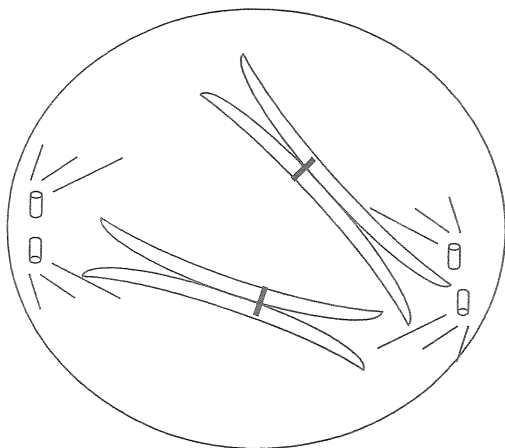


97 學年度 生醫工程與環境科學 系(所) 甲 分子生醫光電 組碩士班入學考試

科目 普通生物學 科目代碼 2505 共 5 頁第 1 頁 *請在試卷【答案卷】內作答

I. Questions (50%)

1. (1) Why is transcriptional control more effective in prokaryotes? (5%)
(2) Some *E. coli* mutant cells have inducible operons that do NOT respond to the appropriate sugar inducer. From your knowledge of how negative control systems operate, can you suggest a reason for this? (5%)
2. Most cells in your body have the same number of chromosomes (notable exceptions are red blood cells, sex cells, and liver cells), and the exact same set of genes, and yet there are a multitude of different types of cells in the body. How is this possible given that most of them possess the same genetic information? (10%)
3. (1) Both of PCR (polymerase chain reaction) and recombinant DNA (cloning) can amplify a target gene. What are the differences? (5%)
(2) A biologist wanted to estimate the genetic relationships of several strains of mushroom. She extracted their DNA and subjected it to PCR using the same randomly generated primers in each case. How would she know which mushrooms were most closely related? (5%)
4. If you look at a cell and see the following, what can you say about (10%)
 - a) Its diploid ($2N$) number of chromosomes?
 - b) The number of pairs of homologous chromosomes?
 - c) The stage of the cell cycle and how you know?
 - d) Whether or not it is in mitosis or meiosis and how you know?



5. Regulating the influx and efflux of ions such as sodium and potassium is quite complex and requires use of ATP energy. How does this motion of positively charged ions create an electrical potential? (10%)

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

科目 普通生物學 科目代碼 2505 共 5 頁第 2 頁 *請在試卷【答案卡】內作答

II. Multiple choice (Only one best answer for each question) (50%; 2 points/each)

- Which of the following statements regarding enzyme action is INCORRECT?
 - Enzymes may lower activation energy.
 - Enzymes catalyze both exergonic and endergonic reactions.
 - Enzymes are involved in metabolic pathways.
 - Induced fit may result in an enzyme changing shape.
 - Enzymes bind to the active sites of substrates.
- Which of the following statements is true?
 - The adenine end of the ATP molecule is referred to as the "working end."
 - The covalent bonds in ATP hold much energy because they are very stable.
 - The splitting of ATP yields ATP and one phosphate group.
 - A given ATP molecule may be stored in the liver or muscle for months.
 - ADP is a major source of energy for muscle contraction.
- Which of the following statements regarding photosynthesis is correct?
 - Plants give off oxygen obtained by splitting carbon dioxide.
 - The energy for making sugars is extracted from NADPH and ATP.
 - The oxygen that the plant builds into glucose ($C_6H_{12}O_6$) is obtained from the splitting of water molecules (H_2O).
 - The electron transport chain results in the oxidation of $NADP^+$.
 - The electron hole in P700 is filled directly by a proton.
- What problem might arise in histone-deficient chromatin?
 - Adjacent DNA strands may not bond.
 - DNA could not be copied.
 - DNA would lack the extra sequences of nucleotides.
 - DNA may fail to condense.
 - The chromosomes would lack caps.
- If one side of a DNA ladder contains the bases ATGCCA, what would be the base composition of the other side of the ladder?
 - ATGCCA
 - ATCGGA
 - UACGGU
 - TACGGT
 - ATCCCT
- If you could detect the binding site of RNA polymerase in a gene that was to be transcribed, where would it be located?
 - Intron
 - Stop sequence
 - Anticodon loop
 - Ribosome
 - Promoter

