

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

考試日期：0302，節次：2

Part I: single-choice question (60%)

- All of the following statements are correct with regard to chromatin EXCEPT
 - Core nucleosomes consist of 8 histone protein molecules and about 146 base pairs of DNA.
 - Histones have been highly conserved during evolution.
 - Almost all of the DNA in a eukaryotic cell is assembled into nucleosomes.
 - Assembly of DNA into nucleosomes compacts it about 100-fold in length.
 - Nucleosome cores are separated by variable amounts of linker DNA.
- Which primers will amplify my favorite gene if it is in the context below? 5'-GGTACAGTC-MY FAVORITE GENE-CTAGATCAT-3'
 - 5'-GACTGTACC and 5'-CTAGATCAT
 - 5'-GGTACAGTC and 5'-ATGATCTAG
 - 5'-GGTACAGTC and 5'-CTAGATCAT
 - 5'-GACTGTACC and 5'-ATGATCTAG
 - 5'-GGTACAGTC and 5'-GACTGTACC
- One of the strands of a double-stranded, 10 kbp DNA duplex has the following numbers of base residues: adenine(a) - 3800, thymine(t) - 2600. The base composition of the whole double-stranded molecule will be
 - a - 5200, t - 5200, g - 4800, c - 4800
 - a - 7600, t - 7600, g - 2400, c - 2400
 - a - 6400, t - 6400, g - 3600, c - 3600
 - a - 6400, t - 3600, g - 6400, c - 3600
 - There is not enough information to determine the overall base composition
- How many net moles of ATP are produced per glucose equivalent when glycogen is the substrate for anaerobic glycolysis?
 - 0
 - 1
 - 2
 - 3
 - 2
- Each of the following may be used to estimate the molecular weight of a protein EXCEPT
 - sucrose density gradient centrifugation.

(背面仍有題目,請繼續作答)

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- B. ion exchange chromatography.
C. SDS (sodium dodecyl sulfate) gel electrophoresis.
D. gel filtration chromatography.
E. sedimentation and diffusion measurements.
6. From what you know about protein chemistry, which peptide migrates fastest to the cathode (or negative charged electrode) at pH 6.0.
A. Asp-Ala-Glu-Phe-Arg
B. Gly-Val-Val-Ile-Ala
C. His-Asp-Ser-Gly-Tyr
D. Lys-Val-His-His-Gln
E. Glu-Asp-Val-Gly-Ser
7. Which of the following is a substrate for RNA synthesis, but not DNA synthesis?
A. adenosine triphosphate (ATP)
B. deoxyuridine triphosphate (dUTP)
C. guanosine-5', 5'-guanosine triphosphate (GpppG)
D. cyclic adenosine monophosphate (cAMP)
E. pseudouridine triphosphate (psiTP)
8. Given this information, what technique(s) would be least useful for determining whether an individual's huntingtin proteins contained extensions of 60 additional glutamines.
A. Ion exchange chromatography
B. Native gel electrophoresis
C. SDS-PAGE
D. Amino acid analysis
E. A and B
9. Which statement about gluconeogenesis is correct?
A. The acetate group of acetyl-CoA is used for the net synthesis of glucose.
B. It occurs primarily in skeletal muscle.
C. It occurs through reversal of the reactions of glycolysis.
D. Lactate and alanine can both serve as substrates.
E. ATP is not required.
10. Cellular DNA and RNA synthesis are distinguished by which of the following?

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- A. release of the product polynucleotide from the template
- B. use of a DNA template
- C. selection of incoming nucleotides by Watson-Crick base pairing rules
- D. release of pyrophosphate in the chemical step of synthesis
- E. polarity of synthesis of the new strand

11. Histones are usually

- A. basic, and therefore negatively charged at neutral pH.
- B. basic, and therefore positively charged at neutral pH.
- C. acidic, and therefore negatively charged at neutral pH.
- D. acidic, and therefore positively charged at neutral pH.
- E. close to neutral, and therefore uncharged at neutral pH.

