

系所組別：熱帶植物科學研究所

考試科目：分子生物學

考試日期：0223，節次：3

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一、Simple-choice questions 單選題 (two points for each question.每題2分)(30%)

(以A、B、C、D、E五種選項作答，其餘一律不計分)

1. Who conducted the X-ray diffraction studies of DNA?
  - A. Franklin and Wilkins
  - B. Miescher and McClintock
  - C. Watson and Crick
  - D. Meselson and Stahl
  - E. Avery and Beadle
  
2. Some genes located on the same chromosome do not show perfect linkage because
  - A. they are too close together.
  - B. they are interrupted by other genes.
  - C. crossover events occur between homologous.
  - D. some genes are deleted.
  - E. too many alleles are present.
  
3. The analytic tools used to show that DNA was the transforming substance include all of the following except
  - A. ultracentrifugation.
  - B. electrophoresis.
  - C. UV absorption spectrophotometry.
  - D. heat inactivation.
  - E. chemical analysis.
  
4. A major function of reporter gene assays is to
  - A. measure mutation rates of a gene.
  - B. measure transcriptional levels.
  - C. measure replication.
  - D. monitor luciferase activity.
  - E. monitor CAT activity.
  
5. An ideal way to visualize the shape of DNA is by
  - A. light microscopy.
  - B. electron microscopy.
  - C. centrifugation.
  - D. spectrophotometry.
  - E. deoxyribonuclease digestion.

(背面仍有題目，請繼續作答)

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6. A circular 3000 bp UC18 plasmid DNA sample was treated with BamHI restriction enzyme. The plasmid has restriction sites at position 100 and position 2000. Which of the following choices represents the size fragments that would be observed on an agarose gel?
- A. 2900, 100
  - B. 1900, 100, 1000
  - C. 1900, 1100
  - D. 2900, 50, 50
  - E. 1900, 50, 50, 1000
7. In an experiment conducted to test the messenger hypothesis, which states that messenger RNA carry the genetic information,  $^{35}\text{S}$  was used instead of  $^{32}\text{P}$ . What is one possible outcome of this experiment?
- A. The phage RNA would be label along the entire molecule.
  - B. No label would be found in the RNA.
  - C. The DNA of the host bacteria would be labeled.
  - D. The ribosomal RNA would be labeled.
  - E. All of the choices are possible outcomes.
8. The formation of a peptide bond can be classified as a
- A. reduction reaction.
  - B. oxidation reaction.
  - C. condensation reaction.
  - D. redox reaction.
  - E. none of the choices are correct.
9. A new mutant cell line was accidentally created in the lab. This mutant was found to be deficient in the enzyme aminacyl-tRNA synthetase. Which of the following would most likely be observed in this cell line?
- A. No tRNA molecules would be present.
  - B. TRNA molecules would contain no anticodons.
  - C. Most tRNA molecules would not be able to attach to amino acids.
  - D. Protein synthesis would increase.
  - E. None of the choices are correct.

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10. The complementary sequence of one of the following is a palindrome. Which one?
- A. GAATTC
  - B. CTGACT
  - C. ATCCTC
  - D. GGCCAA
  - E. CCTTTC
11. Which of the following is ideal for screening a protein expression library?
- A. labeled antibodies
  - B. 3' RACE
  - C. 5' RACE
  - D. RT-PCR
  - E. Real-Time PCR
12. What is the RACE technique?
- A. screening a genomic library
  - B. extending incomplete cDNA sequences
  - C. generating polynucleotide probes
  - D. rapid amplification of genomic DNA
  - E. screening a genomic library and generating polynucleotide probes
13. A disadvantage of using a prokaryotic expression system for eukaryotic proteins is that the proteins are
- A. highly phosphorylated after translation.
  - B. improperly folded.
  - C. highly soluble.
  - D. heavily glycosylated.
  - E. over expressed.
14. A bacterial sample was contaminated with an unknown preparation of vector DNA. In order to identify the vector, the bacteria was streaked on a plate and incubated overnight. Examination of the plate revealed at least 120 clear plaques. Which of the following is a plausible conclusion?
- A. The vector could be a plasmid.
  - B. The vector could be a phage.
  - C. The vector is a Ti.
  - D. The vector is puc18.
  - E. The vector is a cosmid.

(背面仍有題目，請繼續作答)

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15. Rapid purification of proteins based on size can best be done using

- A. gel filtration.
- B. ion-exchange chromatography.
- C. native gel electrophoresis.
- D. 2-D gel electrophoresis.
- E. cation-exchange chromatography.

## 二、Extended Matching Questions 配合題 (20%)

1.

- |                      |                      |
|----------------------|----------------------|
| A). Auxins           | H). Jasmonic acid    |
| B). Ethylene         | I). Peptide hormones |
| C). Cytokinin        | J). Polyamines       |
| D). Gibberellic acid | K). Nitric acid (NO) |
| E). Abscisic acid    | L). Strigolactone    |
| F). Brassinosteroids | M). Flavonoids       |
| G). Salicylic acid   |                      |

Select the hormone(s) involved,

Q1. *Striga* is a parasitic weed that produces a kind of hormone that induce shoot branching in the host plant. (1 point)

Answer:

Q2. Two most common used hormones in manipulating shoot and root morphogenesis under plant tissue culture condition. (2 points)

Answer:

Q3. Two hormones have antagonistic effects on seed development and germination (2 points)

Answer:

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2.

