國立臺灣大學97學年度碩士班招生考試試題

單選題：請就下列各題所列選項中，挑選最適合者(每題1分，40題共40分)請將答案填入選擇題作答區

1) The C value is the amount of DNA in a
A) haploid genome.
B) eukaryotic genome.
C) diploid genome.
D) cell's nucleus.
E) bacterial genome.

2) Who used the X-ray crystallography technique to examine diffraction patterns of DNA molecules?
A) Avery
B) Miescher
C) Franklin
D) Watson and Crick
E) Chargaff

3) Which enzyme elongates the new DNA strand starting at an RNA primer?
A) RNA polymerase
B) DNA polymerase III
C) RNA primase
D) DNA ligase
E) DNA polymerase I

4) The enzymatic activity of a telomerase is best described as a
A) reverse transcriptase.
B) polymerase.
C) ligase.
D) topoisomerase.
E) exonuclease.

5) Which parts of a eukaryotic gene are transcribed?
A) Exons, introns, promoter, and terminator sequence
B) Both exons and introns
C) Only the exons
D) Only the introns
E) It depends on the gene.

6) Which of the following is a characteristic of a rho-dependent terminator?
A) Rich in AT nucleotides
B) Hairpin loop
C) Termination requires ATP
D) Both A and B
E) All of the above

7) A mutation causes a G to be inserted after the first base of the codon for tryptophan. How will this affect the growing polypeptide chain?
A) There will be a single amino acid substitution.
B) The reading frame will be shifted to the left, and the wrong amino acids will be added from this point on.

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C) Elongation will stop prematurely.
D) It will not be affected.
E) None of the above

8) A peptide bond forms between the _____ of one amino acid and the _____ of another.
A) R group, R group
B) amino group, R group
C) amino group, carboxyl group
D) carboxyl group, sulfide group
E) amino group, phosphate group

9) Base analogs may cause mutations because
A) they insert themselves between adjacent bases on the DNA strand and cause an extra base to be inserted during replication.
B) they remove amino groups from bases, causing them to pair with the wrong base during replication.
C) they may exist in alternate chemical states that pair with different DNA bases than the normal state during replication.
D) they modify the chemical structure and properties of the normal base.
E) Both A and C

10) In order for the *Ds* mutations in corn to be stable,
A) an *Ac* element must not be present.
B) the DNA must not be replicated.
C) the *Ds* must contain the gene for transposition.
D) an *Ac* element must be present.
E) None of the above

11) What is conservative transposition?
A) No net increase in the number of transposable elements in the genome
B) Movement of transposable elements with replication of the element
C) Transposition without disruption of normal gene product activity
D) A net increase in the number of transposable elements in the genome
E) Movement of transposable elements without replication of the element

12) _____ blots are used to study DNA fragments, while _____ blots are used to study RNA fragments.
A) Western, northern
B) Western, southern
C) Southern, northern
D) Southern, western
E) Eastern, northern

13) _____ were the first class of genetic marker developed by geneticists.
A) VNTRs
B) RFLPs
C) STRs
D) microsatellites
E) SNPs

14) In a sequenced genome, candidate protein-encoding genes are identified by searching for
A) SNPs. B) ESTs. C) RFLPs. D) STRs. E) ORFs.

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15) To inhibit the transcription of operon genes, the *lacI* gene product binds to
A) β-galactosidase.
B) the operator.
C) the promoter.
D) the inducer.
E) the repressor.

16) Operons can best be defined as
A) a set of genes under common regulatory control.
B) a common mode of gene expression in bacteria.
C) dominant alleles responsible for enzyme synthesis.
D) a balance between repressor and inducer molecules.
E) operational mutations affecting gene expression.

17) The _____ pathway in lambda phage leads to integration of viral DNA with that of the host, while the_____ pathway leads to induction of progeny viruses.
A) invasive, replicative
B) repressive, inductive
C) lytic, lysogenic
D) replicative, lysogenic
E) lysogenic, lytic

18) 5-methylcytosine is most often found associated with
A) the TATA box.
B) CG dinucleotides.
C) enhancer elements.
D) histones.
E) polyadenylation.

19) Nucleosomes are
A) Barr bodies.
B) another term for centrioles.
C) condensed chromosomes.
D) DNA-histone complexes.
E) ribosome-mRNA complexes.

