

一、選擇題（請作答於答案卡。1-16 題每題 2 分，9-16 題為多選題，全對才給分。17-20 題每題 4 分，共 48 分）

1. Which of the following statement is NOT correct for the regulation of lactose (*lac*) operon?
 - A) *lac* operon is repressible catabolic operon.
 - B) *lac I* repressor binds to operator of *lac* operon in the presence of glucose.
 - C) Catabolite gene activator protein (CAP) is a positive control of *lac* operon without cAMP.
 - D) 1,6-allolactose functions as a true inducer.
 - E) I⁻Z⁺/I⁺Z⁻ diploid strain with *lacZ* inducibility in response to IPTG.

2. Which of the following statement is correct for the development of prophage?
 - A) Lambda repressor is expressed in the lysogenic bacteria cells.
 - B) Lambda repressor binds to O_{R1} to express Cro protein.
 - C) Lambda repressor binds to O_{R2} to inhibit the expression of itself.
 - D) Cro binds to O_{R1} to inhibit the expression of lambda repressor.
 - E) Lysogeny is terminated by proteolysis of N protein.

3. Which of the following factor is NOT involved in the efficiency of eukaryotic transcription?
 - A) Histone modification
 - B) DNA methylation on deoxycytidine of CpG island
 - C) Enhancer and silencer
 - D) microRNA (miRNA)
 - E) Deletion of genomic information in B cells

4. Which of the following statement is NOT correct for the characteristics of enhancers?
 - A) Work when located long distances from the promoter.
 - B) Work when upstream or downstream from the promoter.
 - C) Work when only one direction is same as TATA box.
 - D) Work through heterologous promoters.
 - E) Work by binding one or more proteins.

5. Which of the following method is NOT for mRNA quantitation?
 - A) Southern blot analysis
 - B) Reverse transcription-quantitative polymerase chain reaction
 - C) cDNA microarray
 - D) Transcriptome analysis
 - E) Next generation sequencing

6. Which of the following statement is NOT correct for the evaluation of SARS-CoV-2 infection?
 - A) Lower Ct (threshold cycle) value represents the higher titer of the virus.
 - B) Genomic RNA should be converted to cDNA before polymerase chain reaction for the quantitation of virus titers.
 - C) Identification of SARS-CoV-2 variant and sequences is critical to judge the cross-contamination.
 - D) Amicron variant contains more mutations compared to delta variant.
 - E) mRNA of the nucleocapsid protein is currently used for the vaccination.

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7. Which of the following statement is NOT correct for the regulation of *trp* operon?
- A) *trp* operon is repressible anabolic operon.
 - B) In the presence of high [Trp], the attenuated mRNA of *trp* operon is expressed.
 - C) In the presence of low [Trp], *trp* mRNA is synthesized.
 - D) The formation of mRNA stem-loop 3 and 4 causes rho-dependent termination.
 - E) Low level of [Trp-tRNA^{trp}] causes the formation of mRNA stem-loop 2 and 3.
8. Which of the following transcription regulatory protein contains zinc finger binding motif?
- A) *lac* repressor
 - B) Homeo box protein
 - C) Transcription factor TFIID
 - D) Fos and Jun
 - E) c-myc
9. Which enzyme is involved in the ER oligosaccharides processing?
- A) Oligosaccharide:protein transferase
 - B) N-acetyl glucosamintransferase
 - C) Galactose transferase
 - D) Fucosyltransferase
 - E) Mannosidase
10. Which description about proteoglycan glycosylation is correct?
- A) The posttranslational modification for directing glycoprotein transfer from ER to lysosome
 - B) N-acetylglucosamin Asn linkage
 - C) -Ser-X-Gly-Gly is the attachment site
 - D) N-acetylgalactosamin Asn linkage
 - E) Containing Gal-Gal-Xyl trisaccharides core-
11. Which is correct about the integrin connecting to intermediate filament and further transduce the mechano-sensing to the nucleus envelop?
- A) Bind to laminin
 - B) $\alpha3\beta1$
 - C) $\alpha6\beta1$
 - D) $\alpha6\beta4$
 - E) also called desmosome
12. Which following peptide can bind to $\alpha5\beta1$ integrin?
- A) ARADKAA
 - B) ARGESAA
 - C) AYIGSRAA
 - D) AYRGDAA
 - E) AYRAEKAA

