

國 立 宜 蘭 大 學

1 0 6 學 年 度 研 究 所 碩 士 班 考 試 入 學

生物化學試題

(生 物 技 術 與 動 物 科 學 系 生 物 技 術 碩 士 班)

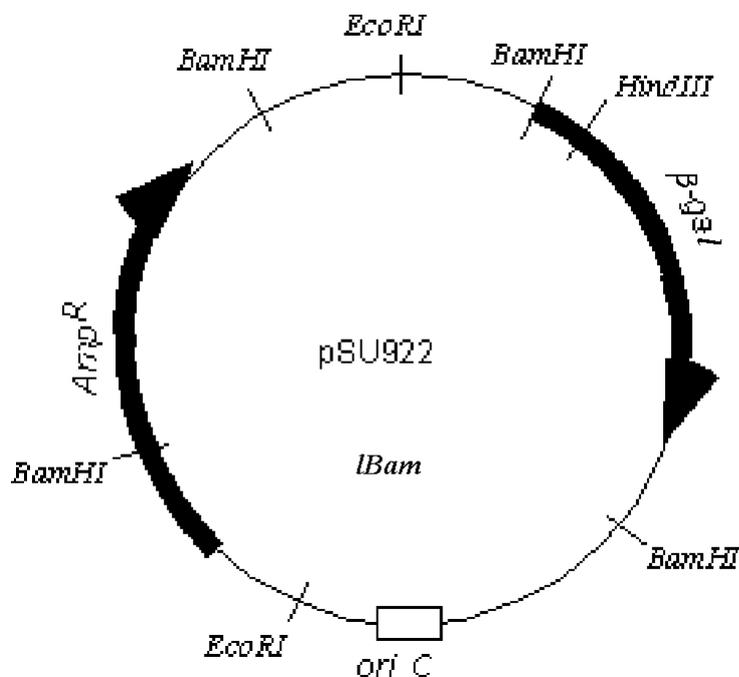
准考證號碼：

《作答注意事項》

- 1.請先檢查准考證號碼、座位號碼及答案卷號碼是否相符。
- 2.考試時間：100 分鐘。
- 3.本試卷共有 50 題選擇題，一題 2 分，共計 100 分。
- 4.請將答案寫在答案卷上。
- 5.考試中禁止使用手機或其他通信設備。
- 6.考試後，請將試題卷及答案卷一併繳交。
- 7.本試卷採雙面影印，請勿漏答。
- 8.應試時不得使用電子計算機。

