonucleases. What prevents these enzymes from degrading their own genomic DNA?
- (A) The restriction endonucleases are exported out of the cell right after synthesis.
 - (B) The host DNA is specifically methylated by enzyme and is therefore protected from cleavage.
 - (C) The strong association between the histones and bacterial DNA prevent the endonuclease from acting on them.
 - (D) All of the above are possible.

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18. Which of the following is an ω -3 fatty acid?
- (A) oleic acid ($\Delta^9C_{18:1}$)
 - (B) linoleic acid ($\Delta^9, 12C_{18:2}$)
 - (C) linolenic acid ($\Delta^9, 12, 15C_{18:3}$)
 - (D) palmitic acid ($C_{16:0}$)
19. Second messengers are intracellular signaling molecules released by the cell in response to exposure to extracellular first messengers. The following first messengers require secondary messengers EXCEPT:
- (A) steroid hormones
 - (B) adrenalin
 - (C) insulin
 - (D) glucagon
20. Assuming that the optical density (OD) of a solution is 1 under a 1-cm light path, what is the percentage of the light be absorbed by solution?
- (A) 90%
 - (B) 10%
 - (C) 9%
 - (D) 1%
21. To set up a polymerase chain reaction, usually 10 pmole primer is required in a 50 μ l reaction. Therefore what is the amount you will take from a 100 μ M primer stock solution to use?
- (A) 0.01 μ l
 - (B) 0.1 μ l
 - (C) 1 μ l
 - (D) 10 μ l
22. One microgram of compound X was dissolved in 1 liter water. The concentration of compound X is:
- (A) 10 ppm
 - (B) 100 ppm
 - (C) 1 ppb
 - (D) 10 ppb
23. Which of the following is NOT the ideal characteristic for an organism to be chosen as "model" for study?
- (A) It has high mutation rate in nature.
 - (B) It has short life-cycle.
 - (C) It has method of transformation.
 - (D) It has simple genome arrangement.

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A transcript in bacteria is abbreviated as following (with the SD sequence underlined and the middle 583 nucleotides omitted)

5'-AGGAAGGAUCGUGUACAAUGGCAUC... (583)...UUUGGCGUGUAGAAUUCAAAU-3'

24. How many amino acids does this transcript encode?

- (A) 600
- (B) 583
- (C) 200
- (D) 194

25. (continued) What is the estimated molecular weight for the encode protein?

- (A) 22 kDa
- (B) 66 kDa
- (C) 19433 Dalton
- (D) 58300 Dalton

26. (continued) There is a 6-cutter restriction enzyme site located at the 5'-UTR of the gene, what is it?

- (A) TGTACA
- (B) AAUGGC
- (C) UGUACA
- (D) AUCGUG

For the following experimental purpose (), please choose one most suitable technique to use from (A)~ (H)

27. To investigate the interaction between proteins and DNA

28. To quantify gene expressions between different tissues

29. To detect nucleotide polymorphisms in human populations

30. To determine the composition of microorganism in environmental samples

- (A) Chromatin ImmunoPrecipitation (ChIP)
- (B) Enzyme-Linked Immuno Sorbent Assay (ELISA)
- (C) 16S rDNA metagenomic sequencing
- (D) Fluorescence Resonance Energy Transfer (FRET)
- (E) Fluorescence *in situ* Hybridization (FISH)
- (F) Fluorescence Activated Cell Sorting (FACS)
- (G) Reverse Transcription qPCR (RT-qPCR)
- (H) Single Nucleotide Polymorphism array (SNP-array)

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簡答題，每題 5 分，僅選擇六題回答，不需要全部作答，否則以前六題計分，共 30 分

1. Zwitterion
2. Phospholipid
3. ATP-binding cassette transporters (ABC transporter)
4. Antigenic determinant site (epitope)
5. CpG island
6. Operator
7. Next-generation sequencing (NGS)
8. Single nucleotide polymorphism (SNP)
9. Expressed sequence tag (EST)
10. Green fluorescent protein (GFP)
11. Monoclonal antibody
12. Cas9-mediated genome modification

請簡要翻譯成中文，10 分，請僅選擇一題回答，不要全部作答

1. For the quantification of mutated genes at greatly varied concentrations in body fluids, the proportional amplifications of nucleic acid are often very challenging. The proposed isotope-based detection strategy demonstrates five orders of linear range amplifications and a lower attomol detection limit, showing promising potential in clinical diagnosis.
2. Most bacterial infections can be treated with antibiotics such as penicillin. However, such drugs are useless against viral infections. Now, in a development that could transform how viral infections are treated, a team of researchers at MIT's Laboratory has designed a drug that can identify cells that have been infected by any type of virus, then kill those cells to terminate their infection. The research group drew inspiration for the therapeutic agents, dubbed DRACOs (Double-stranded RNA Activated Caspase Oligomerizers), from living cells' own defense systems. The drug works by targeting a type of RNA produced only in cells that have been infected by viruses.