94 學年度_生命科學院，生命科學院結構生物學程_ _甲組，甲組_碩士班入學考試

科目__分子生物學 _科目代碼_ 0805, 1104 _共__6___頁第___1__頁 *請在試卷【答案卷】內作答

第 1-33 題為選擇題，每題 2 分，單選，請寫在電腦卡上；第 34-38 題為問答題，請寫在答案卷內

1. Which of the following statements in "recombination" is true?
   (A) RuvA responses for resolution of Holliday junction when RuvB presents.
   (B) Branch migration is essential for efficient resolution of Holliday junctions
   (C) The mechanism of strand exchange catalyzed by Lambda phage--integrase is the same as that of homologous recombination.
   (D) Meiotic recombination in yeast begins with a single-strand break. Spo11 collaborates to create cleavage.

2. Which of the following statements in "Recombination signal sequences recombination (RSSs)" is true?
   (A) RSSs in V(D)J recombination consist of 12 or 23 base pair spacers.
   (B) RSSs in V(D)J recombination consist of a heptamer and a nonamer.
   (C) RSSs in V(D)J recombination consist of 12 or 23 base pair spacers separated by a heptamer and a nanomer.
   (D) RSSs in V(D)J recombination consist of a heptamer and a nonamer separated by either 12 or 23 base pair spacers.

3. Which of the following statements in "Mismatch repair in *E. coli*" is true?
   (A) Mismatch repair in *E. coli* is to correct parental strand during DNA synthesis.
   (B) Methylated adenine on GATC sequence in daughter strand of *E. coli* is usually to be the signals for mismatch repair process.
   (C) Methylated adenine on GATC sequence in parental strand of *E. coli* is usually to be the signals for mismatch repair process.
   (D) 4-base GATC sequence occur approximately every 5000 base pair in *E. coli.*

4. Which of the following statements in "Error-prone bypass" is true?
   (A) It is another way of dealing with DNA damage without really repairing it.
   (B) It is another way of dealing with DNA damage with really repairing it.
   (C) It required RuvA, RuvB, RuvC and RuvD enzymes to repair DNA.
   (D) It required RecBCD enzyme and single strand binding protein to repair DNA.

5. Which of the following statements in "DNA replication" is true?
   (A) DNA replication is continuous on the lagging strand.
   (B) DNA replication is discontinuous on the leading strand.
   (C) DNA replication is conservative on the leading strand and semi-conservative on the lagging strand.
   (D) DNA replication is continuous on the leading strand and discontinuous on the lagging strand.

6. Beta subunits of polymerase III enzymes in bacteria
   (A) add the RNA primers required for DNA synthesis
   (B) are used in lagging and leading strand of DNA synthesis
   (C) are used in either lagging or leading strand of DNA synthesis
   (D) give DNA polymerase I its high processivity

7. In human global genome nucleotide excision repair (GG-NER), which protein products are correct for the "incision" (or endonuclease-type) function?
   (A) XPA and XPB (B) XPA and XPC (C) XPB and XPD (D) XPF and XPG

8. Which of the following statements in "genome" is true?
   (A) A bacterium genome contains about 60,000 DNA base pairs, while human and mouse genomes have some 30 million.
   (B) DNA in the human genome is arranged into 23 distinct chromosomes--physically separate molecules that range from about 0.5 million to 2.5 million base pairs.
   (C) The genome is an organism's complete set of DNA.
   (D) Genes comprise only about 20% of the human genome; the remainder consists of noncoding regions.

9. Which of the following statements in "functional genomics" is true?
   (A) One approach to functional genomics is to create DNA microarrays or DNA microchips
   (B) Functional genomics is the study of expression of all proteins in an organism.
   (C) DNA microarray contains thousands of cDNAs or oligonucleotides, respectively, then it can hybridize protein probe(s) from cells before and after certain treatment.
   (D) One approach to functional genomics is to create protein microarrays.

10. Which of the following statements in "strategies for human genome project" is NOT true?
   (A) The clone-by-clone strategy was used to produce a physical map of the genome including STSs, then sequencing the overlapping clones (mostly BACs) used in the mapping.
   (B) The shotgun strategy calls for the assembly of libraries of clones with different size inserts, then sequencing the inserts at random..
   (C) The shotgun method relies on a computer program to find areas of overlap among the sequences and piece them together.
   (D) Only shotgun strategy is being used to sequence the human genome.

11. Which of the following binds nucleotides at the active site of *E. coli* RNA polymerase?
   (A) α-sububit (B) β-subunit (C) β'-subunit (D) σ-subunit

12. Which of the following permits expression of delayed early genes of λ phage?
   (A) N (B) Q (C) Cro (D) CI

13. Which of the following promoters is used to maintain lysogeny of λ phage in *E. coli*?
   (A) P_L (B) P_R (C) P_{RE} (D) P_{RM}

14. Which of the following subunits of RNA polymerase II is homologous to the β-subunit of *E. coli*?
   (A) RPB1 (B) RPB2 (C) RPB3 (D) RPB4

15. Which of the following genes has an internal promoter?
   (A) β-globin (B) 7S rRNA (C) 5S rRNA (D) U2 RNA

16. Which of the following transcription factors has DNA helicase activity?
   (A) TFII A (B) TFII B (C) TFII D (D) TFII H

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17. Which of the following transcription factors can bind RNA polymerase directly before the formation of PIC?
(A) TFII D (B) TFII E (C) TFII F (D) TFII H

18. TBP can not bind itself to TATA-less promoters with GC box. Which of the following is required to anchor TBP and SP1 to the GC box?
(A) $TAF_{II}250$, $TAFI_{I}50$, $TAF_{II}110$ (B) $TAF_{II}250$, $TAFI_{I}50$ (C) TFII A (D) TFII B