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

科目 普通生物學 科目代碼 2505 共 5 頁第 3 頁 *請在試卷【答案卡】內作答

7. What might be the consequence of a deficiency of DNA polymerase?
- (A) Failure of nucleotide-splitting to create a replication fork.
 - (B) Failure of nucleotide splitting to create a replication bubble.
 - (C) Failure of the addition of nucleotides to the 3' end of a molecule.
 - (D) Failure of addition of nucleotides to the 5' end of a molecule.
 - (E) Failure to link preformed fragments into a single strand.
8. In the absence of the amino acid tryptophan, bacteria of the species *E. coli* produce enzymes used to create tryptophan. How could this happen?
- (A) The regulator protein binds to the operator.
 - (B) RNA polymerase binds to the promoter.
 - (C) The regulator gene binds to the regulator gene.
 - (D) The regulator protein is inactive when not bound to tryptophan.
 - (E) The regulator protein binds to RNA polymerase.
9. In sheep the allele for fleece spotting (*s*) is recessive to the allele for no-spotting (*S*). If a spotted sheep was bred to a true-breeding unspotted sheep, what would be the phenotype and genotype of the lamb?
- (A) Spotted *SS* (B) Unspotted *SS* (C) Spotted *Ss* (D) Unspotted *ss* (E) Unspotted *Ss*
10. During a drought many giraffes died, but those that survived in greatest abundance were those with the longest necks, as they were able to reach scarce foods unavailable to other giraffes. How would you classify the extra-long neck?
- (A) Adaptive radiation (B) Analogous structure (C) Adaptation
(D) Fitness (E) Convergent evolution
11. In a flower, what would be the chromosome number of the ovule, embryo sac, and endosperm?
- (A) Diploid, haploid, haploid.
 - (B) Diploid, haploid, diploid.
 - (C) Haploid, diploid, haploid.
 - (D) Haploid, haploid, diploid.
 - (E) Diploid, diploid, triploid.
12. The cell membrane of a human body cell is likely to acquire oxygen via diffusion directly from where?
- (A) Capillary (B) Alveolus (C) Tissue fluid (D) Tracheole (E) Myoglobin
13. Which of the following would be most likely to provoke a strong cell-mediated immune response?
- (A) Snake bite (B) Breast-feeding (C) Viral infection
(D) Bacterial infection (E) Fever

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

科目 普通生物學 科目代碼 2505 共 5 頁第 4 頁 *請在試卷【答案卡】內作答

14. Under what conditions might fluid in phloem flow upward?
- (A) When sugar content in the leaf is higher than that in the root.
 - (B) When stomata are open.
 - (C) When sugar content in the root is higher than that in the leaf.
 - (D) When sugar content in the leaf and root is equal.
 - (E) When there is air in the xylem.
15. Which of the following best describes a closed circulatory system?
- (A) It is a system prevalent in arthropods.
 - (B) Blood is confined within blood vessels.
 - (C) Oxygen is delivered through hemolymph.
 - (D) Circulation is highly dependent upon animal body movements.
 - (E) oxygen is carried via a tracheal system.
16. Which of the following is an example of a homeostatic positive feedback mechanism?
- (A) High blood sugar causes the body to lower blood sugar level.
 - (B) High body temperature causes the body to sweat and lower the body temperature.
 - (C) Low levels of thyroid hormone cause the body to produce more thyroid hormone.
 - (D) A suckling baby causes the mother's body to continue producing milk.
 - (E) Poor quality air causes a person to breathe faster.
17. The removal of water from body fluid into the Malpighian tubule is determined by chloride transport into the tubule. How would water removal from body fluid occur?
- (A) High chloride concentration in body fluid would release water into the tubule.
 - (B) High chloride concentration in the tubule would attract water from the body fluid via active transport.
 - (C) High chloride concentration in the tubule would attract water from the body fluid via osmosis.
 - (D) High chloride concentration in body fluid would keep water from entering the tubule.
 - (E) High chloride concentration in the tubule would prevent water from entering the tubule.
18. During which phase of neuron activity would you expect to observe maximum permeability of sodium channels?
- (A) Threshold potential phase
 - (B) Resting membrane potential phase
 - (C) Action potential phase
 - (D) Repolarization phase
 - (E) Stimulus phase.
19. Which of the following would you classify as an exoskeleton?
- (A) The plates of a sea star
 - (B) The vertebrae of your neck
 - (C) The segments of an earthworm
 - (D) The shell of a lobster
 - (E) The body fluids of a jellyfish

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

科目 普通生物學 科目代碼 2505 共 5 頁第 5 頁 *請在試卷【答案卡】內作答

20. Which of the following is the most direct result of the presence of ADH (antidiuretic hormone) in the kidneys?
- (A) The kidneys produce epinephrine
 - (B) Kidney cellular changes act to conserve water
 - (C) The kidneys release bladder stimulating chemicals
 - (D) Kidney cellular changes act to release glucose
 - (E) The kidneys signal the digestive tract to regulate appetite
21. Computers designed to scan large amount of DNA sequence easily identify open reading frames by locating
- (A) a repeating string of nucleotide bases
 - (B) the AUG start codon and UGA stop codon
 - (C) two equally spaced regions of DNA coding for the same amino acid order
 - (D) a comparable DNA sequence published on the internet
 - (E) sections of DNA that match the code for a specific gene
22. Positions within the genome where DNA nucleotides of 2 or more individuals differ, i.e., where different nucleotides occupy the same position are called _____.
- (A) polypeptide protein parts (PPP's)
 - (B) single nucleotide polymorphisms (SNP's)
 - (C) snippets
 - (D) unique nucleotide differentiators (UND's)
 - (E) palindromes
23. If an individual were unable to obtain or produce parathyroid hormone, which of the following would you expect to occur?
- (A) loss of the ability to control blood sugar levels
 - (B) no "fight or flight" reaction
 - (C) wide changes in Ca^{++} levels in the blood
 - (D) immature and non functioning gonads
 - (E) decrease in skin pigmentation
24. A point mutation would be defined as
- (A) failure of chromosomes to separate during meiosis
 - (B) DNA codon after one nucleotide base has been changed to another
 - (C) Transfer of alleles from one chromosome to another
 - (D) The presence of an extra chromosome
 - (E) Base deletion on the chromosome affecting subsequent bases
25. Arrange the following events in sequence as they occur in cellular respiration: (1) Krebs's cycle, (2) glycolysis, (3) electron transport chain.
- (A) 1, 2, 3
 - (B) 3, 2, 1
 - (C) 2, 1, 3
 - (D) 2, 3, 1
 - (E) 3, 1, 2