

系所組別：醫學檢驗生物技術學系

考試科目：生化與分生

考試日期：0307，節次：3

※ 考生請注意：本試題 可 不可 使用計算機

請勿在本試題紙上作答，否則不予計分

一、選擇題 (2 points each)

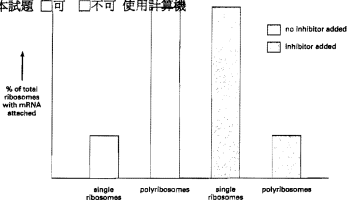
- DNA replication is considered semiconservative because
 - after many rounds of DNA replication, the original DNA double helix is still intact.
 - each daughter DNA molecule consists of two new strands copied from the parent DNA molecule.
 - each daughter DNA molecule consists of one strand from the parent DNA molecule and one new strand.
 - new DNA strands must be copied from a DNA template.
 - an RNA primer must be used to initiate synthesis of the DNA strand.
- A molecule of bacterial DNA introduced into a yeast cell is imported into the nucleus but fails to replicate. Where do you think the block to replication arises? Choose the protein or protein complex below that is most likely responsible for the failure to replicate bacterial DNA. Give an explanation for your answer.
 - Primase
 - Helicase
 - DNA polymerase
 - Sliding clamp protein
 - Initiator proteins
- Which of the following reactions are known to be carried out by a ribozyme?
 - DNA synthesis
 - Transcription
 - Peptide bond formation
 - Protein hydrolysis
 - Polysaccharide hydrolysis
- You have discovered a protein that inhibits translation. When you add this inhibitor to a mixture capable of translating human mRNA and centrifuge the mixture to separate polyribosomes and single ribosomes, you obtain the results shown in the figure below. Which of the following interpretations are consistent with these observations?

(背面仍有題目,請繼續作答)

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- A. The protein binds to the small ribosomal subunit and increases the rate of initiation of translation.
- B. The protein binds to sequences in the 5' region of the mRNA and inhibits the rate of initiation of translation.
- C. The protein binds to the large ribosomal subunit and slows down elongation of the polypeptide chain.
- D. The protein binds to sequences in the 3' region of the mRNA and prevents termination of translation.
5. When a trimeric G protein is activated by a cell-surface receptor
- the β subunit exchanges its bound GDP for GTP.
 - the GDP bound to the α subunit is phosphorylated to form bound GTP.
 - it dissociates into a free β subunit and an $\alpha\gamma$ subunit.
 - the α subunit exchanges its bound GDP for GTP.
 - it dissociates into an active α subunit and an inactive $\beta\gamma$ subunit.
6. Which of the following statements about import of proteins into mitochondria is true?
- The signal sequences on mitochondrial proteins are usually carboxyl terminal.
 - The first stage of import of a mitochondrial protein is across the outer membrane into the intermembrane space.
 - Most mitochondrial proteins are not imported from the cytosol but are synthesized inside the mitochondria.
 - Mitochondrial proteins are translocated across the inner and outer membranes simultaneously.

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- E. Mitochondrial proteins cross the membrane in their native, folded state.
7. Cells in the G_0 state
- cannot reenter the cell cycle.
 - can remain in that state for a lifetime.
 - have entered from G_1 or G_2 checkpoints.
 - will certainly undergo apoptosis
 - have duplicated their DNA.
8. Programmed cell death occurs
- rarely and selectively where survival factors are not present.
 - to eliminate invasive bacteria.
 - only in unhealthy or abnormal cells.
 - only during embryonic development.
 - by means of an intracellular suicide program.
9. How are most eukaryotic gene regulatory proteins able to affect transcription when their binding sites are far from the promoter?
- By binding to their binding site and sliding to the site of RNA polymerase assembly
 - By looping out the intervening DNA between their binding site and the promoter
 - By unwinding the DNA between their binding site and the promoter
 - By attracting RNA polymerase and modifying it before it can bind to the promoter
10. Energetically favorable reactions are those that
- decrease the entropy of a system.
 - increase the free energy of a system.
 - have a positive ΔG .
 - decrease the free energy of a system.
 - create order in a system.
11. Primers for RT-PCR include all of the following except:
- oligo(dT)
 - oligo(dA)