13. Which is a tumor suppressor protein?

- A) Ras
- B) Rb
- C) P53
- D) Myc
- E) Raf

14. Which following glycosaminoglycans can be found in the proteoglycan protein core ?

- A) heparan sulfate
- B) dermatan sulfate
- C) chondroitin sulfate
- D) heparin
- E) hyaluronic acid

15. Which protein is a component for basal membrane?

- A) type IV collagen
- B) laminin
- C) perlecan
- D) type V collagen
- E) fibronectin

16. Which following protein can bind to proteolytic Laminin fragments?

- A) Type IV collagen
- B) $\alpha 2\beta 3$
- C) $\alpha 3\beta 1$
- D) heparan sulfate
- E) $\alpha 6\beta 4$

17. Which enzyme in the cholesterol synthesis process is targeted by the cholesterol-lowering drug, statins?

- A) Thiolase
- B) Phosphomevalonate kinase
- C) Δ^2 -Reductase
- D) Squalene synthase
- E) HMG-CoA reductase

18. What does "R" stand for in the terminology of restriction enzyme *EcoRI*?

- A) Genus
- B) The order of discovery
- C) A strain designation
- D) Species
- E) Bacterial source

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19. Which cloning vector has the largest cloning capacities?

- A) Plasmid
- B) YAC
- C) BAC
- D) Cosmids
- E) Lambda vector

20. Which lipoprotein described below is the precursor of IDL?

- A) Chylomicrons
- B) HDL
- C) VLDL
- D) LDL
- E) HDL

二、問答題 (52 分) ※ 注意：請於試卷內之「非選擇題作答區」作答，並應註明作答之題號。

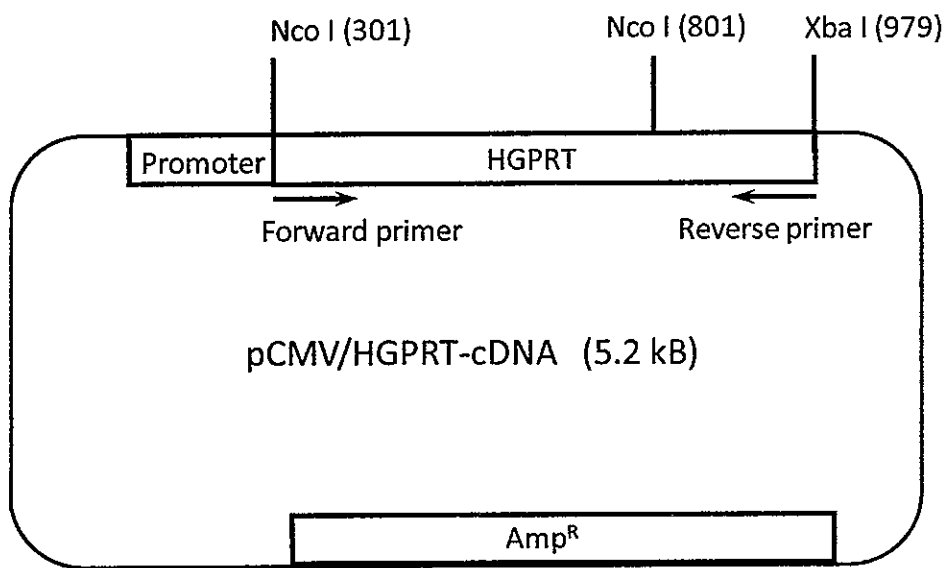
1. Explain why a certain protein has an apparent molecular mass of 90 kD when determined by gel filtration and 60 kD when determined by SDS-PAGE in the presence or absence of 2-mercaptoethanol. Which molecular mass determination is more accurate? (4%)
2. You wish to determine the sequence of a polypeptide that has the following amino acid composition. (4%)
1 Ala 4 Arg 2 Asn 3 Asp 4 Cys 3 Gly 1 Gln 4 Glu
1 His 1 Lys 1 Met 1 Phe 2 Pro 4 Ser 2 Tyr 1 Trp
 - a. What is the maximum number of peptides you can expect if you cleave the polypeptide with cyanogen bromides? (2%)
 - b. What is the maximum number of peptides you can expect if you cleave the polypeptide with chymotrypsin? (2%)
3. Two polypeptides, A and B, have similar tertiary structures, but A normally exists as a monomer, whereas B exists as a tetramer, B₄. What differences might be expected in the amino acid composition of A versus B? (4%)
4.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
Ile-Ala-His-Thr-Tyr-Gly-Pro-Phe-Glu-Ala-Ala-Met-Cys-Lys-Trp-Glu-Ala-Gln-Pro-