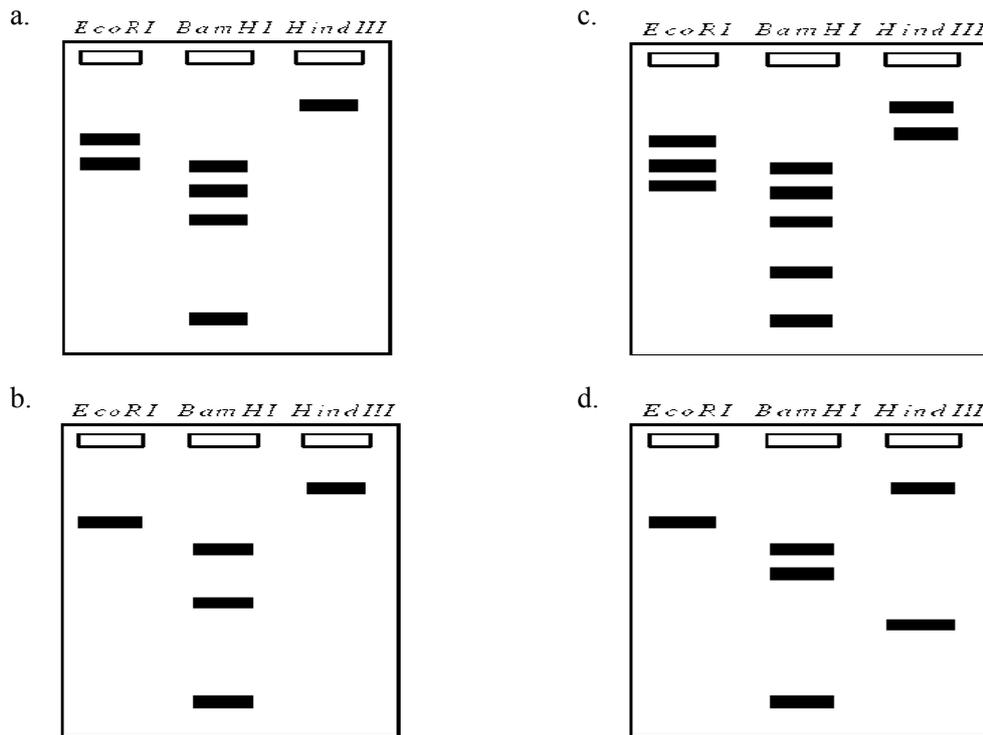
Exhibit 1

The plasmid pSU922 is a circular DNA containing 25000 base pairs. The β -gal gene codes for the enzyme β -galactosidase, the product of which will turn bacterial colonies blue when grown in the presence of X-gal; the Amp^R gene confers ampicillin resistance.



NARREND

1. Refer to Exhibit 1. Which restriction site is best for inserting a DNA fragment for analysis?
 - a. *Bam*HI
 - b. *Eco*RI
 - c. *Hind*III
 - d. They're all equally good.
2. Refer to Exhibit 1. In three separate vessels, the plasmid is treated with the restriction endonucleases *Eco*RI, *Bam*HI, and *Hind*III. Which of the following best represents the electrophoretic gel one would see from these digests?



3. Refer to Exhibit 1. Neglecting any discussion of whether it's a good or bad choice, I attempt to insert a gene fragment into the *HindIII* site and transform bacteria with the plasmid. How can I tell which transformants have the insert?

- The bacteria will not be able to grow in the presence of ampicillin, and they will be blue.
- The bacteria will not be able to grow in the presence of ampicillin, and they will be white.
- The bacteria will be able to grow in the presence of ampicillin, and they will be blue.
- The bacteria will be able to grow in the presence of ampicillin, and they will be white.

4. The polymerase chain reaction requires

- primers complementary to the ends of the sequence to be amplified
- careful temperature control
- both of these
- neither of these

5. The following item was the most important one for the development of PCR as a commercially successful and widely-used procedure:
- Taq* DNA Polymerase.
 - Heat-resistant DNA.
 - Heat-resistant primers for DNA synthesis.
 - Robotic machines to run the PCR® procedure.
 - Heat-resistant nucleoside triphosphate substrates.
6. Which of the following is a unique feature of qPCR compared to the original PCR?
- qPCR uses a DNA polymerase from a heat stable source
 - qPCR requires a primer
 - qPCR allows the reaction to run until all of the primers have been exhausted
 - In qPCR, the speed with which the DNA is produced is used to estimate how much of the original template was in the reaction vessel
7. In a metabolic study using microarrays, a yellow dot represents the location of DNA on the microarray:
- for which mRNA was produced in both the control and the test case
 - for which no mRNA was produced
 - for which only the control case produced mRNA
 - for which only the test case produced mRNA
8. Which of the following monosaccharides is a ketose?
- glucose
 - fructose
 - galactose
 - mannose
9. The simplest aldotriose is:
- acetone
 - dihydroxyacetone
 - glyceraldehyde
 - threose

10. In humans, pyruvate can be converted to
- acetyl-CoA only.
 - lactate only.
 - ethanol only.
 - acetyl-CoA and lactate.
11. Which of the following is not an end product of glucose metabolism via either aerobic or anaerobic means?
- ethanol
 - carbon dioxide
 - lactate
 - fructose
 - all of these are end products of glucose metabolism
12. What is the net ATP yield per glucose during glycolysis?
- 1
 - 2
 - 3
 - 4
 - 6
13. Which enzyme is the key regulatory enzyme in glycolysis?
- Glyceraldehyde-3-phosphate dehydrogenase
 - Enolase
 - Phosphofructokinase
 - Aldolase
14. Which of the following exercise(s) allosteric control in the reaction of phosphofructokinase?
- ATP
 - fructose 2,6-bisphosphate
 - both of these
 - neither of these