20) *Heterochromatin* is associated with
A) mRNA translation.
B) differential gene expression.
C) gene silencing.
D) heterozygotes.
E) A, B, and C

21) In a pea plant that is heterozygous for seed color, what proportion of gametes will carry the recessive allele?
A) 3/4
B) 1/4
C) 1/2
D) All of the gametes
E) None of the gametes

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22) In the F_2 generation, how many genotypic classes are possible from a trihybrid cross of two heterozygotes in which the genes involved show complete dominance?
A) 2　B) 8　C) 16　D) 27　E) 61

23) Cells obtained from a normal woman would contain _____ Barr bodies.
A) 0　B) 1　C) 2　D) 3　E) 4

24) The chromosome theory of inheritance states that
A) chromosomes consist of DNA.
B) chromosomes replicate before cell division.
C) different chromosomes assort independently of one another.
D) alleles of a gene segregate during cell division.
E) genes are located on chromosomes.

25) A person who is known to have a particular genotype does not show the phenotype specified by the gene. This is an example of
A) epistasis.
B) incomplete dominance.
C) incomplete penetrance.
D) phenotype switching.
E) sex reversal.

26) In an interacting gene pair, the gene whose expression is masked by another gene is the _____ gene.
A) homostatic　B) limnostatic　C) hypostatic　D) epistatic　E) hyperstatic

27) Which of the following is a source of genetic variation in a population caused by epistatic interactions between genes?
A) Additive genetic variance
B) Interaction variance
C) General environmental effects
D) Dominance variance
E) Maternal effects

28) A broad-sense heritability of 0.8 for a particular trait indicates that
A) the trait is 80 percent heritable.
B) phenotypic variation stems from environmental influences.
C) genes and environment play equal roles in shaping the trait.
D) genetic differences among individuals account for much of the phenotypic variation for that trait.
E) None of the above

29) If alleles of different genes always maintain their parental association rather than assorting independently into offspring, this is because
A) Mendel's experiments were flawed.
B) they are really alleles of a single gene.
C) there was a meiotic error.
D) they are on the same chromosome but far apart.
E) they are very close together on the same chromosome.

30) If two genes are not linked, then the expected phenotypic ratio resulting from a testcross is
A) 3:1.　B) 1:1.　C) 9:3:3:1.　D) 1:1:1:1.　E) 1:2:1.

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31) A heterozygous chromosomal inversion can be detected
A) by cytogenetic observation of loops in chromosomes.
B) by observing a decrease in the number of viable progeny following genetic crosses.
C) through genetic studies indicating a decrease in the frequency of recombination between genes.
D) Both A and B
E) All of the above

32) A monosomic cell would produce gametes with how many chromosomes?
A) N-1　B) N　C) N and N+1　D) N and N-1　E) N+1

33) Tetrad analysis to create genetic maps is best performed with haploid organisms because
A) only the dominant alleles are expressed.
B) only haploid organisms produce spores.
C) the phenotype directly reflects the genotype.
D) only recessive alleles are expressed.
E) haploid organisms have two copies of each gene.

34) Mitotic recombination cannot occur in cells that are
A) diploid.
B) polyploid.
C) haploid.
D) aneuploid.
E) all of the above.

35) Which method is least useful for assessing levels of genetic variation in populations?
A) RFLP analysis
B) VNTRs
C) Protein electrophoresis
D) DNA sequencing
E) Phenotypic observation

36) Which of the following is **not** a form of genetic drift?
A) Heterozygote advantage
B) Founder event
C) Population bottleneck
D) Nonrandom mating
E) All of the above are forms of genetic drift.

37) Which of the following populations would be expected to experience the greatest degree of genetic drift?
A) Canada geese
B) White-tailed deer in the eastern U.S.
C) Oak trees in the Great Smoky Mountains National Park
D) Rat populations in New York City
E) Wild pandas

38) A sizable population was analyzed for SNPs in a certain DNA region and found all four possible variants at the following frequencies:
SNP 1: GGTCTAGGA; frequency = 0.91　SNP 2: GGTGTAGGA; frequency = 0.03
SNP 3: GGTATAGGA; frequency = 0.03　SNP 4: GGTTTAGGA; frequency = 0.03

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What is the total frequency of heterozygotes at this SNP locus?
A) 0.009　B) 0.170　C) 0.055　D) 0.0018　E) 0.828

39) Which of the following statements is true?
A) Mitochondrial genomes of different organisms are about the same size.
B) Mitochondrial DNA is typically biparentally inherited.
C) Mitochondrial genomes are almost identical to chloroplast genomes.
D) Mitochondrial DNA is rarely supercoiled.
E) Mitochondrial genes are similar to bacterial genes in structure.

