

國立成功大學

111學年度碩士班招生考試試題

編 號： 60

系 所： 生物科技與產業科學系

科 目： 生物化學

日 期： 0220

節 次： 第 1 節

備 註： 不可使用計算機

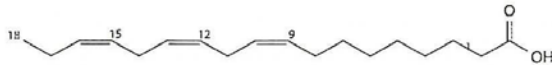
※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

一、單選題 (Simple choice question)：20 題，每題 2 分

- Following which molecule is not a standard amino acid?
 - Glycine
 - Ornithine
 - Tyrosine
 - N-formylmethionine
 - Selenocysteine
- A peptide hormone has the following sequencing: Val Ser Tyr Ser Met Glu Asn Phe Arg Trp Gly Lys Pro. What charge of this peptide would you expect at pH 7?
 - 2
 - 1
 - 0
 - +1
 - +2
- Which of the following methods is effective for separating proteins on the basis of their polarity?
 - Size exclusion chromatography
 - Ammonium sulfate precipitation
 - SDS-PAGE
 - Ion exchange chromatography
 - Reverse phase chromatography
- Which of the following best describes the glycosidic bond below?

 - β (2 \rightarrow 4)
 - α (1 \rightarrow 3)
 - α (1 \rightarrow 4)
 - β (1 \rightarrow 3)
 - α (2 \rightarrow 4)
- An example of a transamination process is:
 - Glutamate \rightarrow Hexanoic acid + NH_3
 - Aspartate + Hexanoic acid \rightarrow Glutamate + Oxaloacetate
 - Aspartate + α -ketoglutarate \rightarrow Glutamate + Oxaloacetate
 - Glutamate \rightarrow α -ketoglutarate + NH_3

- e. Aspartate \rightarrow Oxaloacetate + NH_3
6. Gluconeogenesis is the synthesis of:
- glucose from non-carbohydrate precursors.
 - glycogen from glucose.
 - pyruvate from glucose.
 - fatty acids from glucose.
 - glucose from fatty acids.
7. Following which steroid hormone are derived from cholesterol except ?
- Testosterone
 - Estradiol
 - Cortisol
 - Cycloartenol
 - Aldosterone
8. Following which statements are correct regarding biofunctions of nucleotides except
- IMP is one of the monomers of RNA.
 - IMP is a biosynthetic precursor of AMP.
 - TTP drives lipid synthesis.
 - UTP drives carbohydrate metabolism.
 - GTP drives protein synthesis.
9. The chemical structure of α -linolenic acid (ALA) is shown as below:



- Following which statements are correct regarding ALA except
- ALA is a C18 fatty acid.
 - ALA is a polyunsaturated fatty acid.
 - ALA is a cis fatty acid.
 - ALA is an omega-6 fatty acid.
 - ALA is a n-3 fatty acid.
10. Following which molecule is not a purine?
- Adenine
 - Hypoxanthine
 - Guanine
 - Xanthine
 - Uracil
11. Please arrange the possibility (from most likely to least likely) that can affect the structure of the corresponding polypeptide due to one-base point mutations in the nucleotide sequence.

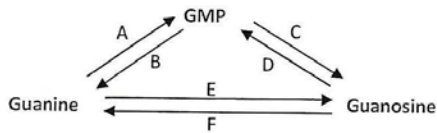
1. insertion mutation deep within an intron
 2. substitution mutation at the third position of an exonic codon
 3. substitution mutation at the second position of an exonic codon
 4. deletion mutation within the first exon of the gene
- a. 1, 2, 3, 4
 - b. 4, 3, 2, 1
 - c. 2, 1, 4, 3
 - d. 3, 1, 4, 2
 - e. 4, 3, 1, 2
12. A short DNA fragment has the base sequence TGCCATTGCGA. After mutation, the sequence became TGGCCATTGCGA. This change represents ____.
- a. a missense mutation
 - b. a conservative missense mutation
 - c. a silent mutation
 - d. frameshift mutation
 - e. a nonsense mutation
13. Which one of the following statements about RNA processing can be best described?
- a. Exons are cut out before mRNA leaves the nucleus.
 - b. Ribozymes may function in RNA splicing.
 - c. RNA splicing can be catalyzed by tRNA.
 - d. RNA splicing can be catalyzed by rRNA.
 - e. A primary transcript is often much shorter than the final RNA molecule that leaves the nucleus.
14. Alternative splicing in the pre-mRNA ____.
- a. is a mechanism for increasing the rate of translation
 - b. can allow the production of proteins of different sizes and functions from a single mRNA
 - c. can allow the production of similar proteins from different RNAs
 - d. increases the rate of transcription
 - e. increases the rate of translation
15. The reason why the sets of proteins are differentially expressed in a nerve and a pancreatic cell of the same individual is that nerve and pancreatic cells contain different ____.
- a. genes
 - b. regulatory sequences
 - c. sets of regulatory proteins
 - d. promoters
 - e. enhancers
16. Why do short tandem repeats (STRs) DNA profiles make them useful for DNA fingerprinting?
- a. The number of repeats varies widely from person to person or animal to animal.

