

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

考試日期：0302，節次：2

※ 請勿在本試題紙上作答，否則不予計分。**I. Simple-choice questions 單選題（每題 2 分，共 44 分）**

1. Site-directed mutagenesis is used to change a codon from AAA lysine to AGA arginine, but the phenotype produced is still wild type. This type of mutation is called
(A) suppression. (B) silent. (C) nonsense. (D) missense. (E) frameshift.
2. If an incorrect base is incorporated during DNA synthesis and is not corrected by DNA polymerase, it can be corrected by postreplication repair. This involves
(A) detection of the mismatch. (B) a process similar to excision repair.
(C) a recognition of the methylation status of the DNA strands.
(D) All the above. (E) None of the above.
3. Which of the following helps to stabilize mRNA by inhibiting its degradation?
(A) spliceosomes. (B) TATA box. (C) 5' cap. (D) poly-A tail. (E) both C and D.
4. Heterochromatin contains
(A) no genes. (B) only nonfunctional genes. (C) only a few genes.
(D) the same number of genes per unit of DNA as euchromatin.
(E) more genes per unit of DNA than euchromatin.
5. Which type of DNA segment codes for a protein?
(A) rDNA. (B) centromere. (C) telomere. (D) nucleolus organizer.
(E) open reading frame
6. The proteome contains
(A) the set of protein-coding genes of an organism.
(B) the tRNA transcribed genes of an organism.
(C) the rRNA transcribed genes of an organism.
(D) all the RNA transcribed genes of an organism.
(E) all the DNA sequences found in the chromosomes of an organism.
7. In eukaryotes, the enzyme that primarily transcribes the nucleolar organizer is
(A) RNA polymerase I (B) RNA polymerase II (C) RNA polymerase III
(D) primase (E) reverse transcriptase
8. List two especially useful characteristics of cloning vectors.
(A) high copy number and antibiotic resistance gene(s).
(B) virulence and lysogenicity.
(C) ability to integrate into the host chromosome and then cause a lytic cycle.
(D) nonautonomous replication and transposition.
(E) reverse transcriptase and ligase activities.
9. What is the function of the TATA binding protein?
(A) aids in the removal of introns from eukaryotic pre-mRNA.
(B) allows prokaryotic RNA polymerase to bind to the promoter of genes.
(C) allows eukaryotic RNA polymerase II to bind to the promoter of genes.
(D) helps termination factors bind and terminate transcription.

（背面仍有題目，請繼續作答）

本試題是否可以使用計算機： 可使用， 不可使用（請命題老師勾選）

考試日期：0302，節次：2

10. In what cellular compartment are introns removed from pre-mRNA to make mature mRNA?
- (A) cytoplasm. (B) endoplasmic reticulum. (C) nucleus.
(D) mitochondria. (E) golgi apparatus.
11. The quaternary structure of protein:
- (A) always consists of four subunits.
(B) is unrelated to the function of the protein.
(C) depends on the primary structure of the subunits.
(D) depends only on disulfide bonds.
12. Which of the following are types of posttranslational processing that will not occur in a prokaryote?
- (A) addition of a phosphate group. (B) removal of a phosphate group.
(C) addition of a co-factor. (D) cleavage of a mitochondrial targeting sequence.
13. Which of the following elements function specifically in eukaryotic transcription and gene expression?
- (A) origin DNA and promoters. (B) promoters and enhancers.
(C) pribnow boxes and enhancers.
(D) Shine-Dalgarno sequences and sigma factors.
14. What is the function of eukaryotic transcription factors?
- (A) They direct mRNA from the nucleus to the cytoplasm.
(B) They recognize sequences within the enhancer and promoter regions and activate transcription.
(C) They serve as sequences to which RNA polymerase binds.
(D) They initiate binding to the Shine-Dalgarno sequence.
15. Which structural motifs are found in the DNA-binding domains of proteins?
- (A) stem and loop, arginine zipper, and lysine zipper.
(B) helix-turn-helix, zinc finger, and basic leucine zipper.
(C) D loop, helix-turn-helix, and leucine zipper.
(D) cruciform, leucine zipper, and zinc finger.
16. In a nucleosome, what is the DNA wrapped around?
- (A) ribosomes. (B) nucleolus protein. (C) histone.
(D) mRNA. (E) polymerase molecules.
17. Which mutagenic event does *not* occur spontaneously?
- (A) deamination. (B) alkylation. (C) depurination.
(D) tautomerization. (E) incorporation of base analogs
18. Which enzymes can recognize damaged nucleotide bases?
- (A) DNA polymerases (B) ligases.
(C) AP endonucleases. (D) glycosylases.