12. Mutations in DNA

- A. are not important if they are in intron sequences.
- B. are not important unless they occur in open reading frames.
- C. always have a negative impact on the gene product affected.
- D. only affect single-copy genes.
- E. can change the translational reading frame of proteins.

13. Consider a single-stranded DNA fragment 1000 bp long in a solution hybridization experiment.

Which of the following parameters has the largest effect on the rate of reannealing of this fragment with its complementary sequence?

- A. The species from which the DNA was derived
- B. The concentration of the complementary strand in the solution
- C. The fraction of Gs and Cs in the sequence of the strand
- D. The amount of helicase added to the solution
- E. The concentration of detergent in the solution

14. Which modification reaction does not occur at a polypeptide chain terminus?

- A. Myristylation
- B. ADP-ribosylation
- C. Acetylation
- D. Glycosylphosphatidylinositol addition
- E. amidation

(背面仍有題目,請繼續作答)

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15. Which of the statements is CORRECT regarding the composition of CORE nucleosome particles?

- A. They contain 5 different kinds of histones
- B. They compact the length of the DNA 20-30 fold
- C. They contain 2 molecules each of H2A, H2B, H3, and H4
- D. They contain about 400 bp of DNA
- E. They wrap DNA around themselves about 3 times

16. Which statement is NOT TRUE regarding cell cycle checkpoints?

- A. Checkpoint proteins participate catalytically in the repair of DNA damage
- B. Checkpoints can be suppressed by chemicals like caffeine, allowing inappropriate passage through the cell cycle.
- C. Checkpoints delay progression of the cell cycle to allow time for repairs to occur
- D. Loss of checkpoints leads to genomic instability
- E. Checkpoints can distinguish accidental double-strand DNA breaks from telomeres

17. Which of the following is TRUE?

- A. mRNA is read 3' to 5', and protein is synthesized C-terminus to N-terminus.
- B. mRNA is read 5' to 3', and protein is synthesized C-terminus to N-terminus.
- C. mRNA is read 3' to 5', and protein is synthesized N-terminus to C-terminus.
- D. mRNA is read 5' to 3', and protein is synthesized N-terminus to C-terminus.
- E. mRNA can be read either 3' to 5' or 5' to 3'.

18. Which of the following is a general feature of both DNA and RNA?

- A. in vivo they are usually double helical structures formed from two separate chains.
- B. Their phosphodiester backbones are stable in solutions above pH 12.
- C. They are made partly of complementary G-C base pairs.
- D. They both have phosphodiester bonds linking the 5' and 2' hydroxyls of the ribose groups.
- E. They interact with histones to form nucleosomes.

19. The melting temperature of double stranded DNA

- A. increases with increasing guanine content
- B. decreases with increasing cytosine content
- C. increases with decreasing guanine content
- D. decreases with decreasing adenine content
- E. increases with increasing thymine content

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20. What feature is shared by promoters and enhancers in eukaryotic gene expression?
- A. There are TATA boxes in both promoters and enhancers.
 - B. Both are binding sites for RNA polymerase II.
 - C. It doesn't matter what their orientation is relative to the gene they control.
 - D. Their effects are mediated by sequence-specific DNA-binding proteins.
 - E. They always cause repression of transcription.
21. Nucleotide excision repair is known to need all of the following enzymes EXCEPT which one?
- A. A nuclease
 - B. A type I topoisomerase
 - C. A DNA helicase
 - D. A DNA ligase
 - E. A DNA polymerase
22. A DNA molecule is labeled and used to locate complementary strands in a restriction enzyme digest of genomic DNA separated by electrophoresis. This is called a
- A. Northern blot
 - B. Western blot
 - C. Southern blot
 - D. Eastern blot
 - E. Ink blot
23. The enzyme which catalyzes the entrance of acetyl CoA into the citric acid cycle is
- A. aconitase.
 - B. citrate synthase.
 - C. succinate thiokinase.
 - D. pyruvate dehydrogenase.
 - E. isocitric dehydrogenase.
24. Superoxide anion is a free radical which can be converted to non-radical products by the action of
- A. superoxide hydrolase.
 - B. catalase.
 - C. superoxide dismutase (SOD) and catalase.
 - D. superoxide hydrolase and catalase.
 - E. ferric iron.