(背面仍有題目,請繼續作答)

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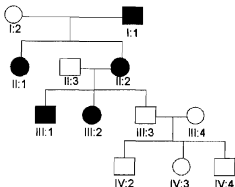
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- C. random hexamers
D. sequence specific primers
12. The blank control in a PCR assay contains all of the following except:
A. dNTPs
B. polymerase
C. primers
D. target DNA
13. Nested PCR increases:
A. the length of amplicon
B. the specificity of reaction
C. the stability of polymerase
D. the ligation of adjacent primer pairs
14. COLD-PCR, a powerful tool for detecting gene mutation, is based on amplification of the target at
A. Lower extension temperature
B. Lower annealing temperature
C. Lower denaturation temperature
D. Higher annealing temperature

Refer to the following pedigree to answer the questions/5-6



15. Daughters of an affected male have what chance of being affected with the disease?
A. 100%

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- B. 50%
- C. 33%
- D. 25%

16. The mode of inheritance depicted in this pedigree is

- A. X-linked dominant
- B. X-linked recessive
- C. non-Mendelian
- D. autosomal recessive

二、問答題

1. Please describe the role and mechanism of microRNA in cells (5 points)
2. Please answer the following questions
 - (1) What is genome imprinting? (1 point)
 - (2) Give four human chromosomes on which imprinting genes are located (2 points)
 - (3) Give the names of three imprinting syndromes in human (2 points)
3. Describe the role of mitochondria plays in programmed cell death (5 points)
4. Please describe the primary, secondary, tertiary and quaternary structures of proteins (5 points)
5. Based on the mechanism, the reversible inhibition of enzyme can be divided into three common modes. Please write down the name, and draw the double reciprocal plots (Lineweaver-Burk plot) of the three mechanisms which must include four concentration of inhibitors (0, low, medium, and high). (20 points)
6. Please give five methods if you attempt to isolate proteins from a mixture by column chromatography. (just write down the name or main principle) (10 points)
7. Explain the primary biological functions of albumin and the characteristics of the albumin molecule which are responsible for these functions (5 points)
8. What is glycated hemoglobin? What are the determinants of its blood level? Describe the advantage of measuring blood glycated hemoglobin as compared to plasma glucose when diagnosing diabetes. (8 points)
9. For each of the following sentences, fill in the blanks with the best word or phrase selected from the list below. Not all words or phrases will be used; each

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word or phrase should be used only once. (3 points)

“A carbon atom in a CO_2 molecule in the atmosphere eventually becomes a part of one of the enzymes that catalyzes glycolysis in one of your cells. The CO_2 first enters a cell in a corn leaf where photosynthesis fixes the carbon to make it part of a sugar molecule, which travels from the leaf to an ear of corn where it is stored as part of a polysaccharide (1) molecule in the corn seed. You then eat a corn chip made from the corn seed. You digest the corn seed, and the free (2) travels in your bloodstream, eventually being taken up by a liver cell and stored as (3). When required, this storage molecule breaks down into glucose-1-phosphate, which enters the glycolytic pathway. Glycolysis produces (4), which is converted into acetyl CoA, which enters the (5). Several intermediates in this process can provide the carbon skeleton for production of (6), which are then incorporated into the enzymes that catalyze steps in glycolysis”.

amino acids

insulin

carbon fixation

lactate

citric acid cycle

nucleotides

fatty acid

oxidative phosphorylation

fermentation

pyruvate

galactose

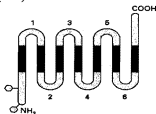
starch

glucose

triacylglycerol

glycogen

10. Examine the multipass transmembrane protein shown below. What would you predict would be the effect of converting the first hydrophobic transmembrane segment to a hydrophilic segment? Please sketch the arrangement of the modified protein in the ER membrane and number the corresponding domains. (2%)



cytosol

ER lumen