20 21 22 23 24 25 26 27 28
Asp-Gly-Met-Glu-Cys-Ala-Phe-His-Arg
 - a. In the amino acid sequence above, where would you predict that bends or β turns would occur? (2%)
 - b. Where might intrachain disulfide cross-linkages be formed? (2%)
5. Match each amino acid in the left-hand column with the appropriate side-chain type in the right-hand column. (4%)

(a) Leu	(1) nonpolar aliphatic
(b) Glu	(2) acidic
(c) Cys	(3) nonpolar aromatic
(d) Trp	(4) sulfur-containing
6. What is the oxidative phosphorylation and its importance in glucose metabolism? (4%)

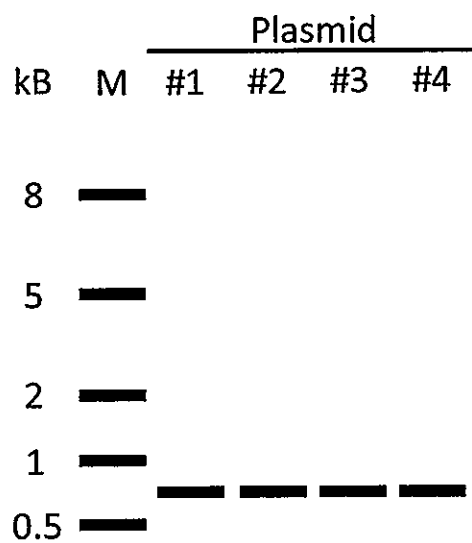
7. What are the molecular mechanisms for insulin to regulate the activities of phosphorylase and glycogen synthase? (4%)
8. How does glucagon regulate glycolysis and gluconeogenesis? (4%)
9. What is the important role of liver in heme catabolism and bilirubin secretion? (4%)
10. Eric Wang generated a plasmid that contains the entire coding region of human hypoxanthine guanine phosphoribosyltransferase (HGPRT) cDNA. The plasmid was termed pCMV/HGPRT-cDNA as shown in Fig. 1.

Fig 1



Eric Wang wanted to identify the pCMV/HGPRT-cDNA from 4 plasmids. In the first experiment, the 4 plasmids were analyzed by PCR using primers that are labelled as in Fig 1, and electrophoresis was performed on the PCR product as shown in Fig. 2.

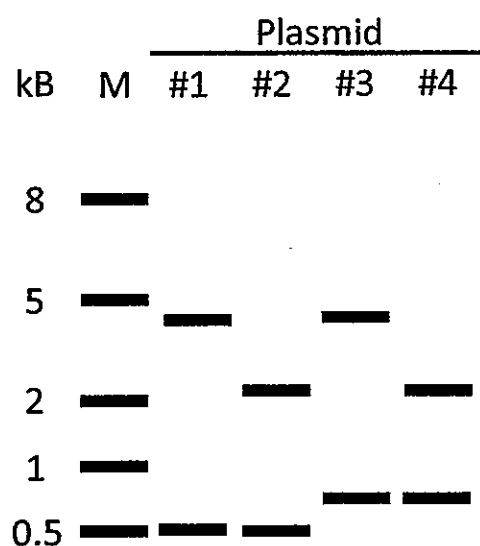
Fig 2



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In the second experiment, the same 4 plasmids were digested with Nco I, and the digests were separated by gel electrophoresis as shown in Fig. 3.

Fig 3



Questions :

- What is the disease caused by inherited mutation of the HGPRT? (2%)
- What is the size of the HGPRT-cDNA? (2%)
- What is the size of the HGPRT protein? (2%)
- Which of the following plasmids does contain the HGPRT-cDNA? (2%)
(A) Plasmid#1 (B) Plasmid#2 (C) Plasmid#3 (D) Plasmid#4 (E) Plasmids#1 and 2 (F) Plasmids#1 and 3
(G) Plasmids#2 and 4 (H) Plasmids#3 and 4 (I) All of them
- Which of the following plasmids is the pCMV/HGPRT-cDNA? (2%)
(A) Plasmid#1 (B) Plasmid#2 (C) Plasmid#3 (D) Plasmid#4 (E) Plasmids#1 and 2 (F) Plasmids#1 and 3
(G) Plasmids#2 and 4 (H) Plasmids#3 and 4 (I) All of them
- Please give one possible reason why the two experiments have different results. (4%)
- What is a useful alternative method to determine which plasmids contain the HGPRT-cDNA? (2%)

試題隨卷繳回