※ 注意：請於答案卷上依序作答，並應註明作答之題號。

一、單選題：請就下列各題所列選項中，挑選一個最適合的答案（70%）

1) The sequence of bases of a molecule of mRNA is converted into a corresponding amino acid sequence during
A) translocation.
B) replication.
C) transcription.
D) transformation.
E) translation.

2) Which type of RNA is found only in eukaryotes?
A) mRNA
B) snRNA
C) tRNA
D) rRNA
E) all of the above

3) A _____ is located adjacent to the beginning of a gene's coding region.
A) transcriptor
B) initiator
C) terminator
D) promoter
E) all of the above

4) The sequence of a template strand of DNA is:
3'-C A T T A C G C T T-5'
Which of the following is the sequence of the corresponding mRNA?
A) 5'-G T A A T G C G A A-3'
B) 5'-C A U U A C G C U U-3'
C) 3'-G U A A U G C G A A-3'
D) 5'-G U A A U G C G A A-3'
E) 3'-A A G C G T A A T G-5'

5) Which type of cloning vector occurs in nature?
A) plasmids
B) cosmids
C) bacteriophage
D) both A and C
E) all of the above

6) On a sequencing gel, which fragment of DNA would travel the farthest distance from the sample well?
A) ATCCGGAATTTTAGGCAT
B) ATCC
C) ATCCGG
D) AT
E) ATCCGGAT

7) A DNA copy of an mRNA molecule is called a(n)
A) dDNA.
B) rDNA.
C) rnaDNA.
D) cDNA.
E) mDNA.

接背面

8) Which polymerase is used in the polymerase chain reaction?
A) *Taq* polymerase
B) *E. coli* DNA polymerase I
C) yeast DNA polymerase III
D) T4 DNA polymerase
E) all of the above

9) To clone a eukaryotic gene that is approximately 925 kb in length, a _____ should be used as the cloning vector.
A) cosmid
B) bacteriophage
C) YAC
D) plasmid
E) all of the above

10) Which enzyme is required to make a cDNA library?
A) DNA ligase
B) reverse transcriptase
C) DNA polymerase
D) all of the above
E) none of the above

11) Polymorphism can be detected by PCR amplification using primers that flank the STRs or VNTRs only if
A) there is only one VNTR.
B) the sequences of the flanking regions are known.
C) the locus is homozygous.
D) all of the above
E) none of the above

12) Genes that are located on the same chromosome are
A) linked.
B) homozygous.
C) homologous.
D) chromologs.

13) Crossing over occurs during which stage of meiosis?
A) anaphase I
B) metaphase II
C) prophase II
D) metaphase I
E) prophase I

14) During sexual reproduction in *Neurospora crassa*, fusion of the haploid nuclei of cells with different mating types results in _____ ascospores in an ascus.
A) eight diploid
B) four haploid
C) four diploid
D) four diploid and four haploid
E) eight haploid

15) When two linked alleles on a single chromosome are either both wild-type or both mutant, the arrangement of the alleles on the chromosome is said to be in
A) recombination.
B) fixation.
C) repulsion.
D) coupling.
E) regression.

接次頁

16) *X*, *Y*, and *Z* are linked genes. Based on testcross data, the frequency of recombination between genes *X* and *Y* was determined to be 33.1 map units; between genes *X* and *Z* the distance was 11.8 mu; and between genes *Y* and *Z* the distance was 21.3 mu. What is the order of these three genes on the chromosome?
A) *X-Z-Y*
B) *Y-X-Z*
C) *Z-Y-X*
D) *X-Y-Z*

17) Two genes that show recombination between them more than 50% of the time are probably
A) on different chromosomes.
B) far apart on the same chromosome.
C) close together on the same chromosome.
D) both A and B
E) all of the above

18) Which bacterium is commonly used for experiments in genetics and molecular biology?
A) *Saccharomyces cerevisiae*
B) *Edwarsiella tarda*
C) *Escherichia coli*
D) *Neurospora crassa*
E) all of the above

19) Which type of genetic exchange in bacteria requires direct cell-to-cell contact?
A) transformation
B) transduction
C) conjugation
D) all of the above
E) none of the above

20) An *Hfr* strain of *E.coli* with the genotype $a^+b^+c^+d^+e^+f^+$ is mated with an F- auxotrophic strain with the genotype *a-b-c-d-e-f-*. Conjugation is stopped at 10 minute intervals and the genotypes of the resulting conjugants are determined. The following results are obtained:

After 10 minutes	e^+
After 20 minutes	a^+e^+
After 30 minutes	$a^+b^+e^+$
After 40 minutes	$a^+b^+d^+e^+$
After 50 minutes	$a^+b^+c^+d^+e^+$
After 60 minutes	$a^+b^+c^+d^+e^+f^+$

Which represents the correct order of genes on this bacterial chromosome?
A) *e-f-a-b-c-d*
B) *f-e-d-c-g-a*
C) *c-d-e-f-a-b*
D) *a-b-c-d-e-f*
E) *e-a-b-d-c-f*

21) When a promoter element is bound by a positive regulatory protein, the result is
A) activation of transcription.
B) repression of replication.
C) repression of transcription.
D) repression of translation.
E) activation of replication.

22) A mutation in a gene may alter a cell's
A) phenotype.
B) genotype and phenotype.
C) genotype.

接背面

23) Ionizing radiation creates mutations by causing
A) chromosomal rearrangements.
B) base substitutions.
C) chromosomal breakage.
D) both B and C

24) A chromosomal mutation that results in an increase in the amount of DNA is a(n)
A) duplication.
B) deletion.
C) inversion.
D) both A and C
E) all of the above

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

26) During cell division, cytokinesis is completed by the end of
A) anaphase.
B) prophase.
C) interphase.
D) metaphase
E) telophase.

27) Crossing over occurs most frequently during which stage of cell division?
A) metaphase II of meiosis
B) prophase I of meiosis
C) prophase of mitosis
D) prophase II of meiosis
E) telophase of mitosis

28) Which of the following is a pyrimidine found only in RNA?
A) adenine B) thymine C) guanine D) cytosine E) uracil

29) Chromatin contains
A) DNA.
B) RNA.
C) protein.
D) both A and C
E) all of the above

30) Gregor Mendel performed his now famous breeding experiments that led to the proposal of his principles of heredity on which organism?
A) mice
B) yeast
C) corn
D) bacteria
E) peas

31) In pea plants, the smooth seed allele is dominant to the wrinkled seed allele. The F_1 generation resulting from a mating between a true-breeding pea plant bearing smooth seeds and one bearing wrinkled seeds would show which phenotype?
A) all wrinkled seeds
B) 3/4 wrinkled and 1/4 smooth
C) all smooth seeds
D) 1/2 smooth seeds and 1/2 wrinkled seeds
E) 1/4 wrinkled and 3/4 smooth

接次頁

32) In a testcross between an individual with an unknown genotype that exhibits the dominant phenotype, and a known homozygous recessive individual, the progeny showed a 1:1 ration of dominant to recessive phenotypes. The individual of unknown genotype is therefore _____ for that gene.
A) homozygous
B) heterozygous
C) homogeneous
D) hemizygous

33) In the F_2 generation, how many genotypic classes are possible from a dihybrid cross of two heterozygotes in which the genes involved show complete dominance?
A) 4
B) 8
C) 12
D) 9
E) 3

34) The offspring of two phenotyically normal people who are heterozygotes for albinism would be expected to exhibit which phenotypic ratio of normal to affected individuals?
A) 4:0
B) 3:1
C) 1:2:1
D) 1:3
E) 1:1

35) What is the probability that the first child of two parents is a girl?
A) 1/256
B) 1/8
C) 1/16
D) 1/2
E) 1/4

請注意：下列題目中如有需要計算者，未列演算過程將不予計分！

二. 解釋名詞：(6%)
甲、近親係數 (Inbreeding coefficient)
乙、狹義遺傳率 (Narrow sense heritability)
丙、Realized heritability

三. 淘汰是演化的動力，然而自然界處與淘汰的壓力之下，仍然能夠保存基因的多型性，請描述三種可能的機制。(6%)

四. 以圖形表示 Stabilizing selection 時，Δq (Y軸) 與 q (X軸) 的關係，請注意正負號的關係。(4%)

五. 請描述控制數量性狀基因 (數量基因) 的特性。(5%)

六. 請描述近親交配 (inbreeding) 對於族群遺傳結構的影響。(5%)

七. 人類 MN 血型樣品 (200 人) 的分佈如下：MM 114, MN 76, NN 10，請計算 p (M 對偶基因頻度) 與 q (N 對偶基因頻度)。(4%)

試題隨卷繳回