(背面仍有題目,請繼續作答)

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25. A simple definition of "oxidative stress" is
- A. it involves the oxidation of biological tissues by free radicals.
 - B. it always causes cancer.
 - C. it is the "stress" that follows extreme exercise.
 - D. it describes the over saturation of hemoglobin.
 - E. it results in the formation of methemoglobin.
26. What is NOT true of the peptide bond
- A. limited rotation of the peptide bond
 - B. planar
 - C. partially charged groups
 - D. bond between alpha carbon and carbonyl carbon
 - E. resonance stabilized
27. "Respiratory control" over oxidative phosphorylation states that electron flow and ATP formation stop when which compound is absent?
- A. ATP
 - B. ADP
 - C. NADH
 - D. FADH
 - E. oxygen
28. An enzyme absent in skeletal muscle is...
- A. lactate dehydrogenase.
 - B. hexokinase.
 - C. pyruvate dehydrogenase.
 - D. glucose-6-phosphatase.
 - E. glycogen synthetase.
29. NADPH for fatty acid synthesis is directly supplied by
- A. isocitrate dehydrogenase.
 - B. glycogen phosphorylase.
 - C. alpha-ketoglutarate dehydrogenase.
 - D. glucose-6-phosphate dehydrogenase.
 - E. the transfer of reducing power from NADH to NADP in mitochondria.

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30. Which modification reaction is NOT important in directing membrane association?
- A. myristylation
 - B. palmitoylation
 - C. ADP-ribosylation
 - D. isoprenylation
 - E. phosphoinositol-glycan
31. The best evidence that DNA carries genetic information is
- A. it can transform the properties of cells in heritable ways
 - B. it can be duplicated using the information in either strand
 - C. it is a chemically stable polymer
 - D. it comprises most of the material injected into cells by some viruses
 - E. information in DNA is found to be copied into RNA
32. The stability of DNA duplexes is increased by
- A. increasing the temperature above 20 degrees C
 - B. changing the pH to values near 7
 - C. adding formamide or other non-aqueous solvents
 - D. decreasing the concentration of salts
 - E. the hypochromic shift
33. Cyclic AMP causes metabolic effects in tissues by
- A. being converted to AMP.
 - B. inhibiting protein phosphatase.
 - C. stimulating protein kinases.
 - D. binding to the allosteric site on phosphorylase.
 - E. inhibiting tyrosine kinase.
34. A person with lactose intolerance likely has diminished activity of
- A. lactase.
 - B. fructokinase.
 - C. aldolase-B.
 - D. galactokinase.
 - E. phosphofructokinase.
35. Which of following is NOT TRUE of histones?

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- A. They are small, basic proteins
 - B. They are found in nucleosomes in a ratio of 1:1:1:1 H2A:H2B:H3:H4
 - C. They are only associated with transcriptionally active DNA
 - D. They form a core of proteins about which DNA wraps about 1.8 times
 - E. They are abundant in eukaryotic chromatin
36. BrdU is a nucleoside analog that is readily taken up by human cells and incorporated into DNA. If you add BrdU to human cells and let them replicate their DNA 3 times, what fraction of the DNA strands will have the analog in them (assuming no recombination)?
- A. 1 out of 2
 - B. 3 out of 4
 - C. 1 out of 4
 - D. 7 out of 8
 - E. 1 out of 8
37. When a human cell is damaged by ultraviolet light, the most likely mechanism of repair is
- A. by photolyase
 - B. by a mechanism using an AP endonuclease
 - C. by base excision repair
 - D. by a mechanism using a MutH homolog
 - E. by nucleotide excision repair
38. If two homologous DNA molecules have sequences that can be represented as ABCDEF and abcdef participate in recombination,
- A. both products will be ABCDEF
 - B. both products will be abcdef
 - C. neither product will have any mismatches, only exchanges
 - D. resolution in the patch configuration will produce ABCdEF
 - E. resolution in the recombinant configuration will produce ABcdEF
39. Which of the following modifications does NOT take place during the production of mature tRNAs?
- A. Rotation of a uracil base to produce pseudouridine.
 - B. Methylation of a uracil base to produce (ribo)thymidine.
 - C. PolyA addition at the 3' end.
 - D. Addition of some complicated substituents, like an isopentenyl group to adenosine.
 - E. Conversion of uridine to dihydrouridine (DHU).

