※ 第一大題請於試卷內之「選擇題作答區」依序作答，
其餘各題請於試卷內之「非選擇題作答區」標明題號依序作答。

第一大題：單選題 (將唯一對的答案選出。每題二分，共五十二分，答錯不倒扣。)

1. Which of the following restrict enzymes will produce a blunt end (the cutting site is indicated with * in the recognition sequence)?
   (a) EcoRI (G*AATTC).
   (b) SacI (GAGCT*C).
   (c) TaqI (T*CGA).
   (d) StuI (AGG*CCT).
   (e) NotI (GC*GGCCGC).
2. Which of the following features would you NOT expect to find in heterogeneous nuclear RNA (hnRNA)?
   (a) intron.
   (b) exon.
   (c) polyadenylation in 3' end.
   (d) 5' cap structure.
   (e) none.
3. Which of the following is NOT part of RNA processing in eukaryotes?
   (a) addition of a poly A tail.
   (b) splicing of exon.
   (c) addition of a 5' cap.
   (d) reverse transcription.
   (e) intron removal.
4. Most of the histones are well conserved from one organism to another, which histone shows the greatest variation among tissues and species?
   (a) H1.
   (b) H2A.
   (c) H2B.
   (d) H3.
   (e) H4.
5. Which of the following is NOT required by DNA polymerase for *in vitro* synthesis of DNA?
   (a) template.
   (b) ATP.
   (c) primer.
   (d) dATP.
   (e) tRNA.
6. Which of the following values is significantly unreasonable?
   (a) An Okazaki fragment in eukaryotes is about 150 nucleotides long.
   (b) An RNA primer is 5 to 15 nucleotides long.
   (c) The E. coli genome is 46,392 base pairs long.
   (d) The human genome is about 3 billion base pairs long.
   (e) A DNA primer is 100 to 500 nucleotides long.
7. Which of the following enzymes or proteins do NOT function at the origin of replication in *E. coli*?
   (a) DNA ligase.
   (b) SSBP (single-strand binding protein).
   (c) DNA gyrase.
   (d) DnaA, DnaB and DnaC proteins.
   (e) helicase.
8. The proofreading capability of DNA polymerase is dependent on its
   (a) 3' → 5' endonuclease activity.
   (b) 5' → 3' endonuclease activity.
   (c) 3' → 5' exonuclease activity.
   (d) 5' → 3' exonuclease activity.
   (e) reverse transcriptase activity.

見背面

9. UV light mainly induces a(n)
(a) alkylation.
(b) insertion.
(c) depurination.
(d) T-T dimer.
(e) tautomeric sfift.

10. Which of the following cloning vector would you use for cloning an insert of the size of 500 bp?
(a) a plasmid vector.
(b) a cosmid vector.
(c) phage lamda.
(d) bacterial artificial chromosome (BAC).
(e) yeast artificial chromosome (YAC).

11. The complete genome of the simplest bacterium known, *Mycoplasma genitalium*, is a circular DNA molecule with 580,070 bp. What is the molecular weight and contour length (when relaxed) of this molecule?
(a) 1.8 x 10^8 and 100 microns.
(b) 1.8 x 10^8 and 200 microns.
(c) 3.8 x 10^8 and 100 microns.
(d) 3.8 x 10^8 and 200 microns.
(e) none.

12. Which of the following process requires a RecA activity?
(a) integration of lamda.
(b) resolving Holliday junction during recombination.
(c) resolving cointegrate during during trasposition.
(d) activating immunoglobin gene rearrangement.
(e) activating SOS gene expression.

13. Which of the following statement concerning the Ac-Ds of maize in NOT true.
(a) The system of was first discovered by Barbara McClintock.
(b) Ac element cannot transpose by itself.
(c) these DNA elements can induce chromosome breakage.
(d) these DNA elements can induce the formation of dicentric chromosome.
(e) Ds cannot induce chromosome breakage by itself.

14. Which of the following is NOT true?
(a) RNA polymerase I synthesizes rRNA in the nucleolus.
(b) RNA polymerase II synthesizes precursor of mRNA in the nucleus.
(c) RNA polymerase III synthesizes tRNA, rRNA and other small RNA found in the nucleus and cytosol.
(d) RNA polymerase III synthesizes microRNA in the cytosol.
(e) RNA polymerase IV synthesizes siRNA in plants.

15. Which of the following described mechanism about antibiotics is true?
(a) Chloramphenicol disrupts the formation of the bacterial cell wall.
(b) Erythromycin inhibits DNA synthesis.
(c) Tetracycline blocks peptide formation.
(d) Ampicillin interferes with tRNA anticodon-reading on mRNA.
(e) Kanamycin interferes with the synthesis of RNAs.

16. Cytosine is a
(a) nucleotide.
(b) component of RNA.
(c) pyrimidine.
(d) a and b.
(e) b and c.

17. The polymerase chain reaction (PCR) technique can be used for
(a) synthesis of RNA from genomic DNA.
(b) direct isolation of a specific segment of genomic DNA.
(c) preparation of probes.
(d) a and b.
(e) b and c.

接次頁

18. Which of the following method(s) can be used for functionally inactivating a gene without altering its sequence?
(a) dominant negative constructs.
(b) RNA interference.
(c) gene knockout.
(d) a and b.
(e) b and c.

