

94 學年度 生命科學 系(所) 甲 組碩士班入學考試

科目 遺傳學 科目代碼 0807 共 6 頁第 1 頁 *請在試卷【答案卷】內作答

Multiple Choice: 40 questions, 2.5 points each, for a total of 100 points. Good luck!

1. Assuming that genomic DNA sequence is random (i.e. that every nucleotide is equally likely to have A, C, G, or T), how often would a restriction enzyme cut DNA on average if it had a 6bp target sequence?
a) every 256bp b) every 1024bp c) every 24bp d) every 4096bp e) every 1296bp
2. Which is the best estimate for the minimum number of BACs it would take to clone a 2 million base pair genome?
a) 14 b) 500 c) 2 d) 100 e) 40
3. How are dideoxynucleotides modified so that they terminate DNA synthesis?
a) They have a 3' hydrogen instead of a 3' hydroxyl
b) They lack the base
c) They have a 3' phosphate instead of a 3' hydroxyl
d) They have a 5' hydroxyl instead of a 5' phosphate
e) They have a 2' hydrogen instead of a 2' hydroxyl
4. Which choice best describes the sequence of events in one round of polymerase chain reaction (PCR)?
a) First incubate at 95°C to denature double strand DNA, then incubate at 72°C to polymerize a new DNA strand, then incubate at 55°C to hybridize the primers to the template.
b) First incubate at 95°C to denature double strand DNA, then incubate at 55°C to hybridize the primers to the template, then incubate at 72°C to polymerize a new DNA strand.
c) First incubate at 72°C to denature double strand DNA, then incubate at 95°C to hybridize the primers to the template, then incubate at 55°C to polymerize a new DNA strand.
d) First incubate at 95°C to denature double strand DNA, then incubate at 72°C to hybridize the primers to the template, then incubate at 55°C to polymerize a new DNA strand.
e) First incubate at 55°C to hybridize the primers to the template, then incubate at 95°C to denature double strand DNA, then incubate at 72°C to polymerize a new DNA strand.
5. Which of the following statements about transgenic plants is true?
a) The Ti plasmid only inserts at one place in the plant chromosomal DNA
b) All transgenic plants have crown galls.
c) T-DNA is transferred to plant cells upon infection with *Agrobacterium tumefaciens*.
d) Transgenic plants require nopaline for their survival.
e) The Ti plasmids in transgenic plants must have an origin of replication to replicate.

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6. You have generated a tk targeting vector containing a mouse gene that was inactivated by inserting a neomycin resistance gene into the protein coding region. To select for a recombinant mouse ES cell in which the disrupted gene has replaced the normal gene, you select for cells that are:
 - a) $neo^R tk^-$ b) $neo^R tk^+$ c) $neo^S tk^-$ d) $neo^S tk^+$
7. Which of the following best describes an Ac transposable element?
 - a) A non-autonomous retrotransposon in corn.
 - b) An autonomous retrotransposon in *Drosophila*.
 - c) An autonomous transposon in corn.
 - d) A non-autonomous transposon in corn.
 - e) An autonomous retrotransposon in corn.
8. Bacterial IS elements always generate _____ repeats at their site of insertion.
 - a) inverted b) 14bp c) direct d) no e) 5bp
9. During transposition, retrotransposons use reverse transcriptase to:
 - a) Synthesize retrotransposon RNA from retrotransposons in the chromosome.
 - b) Insert retrotransposon DNA into a chromosome.
 - c) Degrade excess copies of retrotransposon RNA.
 - d) Synthesize DNA copies of retrotransposon RNA.
 - e) Synthesize RNA copies of retrotransposon RNA.
10. Which of the statements below best describe what will happen when a female *Drosophila* with a P cytotype is crossed to a male *Drosophila* with an M cytotype?
 - a) P elements will be mobilized in the F_1 progeny b) There will be no F_2 progeny if the F_1 is selfed
 - c) The F_1 progeny will be dysgenic d) The F_1 progeny will all be M cytotype
 - e) Normal numbers of F_2 progeny will result if the F_1 is selfed.
11. Alu sequences are nonautonomous _____ that comprise 10% of the human genome.
 - a) transposons b) SINEs c) P-elements d) LINEs e) Ac elements
12. Which of the following represents a transversion mutation?
 - a) $G \cdot C \rightarrow T \cdot A$ b) $A \cdot T \rightarrow G \cdot C$ c) $C \cdot G \rightarrow T \cdot A$ d) $T \cdot A \rightarrow C \cdot G$
13. A mutation that causes a lysine to be replaced with an arginine is called a _____ mutation.
 - a) nonsense b) missense c) transition d) synonymous e) transversion

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14. What is the only type of mutation that can arise from mispairing due to tautomeric shifts?
a) recessive b) missense c) transversion d) transition e) frameshift
15. Intercalating agents always cause _____ mutations?
a) transition b) frameshift c) insertion/deletion d) transversion e) base substitutions
16. An alkylated guanine will base pair with:
a) adenine b) cytosine c) guanine d) thymine e) uracil
17. In the Luria and Delbrück fluctuation test, large variations in the number of bacteria resistant to T1 phage infection from different independently grown cultures led to the following conclusion:
a) T1 phage induced mutations at different rates.
b) Mutations occurred randomly in the population before T1 phage were added.
c) Cells grown with T1 phage were more susceptible to mutation.
d) Not all *E. coli* can be induced to be resistant to T1 phage infection.
e) Some cultures of *E. coli* are not fast enough to avoid T1 phage infection
18. DNA glycosylases function in which DNA repair system?
a) Base excision repair b) Mismatch repair
c) Double strand break repair d) Nucleotide excision repair
e) Direct reversal of pyrimidine dimers
19. Meiotic recombination is initiated by:
a) Single strand breaks b) Strand invasion
c) Double strand breaks d) Heteroduplex formation
e) Mismatch repair
20. Which of the following can not produce viable gametes? (assume $2n = 20$)
a) Autotetraploids b) Triploids c) Trisomics d) Allotetraploids e) Diploid
21. An fertile hybrid generated by crossing a cabbage and a radish is called an _____.
a) Allopolyploid b) Monosomic c) Autotetraploid d) Trisomic e) Aneuploid
22. Which of the following would generate the largest grapes?
a) A trisomic b) An autotriploid c) An autotetraploid d) A diploid e) An autooctaploid