40. Which residue is an aromatic amino acid?

- A. Thr
- B. Pro
- C. Met
- D. Tyr
- E. His

Part II: short-answer question

1. Describe the procedure of site-directed mutagenesis. (4%)

2. Name the techniques for proteins separation (4 %)

(a) Proteins are separated on the basis of their ability to migrate in an electric field (1%)

(b) Proteins are chromatographically separated solely on the basis of size (1 %)

(c) Proteins are chromatographically separated solely on the basis of charge interaction (1 %)

(d) Proteins are precipitate by solubility (1 %)

3. Immunotechniques (8 %)

The extraordinary binding affinity and specificity of antibodies make immuno assay, like the immunoblot assay or ELISA (enzyme-linked immunosorbent assay), is one of the most important analytic methods in biochemistry.

(a) Please explain the working mechanism of Western blot and ELISA, respectively (3 %).

(b) Please describe the differences between the polyclonal antibodies and monoclonal antibodies and give a brief description about epitope. (3 %)

(c) Is it possible a protein can be detected by ELISA but can not be detected by Western blot?

Give your answer with a brief explanation. (2 %)

4. Please describe the important features of the structures present on the 5' and 3' ends of mature, processed eukaryotic mRNAs. (4 %)

5. The sequences of a piece of double-stranded DNA and its transcribed mRNA sequence are shown below:

DNA: 5'-GCTAGCTACGCAGCATGGCTACTG-3' ---(A) strand

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3'-CGATCGATGCGTCGTACCGATGAC-5' ---(B) strand

mRNA: 5'-GCUAGCUACGCAGCAUGGCCUACUG-3'

Please answer the following questions:

(1) Which DNA strand is the template strand used for RNA transcription? (1 %)

(2) Which DNA strand is the coding strand? (1 %)

If this mRNA can be translated into a polypeptide chain,

(3) What is the polypeptide sequence from N terminal to C terminal? (1 %)

(4) How many kinds of aminoacyl-tRNAs are used for the synthesis of this oligopeptide? (2 %)

		Second letter of codon							
		U		C		A		G	
First letter of codon (5' end)	U	UUU	Phe	UCU	Ser	UAU	Tyr	UGU	Cys
		UUC	Phe	UCC	Ser	UAC	Tyr	UGC	Cys
		UUA	Leu	UCA	Ser	UAA	Stop	UGA	Stop
		UUG	Leu	UCG	Ser	UAG	Stop	UGG	Trp
	C	CUU	Leu	CCU	Pro	CAU	His	CGU	Arg
		CUC	Leu	CCC	Pro	CAC	His	CGC	Arg
		CUA	Leu	CCA	Pro	CAA	Gln	CGA	Arg
		CUG	Leu	CCG	Pro	CAG	Gln	CGG	Arg
	A	AUU	Ile	ACU	Thr	AAU	Asn	AGU	Ser
		AUC	Ile	ACC	Thr	AAC	Asn	AGC	Ser
		AUA	Ile	ACA	Thr	AAA	Lys	AGA	Arg
		AUG	Met	ACG	Thr	AAG	Lys	AGG	Arg
G	GUU	Val	GCU	Ala	GAU	Asp	GGU	Gly	
	GUC	Val	GCC	Ala	GAC	Asp	GGC	Gly	
	GUA	Val	GCA	Ala	GAA	Glu	GGA	Gly	
	GUG	Val	GCG	Ala	GAG	Glu	GGG	Gly	

6. Please define the following terms and its purpose or function: (10%, 2% for each)

- (a) small interfering RNA (siRNA) (b) microarray (c) telomerase (d) proteomic
(e) chromatin immunoprecipitation (ChIP)

7. Please list 5 transcription factors involved in the regulation of gene expression. (5%)