15. Which of the following enzymes of glycolysis is not involved in regulation of the pathway?
- Hexokinase
 - Phosphofructokinase
 - Aldolase
 - Pyruvate kinase
 - All of these proteins regulate glycolysis.
16. A characteristic of the glycerol phosphate shuttle is
- it shuttles NADH across the mitochondrial membrane to yield 5 ATP/NADH
 - it shuttles the electrons from NADH across the mitochondrial membrane to FADH₂, yielding 5 ATP/NADH
 - it only operates efficiently at high levels of NADH
 - malate is a key component in the shuttle process
17. *E. coli* replication to remove primer on the lagging strand
- is carried out by DNA polymerase I
 - is carried out by DNA polymerase II
 - is carried out by DNA polymerase III
 - is carried out by DNA ligase
18. In eukaryotic replication, the RNA primers are degraded by:
- the 5' to 3' exonuclease activity of pol δ
 - DNA ligase
 - Helicase
 - FEN-1 and RNase H1
19. The promoter site is
- the start site for transcription in DNA
 - the binding site for regulatory proteins that stimulate transcription
 - the general region of DNA downstream from the start site
 - the site on DNA at which RNA polymerase binds to initiate transcription

20. Which of the following is the best description of an operon?
- An enhancer that positively regulates gene expression.
 - An silencer that negatively regulates gene expression.
 - A binding element for the sigma (σ) factor.
 - A group of genes under the control of a common promoter.
21. Which of the conditions would result in the greatest amount of transcription of the *lac* operon?

	[glucose]	[lactose]
I.	low	high
II.	low	low
III.	high	low
IV.	high	high

- I
 - II
 - III
 - IV
22. Which of the following is not a characteristic of catabolite activator protein (CAP)?
- it is a positive regulator of the *lac* operon
 - when the cell has sufficient glucose and lactose, CAP will not be bound to the CAP binding site
 - CAP binding near the promoter site depends on CAP complexation with cAMP
 - the binding of CAP to DNA requires ATP hydrolysis
23. Capping of eukaryotic mRNA
- occurs at the 5' end.
 - occurs at the 3' end.
 - occurs at both ends.
 - doesn't occur at all.

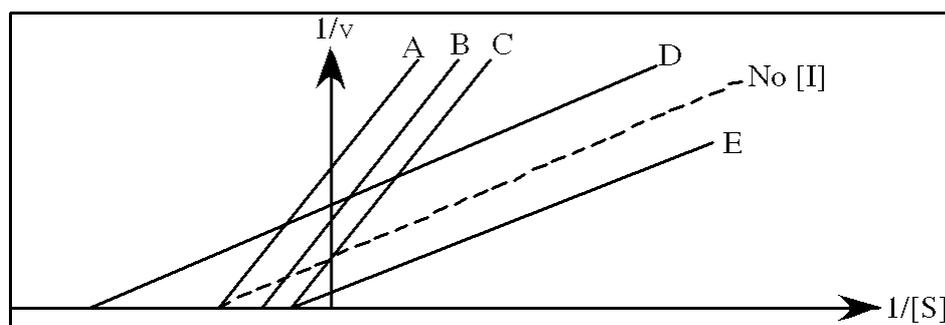
24. Which separates based on the ionic charge on a protein?
- Gel filtration
 - Affinity chromatography
 - Cation exchange
 - Anion exchange
 - Cation or anion exchange
25. Which would be best to separate a protein that binds strongly to its substrate?
- Gel filtration
 - Affinity chromatography
 - Cation exchange
 - Anion exchange
 - Cation or anion exchange
26. If a protein with the sequence FEWPRQVDMARINE is treated with chymotrypsin, what will the products be?
- F EW PRQVMARINE
 - FE WPRQVD MARINE
 - FEWPR QVDMAR INE
 - FEWPRQVDM ARINE
27. If a protein with the sequence PQRKYPIG is treated with trypsin, what will the products be?
- PQR KYPIG
 - PQRK YPIG
 - PQR K YPIG
 - PQ R KPIG0
28. Cyanogen bromide (CNBr) cleaves proteins
- after positively charged residues, such as K & R.
 - after negatively charged residues, such as D & E.
 - after aromatic residues, such as Y & W.
 - after methionine residues.