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23. Nondisjunction during meiosis results in:

- a) Autotriploidy b) Autopolyploidy c) Aneuploidy d) Allopolyploidy e) Monoploidy

24. Which of the following is a monosomic condition in humans?

- a) Down syndrome b) Williams syndrome
c) cri du chat syndrome d) Turners syndrome
e) Klinefelters syndrome

25. Selection that favors an extreme phenotype is called:

- a) balanced polymorphism b) directional selection
c) disruptive selection d) frequency-dependent selection
e) stabilizing selection

26. Crossing-over within a pericentric inversion loop generates:

- a) Two 'normal' products (one inverted & one in correct order), a dicentric bridge and an acentric fragment
b) Two 'normal' products (both in correct order), a dicentric bridge and an acentric fragment
c) Two 'normal' products (one inverted & one in correct order) and two abnormal products (both contain a duplication & a deletion).
d) Two 'normal' products (one inverted & one in correct order) and two abnormal products (both are duplications).
e) Two 'normal' products (both in correct order) and two abnormal products (both contain a duplication & a deletion).

27. Which of the following statements is associated with reverse genetic analysis?

- a) Making a null mutant in a particular gene to determine its phenotype.
b) Complementation analysis of mutants having a common phenotype.
c) Identifying all genes that produce a certain phenotype.
d) Mutagenizing wild type with a general mutagen such as EMS.
e) Isolating all genes having a particular expression pattern.

28. Which of the following is an example of a genetic selection?

- a) Isolating genes having a particular expression pattern.
b) Isolating mutants that affect eye development.
c) Isolating mutants that are resistant to insecticide.
d) Isolating mutants that have sleep abnormalities.
e) Isolating genes having altered pigmentation patterns.

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29. RISC mediates all of the following aspects of RNA interference EXCEPT:

- a) Binding dsRNA
- b) Chopping up dsRNA
- c) Degrading mRNA
- d) Unwinding dsRNA
- e) Binding mRNA complementary to unwound dsRNA

30. A mutation having reduced function is referred to as a:

- a) Null mutant
- b) Hypermorphic mutant
- c) Neomorphic mutant
- d) Hypomorphic mutant
- e) Conditional mutant

31. Which of the following will increase genetic variation?

- a) Decreased population size
- b) Decreased migration
- c) Random mating
- d) Increased repair of mutations
- e) Equivalent reproduction and survival rates among genotypes

32. The D locus has only two alleles, D and d. What is the frequency of the d allele in the following population.

105 D/D

210 D/d

185 d/d

- a) 42%
- b) 21%
- c) 24%
- d) 58%
- e) 79%

Questions 33-35 concern the three populations listed below.

	$f_{R/R}$	$f_{R/r}$	$f_{r/r}$
Population I	0.3	0.2	0.5
Population II	0.2	0.4	0.4
Population III	0.0	0.8	0.2

33. What is the frequency of R in each population?

- a) 0.4
- b) 0.3
- c) 0.6
- d) 0.2
- e) 0.8

34. What is the frequency of R/r when these populations are in Hardy-Weinberg equilibrium?

- a) 0.16
- b) 0.24
- c) 0.36
- d) 0.48
- e) 0.72

35 Which population is closest to being in Hardy-Weinberg equilibrium?

- a) I
- b) II
- c) III

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36. A population may not be in Hardy-Weinberg equilibrium because:
- Individuals having different genotypes may immigrate.
 - Some genotypes may prefer to mate with another genotype.
 - A new mutant may generate more progeny.
 - A new combination of alleles may extend lifespan.
 - All of the above.
37. In nature, phenotypic variability is essentially continuous because of all the reasons listed below except:
- Each genotype does not produce a single phenotype.
 - There is little phenotypic overlap between different genotypes.
 - Many genes contribute to a given phenotype.
 - Environmental variability affects phenotype.
38. Broad heritability is defined as:
- The part of total phenotypic inheritance due to environmental variance.
 - The part of total phenotypic inheritance due to dominance genetic variance
 - The part of total phenotypic inheritance due to additive genetic variance
 - The part of total phenotypic inheritance due to maternal genetic variance
 - The part of total phenotypic inheritance due to total genetic variance
39. The norm of reaction:
- Converts a distribution of environments into a distribution of phenotypes.
 - Is the portion of phenotypic variance due to environmental variance.
 - Is the central tendency of the phenotype for a given genotype.
 - Converts a distribution of environments into a distribution of genotypes.
 - Converts the distribution of genotypes into a distribution of phenotypes
40. A mixture of two types of mitochondria within a cell is called:
- heteroplasmy
 - homoplasmy
 - alloplasmy
 - heteroplastid
 - non of the above