19. Why Chargaff's Rule (A+G = C+T) is NOT a universal rule?
(a) Because genetic material of some marine bacteria doesn't obey it.
(b) Because genetics material of Φ x174 doesn't obey it.
(c) Because genetic material of Pneuococcus doesn't obey it.
(d) a and b.
(e) b and c.

20. Which of the following statement(s) is correct about enhancers?
(a) They bind protein factors and stimulate transcription.
(b) They are non-promoter protein elements.
(c) They stimulate the binding of repressor to DNA.
(d) a and b.
(e) b and c.

21. In *E. coli* glucose represses the gene expression of many sugar utilization genes (ie lactose operon). Which of the following statements is/are correct?
I. The glucose effect is mediated by the operator site of the lactose operon.
II. The glucose effect is mediated by the lactose repressor.
III. The glucose effect is mediated by a negative regulation.
IV. The glucose effect is mediated by the concentration of cAMP.
(a) III
(b) IV
(c) I and II
(d) III and IV
(e) I, II and III

22. Which of the following is NOT used in regulating eukaryotic gene expression.
I. Operons with polycistronic mRNA.
II. Splicing precursor mRNA differently.
III. Controlling transcription with specific transcription factors.
IV. Inactivating or altering DNA.
(a) I
(b) III
(c) IV
(d) I and II
(e) II and IV

23. Which of the following in NOT true for telomeres?
I. Hairpin DNA configurations.
II. Repeated sequence.
III. Template-free sequence additions.
IV. The length of telomere is regulated.
(a) I
(b) III
(c) IV
(d) II and IV
(e) III and IV

24. Which of the following mechanisms can be used to deal with aberrant termination in eukaryotes?
I. tmRNA-mediated ribosome rescue.
II. exosome-mediated degradation.
III. nonsense-mediated RNA decay.

見背面

IV. nonsense-associated altered splicing.
(a) I, II and III
(b) I, II and IV
(c) I, III and IV
(d) II, III and IV
(e) I, II, III and IV

25. An enzyme isolated from rat liver has 192 amino acid residues and is coded by a gene with 1,440 bp. Which of the following statement is correct according to the above mentioned data?
I. The enzyme is not fully synthesized.
II. The enzyme is coded by 576 bases out of 1440 bases.
III. The coding sequence of enzyme contains non-coding sequence of the length 764 bases.
IV. The extra size of the gene is because of the presence of untranslated region present on the gene.
(a) I and II
(b) II and III
(c) II and IV
(d) I and IV
(e) III and IV

26. Which of the following reagents are components of LB medium?.
I. Bacto agar.
II. Bacto tryptone.
III. Beef extract.
IV. Sodium chloride.
V. Yeast extract.
(a) I, II and III
(b) I, III and IV
(c) II, III and IV
(d) II, IV and V
(e) III, IV and V

第二大題：填充題 (由下列名詞選擇合適答案填入試卷內相應答案編號格內。每空格二分，共二十分，答錯不倒扣。)

Aminoacyl-tRNA synthetase	Angiogenesis
Anabolism	Apotosis
Bacteriophage	Centrosome
Chromatin	Chromosome
Deletion	Dynamin
Endosome	Euchromatin
Genome	Helix-loop-helix
Homeodomain	Inversion
Insertion	Kinetochore
Nucleosome	Peptidyl transferase
Primase	Receptor
Replication origin	Replication unit
Repressor	Telomerase
Topoisomerase	Transversion
Transition	Zinc finger

27. _____ recognizes the sequences at the ends of eukaryotic chromosomes and prevents chromosome shorting with each round of DNA replication.
28. _____ protein typically binds to a consensus sequence called an E-box, CANNTG.

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29. _____ is the location on a DNA molecule where duplication of the DNA begins.
30. _____ catalyzes the attachment of amino acids to tRNA molecule.
31. Substitution of adenine with cytosine is referred to as _____ mutation.
32. _____ is protein that binds to a specific region of DNA to prevent transcription of an adjacent gene.
33. _____ is a single-stranded DNA-dependent RNA polymerase that functions to initiate DNA synthesis by synthesizing a nucleotide RNA polymer.
34. _____ prevents supercoiling ahead of the replication fork during DNA replication.
35. _____ is a protein structure on chromatids where the spindle fibers attach during cell division to pull sister chromatids apart.
36. _____ is the part of genetic materials that during interphase are uncoiled dispersed threads, stained diffusely, and metabolically active.

第三大題：問答題（共二十八分，答錯不倒扣。）

37. A series of eukaryotic tRNAs have the following anticodons. Consider the wobble base-pairing rule and give all possible codons with which each tRNA can pair (Note: please pay attention to the 5' and 3' direction).
(A) 5'-GAC-3' (2%)
(B) 5'-AGG-3' (2%)
(C) 5'-IAC-3' (2%)

38. Lists any **two** similarities and any **three** differences between DNA replication and DNA transcriptions (10%).

39. Describe (any) three kinds of experiments to demonstrate DNA and protein interactions (6%, methods and principles).

40. Describe (any) three kinds of experiments to demonstrate protein and protein interactions (6%, methods and principles).

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