- |                      |                         |
|----------------------|-------------------------|
| A). Thigmotropism    | H). Polar growth        |
| B). Apical dominance | I). Gravitropic bending |
| C). Totipotency      | J). de-foliate          |
| D). Habituation      | K). Parthenocarpy       |
| E). Apical dominance | L). Phase change        |
| F). Phototropism     | M). Vivipary            |
| G). Triple response  | N). Crown gall disease  |

Select the most likely phenomenon or physiological effect,

Q1. When cultured normal callus tissues of many species are subcultured repeatedly over a long period, they can grow on culture medium lacking hormones (such as auxin or cytokinin). (1 point)

Answer:

Q2. Spray "orange agent" containing a mixture of two synthetic auxins, 2,4-Dichlorophenoxyacetic acid (2,4-D) and 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T), on plants leading to what plant response. (1 point)

Answer:

Q3. Growth response to light mainly in all shoots and some roots to ensure leaves can receive optimal sunlight. (1 point)

Answer:

Q4. Spray auxin on the terminal bud of a plant. (1 point)

Answer:

Q5. Expose pea-seedlings to ethylene leads to swelling of hypocotyl, exaggeration of the curvature of the apical hook and inhibition of root elongation. (1 point)

Answer:

(背面仍有題目，請繼續作答)

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3.

- |                                                 |                                         |
|-------------------------------------------------|-----------------------------------------|
| A). Isopentenyl transferase ( <i>ipt</i> ) gene | G). Homeotic mutants                    |
| B). T-DNA                                       | H). ABC model                           |
| C.) Electroporation                             | I). Taq polymerase                      |
| D.) <i>iaaH</i> and <i>iaaM</i> synthase genes  | J). LacZ gene ( $\beta$ -galactosidase) |
| E.) octopine synthase                           | K). GA 20 oxidases                      |
| F.) cytokinin oxidase gene                      | L). microsatellite DNA                  |

Select one appropriate answer for the following questions,

Q1. The most common gene used in plant transformation to delay leaf and flower senescence. (1 point)

Answer:

Q2. The most common mutants used in studying morphogenesis (such as floral organ development) in plants. (1 point)

Answer:

Q3. Which part of plasmid DNA is important for *Agrobacterium tumefaciens* mediated plant transformation. (1 point)

Answer:

Q4. Which enzyme in the list is used to amplify a DNA fragment in PCR reactions? (1 point)

Answer:

Q5. Blue white screening is used in molecular cloning to screen *E. coli* colonies that have successfully inserted a gene of interest into plasmid vector during transformation. Which gene listed above is used in this screening method works by disrupting  $\alpha$ -complementation process to prevent the formation of a functional enzyme. (1 point)

Answer:

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4.

- |                    |                         |
|--------------------|-------------------------|
| A). Nutrigenomics  | G). Metatranscriptomics |
| B). Proteomics     | H). Lipidomics          |
| C). Metabolomics   | I). Transcriptomics     |
| D). Metagenomics   | J). Epigenomics         |
| E). Ecogenomics    | K). Pharmacogenomics    |
| F). Proteogenomics | L). Immunoproteomics    |

Q1. The soils in which plants grow are inhabited by microbial communities, with one gram of soil containing around  $10^9$ - $10^{10}$  microbial cells which comprise about one gigabase of sequence information. Which three fields of studies are associated in studying genetic material recovered directly from soil samples by massively parallel pyrosequencing? (3 points).

Answer:

Q2. Which field can be used in studying all RNA molecules, including mRNA, tRNA, rRNA, and other non-coding RNA produced in one or a population of cells? (1 point)

Answer:

Q3. Systematic study of the unique chemical fingerprints that specific cellular processes leaves behind. (1 point)

Answer:

三、Definition of the following terms 解釋名詞 (two points for each question. 每題2分)(20%)

1. Alternative splicing
2. Wobble hypothesis
3. Signal sequence (or signal peptide)
4. Reverse transcription
5. Homologous gene
6. Chaperone
7. Reverse genetics
8. Photorespiration
9. Bioinformatics
10. Next Generation Sequencing (NGS)

(背面仍有題目，請繼續作答)

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四、Short essay questions 問答題 (ten points for each question. 每題 10 分) (30%)

1. It is common for an activators to have a modular structure in which different domains are responsible for binding DNA and for activating transcription. Transcription factors are often classified according to the type of DNA-binding domain. What are the five structure futures of DNA-binding domains? (10%)
2. What is position effect variegation? What is mechanism underlying this effect? (10%)
3. Small RNA are generally produced by processing of longer precursors. Please draw a picture to compare three separate but overlapping pathways for processing siRNAs, miRNAs and piRNAs. (10%)