- b. The sequence of DNA that is repeated varies significantly from individual to individual.
 - c. The sequence variation is acted upon differently by natural selection in different environments.
 - d. Every racial and ethnic group has inherited different short tandem repeats.
 - e. Every racial and ethnic group has inherited the same short tandem repeats.
17. Recently, adult cells have been shown that can be induced to become pluripotent stem cells (iPS). To make this conversion, what has been done to the adult cells?
- a. A retrovirus is used to introduce four specific regulatory genes.
 - b. The adult stem cells must be fused with embryonic cells.
 - c. Cytoplasm from embryonic cells is injected into the adult cells.
 - d. The nucleus of an embryonic cell is used to replace the nucleus of an adult cell.
 - e. Nucleus from embryonic cells is injected into the adult cells.
18. In order to disable the function of a gene in the cell, in vitro mutagenesis was used for cloning and the mutated gene was reinserted. To have the mutated sequence in the genome, what must then occur?
- a. recombination resulting in replacement of the wild type with the mutated gene
 - b. use of a microarray to verify continued expression of the original gene
 - c. use of RT-PCR to verify continued expression of the original gene
 - d. replication of the cloned gene using a bacterial plasmid
 - e. transcription of the cloned gene using a BAC
19. RNAi technology is used to breakdown of a specific mRNA or inhibits its translation. Which of the following purposes can be done by this method?
- a. to decrease the production from a harmful mutated gene
 - b. to destroy an unwanted allele in a homozygous individual
 - c. to destroy an unwanted allele in a heterozygous individual
 - d. to form a knockout organism that will not pass the deleted sequence to its progeny
 - e. to raise the concentration of the desired protein
20. The dideoxynucleotides are usually used to _____.
- a. separate DNA fragments
 - b. produce cDNA from mRNA
 - c. sequence a DNA fragment
 - d. visualize DNA expression
 - e. visualize mRNA expression

二、問答題 (Essay)：共 10 題，60 分

1. (6%) Given the molecular components glycerol, fatty acid, phosphate, long-chain alcohol, and carbohydrates:
- (a) Which two are present in both waxes and sphingomyelin? (2%)
 - (b) Which two are present in both fats and phosphatidylcholine? (2%)
 - (c) Which are present in a ganglioside but not in a fat? (2%)

2. (6%) Identify each reaction catalyzed by (a) nucleotidase (2%) (b) phosphorylase (2%) (c) phosphoribosyltransferase (2%)



3. (8%) Briefly introduce the following enzymes: (1) Isomerase (2%) (2) Kinase (2%) (3) Phosphatase (2%) (4) Fatty acid synthase (2%)
4. (5%) Melittin is a protein in bee venom that activates phospholipase A2. How might this effect contribute to the local inflammation that is caused by bee stings?
(Hint: stimulate the production of prostaglandin)
5. (5%) HMG-CoA reductase is a key enzyme in cholesterol biosynthesis in animals (responsible for the conversion of HMG-CoA to mevalonate). The activity of HMG-CoA reductase is feedback inhibited by cholesterol, the end-product of cholesterol biosynthesis.
What would you expect to happen to the level of mevalonate in human plasma if one was to go from an ordinary to a vegetarian diet (素食)? Why?
6. (5%) Please explain what are the roles of the cre and loxp in the conditional knockout technology?
7. (5%) What are the different point mutations (including silent, nonsense, and missense) of nucleotide sequences? How do they affect the amino acid sequence in the open reading frame of a gene?
8. (5%) What are the roles of small guide RNA (sgRNA) and Cas9 endonuclease in CRISPR-Cas9 system?
9. (5%) What is the Ct value in quantitative RT-PCR?
10. (10%) What is the principle of RNA-Seq (RNA sequencing) (5%) and what kind of research can it be applied (5%)?