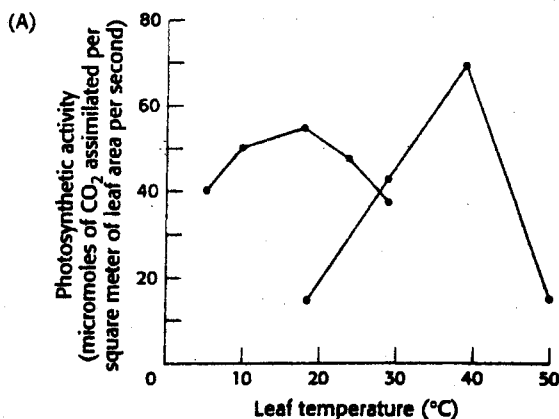
本試題是否可以使用計算機： 可使用， 不可使用 (請命題老師勾選)

考試日期：0302，節次：2

19. Which of the following statements best describes translational-level control?
 (A) upregulation of mRNA synthesis determines translational-level control.
 (B) downregulation of mRNA production determines translational-level control
 (C) translation is independent of the amount of mRNA present.
 (D) translation of the message into protein controls mRNA stability.
20. The role of tautomerism in causing mutations relates to the fact that the process ultimately affects the
 (A) covalent bonding affinities of the nitrogenous base.
 (B) hydrogen bonding affinities of the nitrogenous base.
 (C) deoxyribose sugar. (D) ability of DNA to replicate at all.
21. Which enzyme is responsible for proofreading during replication?
 (A) DNA polymerase. (B) RNA polymerase.
 (C) DNA ligase. (D) DNA glycosylase.
22. What is the name of the protein that appears to regulate the entry of cell into S phase? This protein is also known as the "guardian of the genome."
 (A) p34. (B) p102. (C) cyclin. (D) p53. (E) phosphokinase.

II. Short essay 簡答題 (共 56 分)

1. Ribose 5-phosphate labeled with ^{14}C at C-1 is added to a solution containing transketolase, transaldolase, phosphopentose epimerase, phosphopentose isomerase, and glyceraldehyde 3-phosphate. What is the distribution of the radioactive label in the erythrose 4-phosphate and fructose 6-phosphate that are formed in this reaction? (4%)
2. Graph A shows the photosynthetic activity of two species of plant, one a C_4 plant and the other a C_3 plant, as a function of leaf temperature.



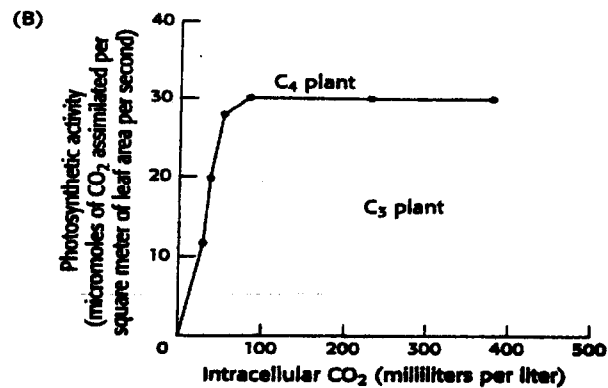
- (a) Which data were most likely generated by the C_4 plant and which by the C_3 plant? Explain. (2%)
- (b) Suggest some possible explanations for why the photosynthetic activity falls at higher temperatures. (2%)

(背面仍有題目,請繼續作答)

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

考試日期：0302，節次：2

Graph B illustrates how the photosynthetic activity of C_3 and C_4 plants varies with CO_2 concentration when temperature ($30^\circ C$) and light intensity (high) are constant.



- (c) Why can C_4 plants thrive at CO_2 concentrations that do not support the growth of C_3 plants? (2%)
- (d) Suggest a plausible explanation for why C_3 plants continue to increase photosynthetic activity at higher CO_2 concentrations, whereas C_4 plants reach a plateau. (2%)
3. A sample of glycogen from a patient with liver disease is incubated with orthophosphate, phosphorylase, the transferase, and the debranching enzyme (α -1,6-glucosidase). The ratio of glucose 1-phosphate to glucose formed in this mixture is 100. What is the most likely enzymatic deficiency in this patient? (4%)
4. Protein kinase A activates muscle phosphorylase kinase by rapidly phosphorylation its β subunits. The α subunits of phosphorylase kinase are then slowly phosphorylated, which makes the α and β subunits susceptible to the action of protein phosphatase 1. What is the functional significance of the slow phosphorylation of α ? (4%)
5. Counterpoint. Compare and contrast fatty acid oxidation and synthesis with respect to
- Site of the process. (2%)
 - Acyl carrier. (2%)
 - Reductants and oxidants. (2%)
6. High blood levels of triacylglycerides are associated with heart attacks and strokes. Clofibrate, a drug that increases the activity of peroxisomes, is sometimes used to treat patients with such a condition. What is the biochemical basis for this treatment? (4%)

本試題是否可以使用計算機： 可使用， 不可使用（請命題老師勾選）

考試日期：0302，節次：2

7. Name the α -ketoacid that is formed by the transamination of each of the following amino acids: (4%)
 - a. Alanine
 - b. Tyrosine
8. Which of the 20 amino acids can be synthesized directly from a common metabolic intermediate by a transamination reaction? (4%)
9. Propose a mechanism for the conversion of S-adenosylmethionine into 1-aminocyclopropane-1-carboxylate (ACC) by ACC synthase, a PLP enzyme. What is the other product? (4%)
10. What is the distribution of isotopic labeling in cholesterol synthesized from each of the following precursors?
 - a. Mevalonate labeled with ^{14}C in its carboxyl carbon atom. (2%)
 - b. Malonyl CoA labeled with ^{14}C in its carboxyl carbon atom. (2%)
11. Human beings and the plant Arabidopsis evolved from the same distant ancestor possessing a small number of cytochrome P450 genes. Human beings have approximately 50 such genes, whereas Arabidopsis has more than 250 of them. Propose a role for the large number of P450 isozymes in plants. (4%)
12. About 25,000 genes in the human genome and that number was much lower than the actual number of proteins in a human cell (more than 100,000). Why? (6%)