40) The phenomenon where the expression of certain genes is determined by whether they are inherited from the maternal parent or paternal parent is called
A) uniparental inheritance.
B) maternal inheritance.
C) extranuclear inheritance.
D) genetic imprinting.
E) maternal effect.

是非題：請就下列各題的敘述，以T標示正確者F標示錯誤者(每題1分，20題共20分)請將答案依題號填入選擇題作答區的A格位。

41) In eukaryotes, the greatest amount of tandemly repeated DNA is associated with centromeres and telomeres.

42) The Shine-Dalgarno sequence is a purine-rich region just upstream of a start codon and is necessary for the initiation of protein synthesis in prokaryotes.

43) A DNA polymorphism is defined as two or more alternative forms or alleles differing in sequence at a specific chromosomal locus.

44) "Knock-out" mutants involve eliminating gene activity, a useful strategy to see what effect the gene has in physiology, development, etc.

45) *Clone contigs* are a set of contiguous, partially overlapping sequences that collectively cover a whole chromosome or chromosome region without gaps.

46) A *constitutive* gene is a gene that is occasionally expressed.

47) Genetic imprinting refers to allelic transformation by imprinting loci.

48) Genetic exchange in bacteria by transduction requires cell-to-cell contact.

49) All the cells in a bacterial colony are genetically identical.

50) In $F^+ \times F^-$ crosses, none of the bacterial chromosome is transferred; only the *F* factor is.

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51) Mendel's work immediately revolutionized the study of inheritance.

52) Nondisjunction leads to polyploidy.

53) Sex-limited traits are caused by genes that are on sex chromosomes.

54) Continuous traits are often influenced by multiple simple (Mendelian) genes.

55) A coefficient of coincidence of zero is the same as an interference value of zero.

56) Both changes in chromosome number and chromosome structure are believed to have resulted in novel genomes, leading to new species.

57) In order for mitotic crossover to occur, chromosomes line up at random at the metaphase plate.

58) The Hardy-Weinberg relationship cannot be used to compute allele frequencies when one or more alleles are recessive.

59) Two closely related insect species are active at different times of day, with one diurnal and the other nocturnal. This is an example of *spatial* isolation.

60) In reciprocal crosses of animals, extranuclear inheritance typically results in the exclusive expression of the maternal phenotype.

簡答題：請在答案紙上標明題號依序回答下列各題(每題4分，10題共40分)請將答案填入非選擇題作答區

61) Monsanto Corporation developed transgenic crop plants conferring tolerance of the herbicide Roundup™ (glyphosate), which Monsanto owns. What are some advantages and disvantages, in ecological and economic terms, of producing such herbicide-resistant plants?

62) In eukaryotes, what is the difference between promoter proximal elements in "housekeeping genes" vs. cell-specific genes, and how does this relate to gene expression?

63) How can PCR be used to induce site-specific mutations in DNA?

64) Explain the basic differences in goal and approach of functional, structural, and comparative genomics.

65) Describe how siRNA functions in regulation of expression and how this can be used as a tool in genetic research.

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66) You observe an individual of your favorite study organism expressing the dominant phenotype for a certain trait. How would you go about determining if the individual was homozygous dominant or heterozygous for that trait?

67) You are a breeder of animals with an X-linked coat-color gene, one allele of which gives black fur and another of which gives white fur. If you cross a black-colored female with a white-colored male, what would their male and female offspring look like?

68) How could a man with blood type A and a woman with blood type B produce a child with blood type O?

69) Continuously varying traits typically show a bell-shaped frequency distribution. Explain why this is so; why are intermediate phenotypes more frequent than phenotypes at either end of the distribution?

70) In light of the fact that the assumptions of the Hardy-Weinberg principle are unrealistic (no mutation, no selection, etc.), how can the principle be useful to population geneticists?