19. Which of the following snRNA recognizes 5' splicing signal during splicing of the intron
(A) U1 (B) U2 (C) U4/U6 (D) U5

20. Which of the following is involved in polyadenylation of mRNA?
(A) CF I (B) guide RNA (C) acetylase (D) deacetylase

21. Which of the following DNA (only one strand is shown) has the highest Tm value?
(A) AGCTGCTGGCATACGCATCGTCA
(B) CAGACCTACTTCTGGACGTCGGC
(C) ACATGGCAAGTGTTCAAGACAGT
(D) TCTATCCGCGATTCTAATCTCTG

22. Which of the following reagent is used for the translation initiation of eukaryotes?
(A) $Met\text{-}tRNA_m^{Met}$
(B) $fMet\text{-}tRNA_f^{Met}$
(C) $Met\text{-}tRNA_f^{Met}$
(D) $Met\text{-}tRNAi^{Met}$

23. Which of the following does NOT contain a catalytic RNA molecule?
(A) Group I intron
(B) RNase H
(C) RNase P
(D) 23S rRNA

24. The inhibitor of which of the following enzymes does NOT affect SARS coronavirus?
(A) Reverse transcriptase
(B) 3CL protease
(C) Helicase
(D) RNA polymerase

25. Which of the following DNA molecules possesses left-handed helix?
(A) A form DNA
(B) B form DNA
(C) E form DNA
(D) Z form DNA

26. Which of the following methods can be applied to determine the pI values of proteins in bacterial cell lysate?
(A) X-Ray crystallography
(B) Immunoprecipitation
(C) Two-dimensional gel electrophoresis
(D) Fluorescence microscopy

27. Which of the following methods does NOT separate molecules by size?
(A) Affinity column chromatography
(B) Agarose gel electrophoresis
(C) Gel filtration chromatography
(D) SDS-PAGE

28. Which of following enzymes cleaves only single-stranded nucleotides?
(A) RNase H
(B) Restriction enzyme *Eco*RI
(C) Klenow fragment
(D) S1 nuclease

29. Which of the following equipment is NOT designed to measure radioisotope?
(A) Ultracentrifuge
(B) Densitometer
(C) Phosphoimager
(D) Scitillation counter

30. Which statement about DNA-protein interaction is true?
(A) As a DNA bends by proteins, it is more susceptible to DNase digestion.
(B) The four different base pairs present four different hydrogen bonding profiles to amino acids approaching either the major or minor groove DNA.
(C) λ repressor forms hydrogen bonding with the minor groove of the operator.
(D) Binding with tryptophan does not change the shape of the *trp* repressor

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31. The Sanger method of determining a DNA sequence involves the use of

I. electrophesis II. dimethyl sulfate III. DNA polymerase

IV. 5'-end labeling V. 3'-end labeling VI. dideoxyribonucleotide

(A) I, II, III, IV, V, VI

(B) I, II, V, VI

(C) I, III, IV, VI

(D) I, III, V, VI

32. Which of the following statement about X-ray crystallography is NOT true?

(A) One has to generate a protein crystal prior to diffraction.

(B) Diffraction patterns can be converted to the electron density map.

(C) Good X-ray resolution is generally considered to be within 2 angstroms range.

(D) Direct protein-DNA interaction in solution can be solved.

33. Which of the following methods can be used to assay DNA-protein interactions?

I. EMSA II. Nitrocellulose filter binding

III. DNase footprinting IV. Hydroxyl radical footprinting

(A) I, II, III

(B) I, II, IV

(C) II, III, IV

(D) I, II, III, IV

34. Answer the questions according to the short essay and common sense in laboratory of molecular biology. (10%)

Tet(O) is an elongation factor-like protein which confers resistance to the protein synthesis inhibitor tetracycline by promoting the release of the drug from its inhibitory site on the ribosome. The interaction of Tet(O) with the elongating ribosome has been investigated employing DMS probing and binding assays. The results show that Tet(O) interacts preferentially with the post-translational ribosome, it also induces conformational rearrangements within the ribosome which can be detected by EF-Tu, and manifested as a stimulation in the GTPase activity of this elongation factor. Such conformational changes probably involve the ribosomal GTPase-associated center and accordingly Tet(O) alters the DMS modification pattern of the L11 region. These results suggest a model where both Tet(O) and tetracycline induce a conformational change in functionally opposite directions and the Tet(O)-induced conformation persists after it has left the ribosome; this prevents rebinding of the drug while allowing productive A-site occupation by a ternary complex in the presence of tetracycline.

(1) What solvent is used to dissolve tetracycline and what color is the solution?

(2) How do you prepare and store an LB agar plate containing 25 μg/mL tetracycline?

(3) What is the major difference between pre-translational and post-translational states of ribosome?

(4) Draw a figure to show how tetracycline inhibits protein synthesis.

(5) Draw a figure to show how Tet(O) mediates tetracycline resistance.

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35. List 4 differences between agarose gel electrophoresis and SDS-PAGE in terms of fundamental theory and instrumentation.(4%)

36. Many proteins participate in mRNA splicing. They can be classified as snRNP proteins or non-snRNP proteins. Please briefly answer the following questions. (5%)
    (1) What is snRNP?
    (2) Define snRNP protein and non-snRNP protein, and name two of those proteins in each group.

37. Introduction of double-stranded RNA (dsRNA) into cells can cause RNA interference (RNAi). Please briefly answer the following questions. (5%)
    (1) Explain what does RNAi mean.
    (2) Describe the mechanism that dsRNA causes RNAi.

38. Please briefly describe how the abundance of each species of mRNA in the eukaryotic cells differs significantly. (10%)