29. The most efficient method for determining the sequence of a short peptide is:

- Edman degradation
- Trypsin digestion
- Chymotrypsin digestion
- Cyanogen bromide digestion

30. Refer to Exhibit 6A. "Restratinin" is an inhibitor of triose phosphate isomerase. When it is added to cells at a concentration of 0.4 nM, the enzyme's apparent K_M for the substrate is altered to 100 μM , but the V_{max} is unchanged.

In the following graph, which line best represents the Lineweaver-Burk plot obtained in the presence of restratinin?



- A
- B
- C
- D
- E

31. Which of the following four fatty acids has the highest melting point?

- $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$
- $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$

- a. 1
 - b. 2
 - c. 3
 - d. 4
32. Which of the following is a metabolic precursor of prostaglandins & leukotrienes?
- a. vitamin A.
 - b. arachidonic acid.
 - c. sphingomyelin.
 - d. cholesterol.
33. The dissociation constant for an acid with a pK_a value of 6.0 is
- a. 1×10^{-6}
 - b. -1×10^6
 - c. 1×10^6
 - d. -1×10^{-6}
34. A buffer solution at pH 10 has a ratio of $[HA]/[A^-]$ of 10. What is the pK_a of the acid?
- a. 8
 - b. 9
 - c. 10
 - d. 11
 - e. 12
35. The pH of a solution of 0.04 M HCl is:
- a. 4
 - b. 1.4
 - c. 0.4
 - d. 0.04
 - e. The pH cannot be determined
36. The pOH a solution of 0.04 M HCl is:
- a. 1.4
 - b. 10
 - c. 12.6
 - d. 13.6
 - e. The pOH cannot be determined

37. An HCl solution has a pH = 3. If you dilute 10 mL of the solution to 1000mL, the final pH will be:
- 1.0
 - 2.0
 - The pH does not change.
 - 4.0
 - 5.0
38. A solution at pH 7 contains a weak acid, HA. The pK_a of the acid is 6.5. What is the ratio of $[A^-]:[HA]$?
- 1:3
 - 1:1
 - 3:1
 - 10:1
39. The main intracellular buffer system is
- $H_3PO_4/H_2PO_4^-$
 - $H_2PO_4^-/HPO_4^{2-}$
 - HPO_4^{2-}/PO_4^{3-}
 - H_3PO_4/PO_4^{3-}
40. The main blood buffer system is
- H_2CO_3/HCO_3^-
 - HCO_3^-/CO_3^{2-}
 - H_2CO_3/CO_3^{2-}
 - none of the above
41. The structure of myoglobin consists
- almost entirely of α -helices.
 - almost entirely of β -sheets.
 - of a mixture of α -helices and β -sheets.
 - of a unique secondary motif that is neither α -helix nor β -sheet.
42. The Bohr effect for oxygen binding states that
- Mb binds oxygen more tightly than Hb.
 - Hb will bind oxygen very tightly when the CO_2 concentration is high.
 - as the pH goes down, Hb binds oxygen less tightly.
 - Hb's ability to bind oxygen increases with higher oxygen concentration.

43. Hemoglobin differs from myoglobin because
- it does not have a heme group.
 - it is a tetramer, whereas myoglobin is a single polypeptide chain.
 - it does not contain any helical regions.
 - it contains more β -pleated sheet structure.
44. In the Bohr effect the binding of oxygen to hemoglobin
- is increased by the presence of Na^+
 - is increased by the presence of H^+ and CO_2
 - is decreased by the presence of H^+ and CO_2
 - is unchanged
45. Which of the following best describes what happens when hemoglobin binds *bisphosphoglyceric acid* (BPG)?
- Binding of BPG leads to tighter binding of oxygen.
 - Binding of BPG allows maternal (adult) Hb to bind oxygen more tightly than fetal Hb.
 - Binding of BPG causes oxygen to dissociate from Hb.
 - Binding of BPG causes the subunits of hemoglobin to separate.
46. Which of the following proteins is not homologous with the others?
- myoglobin
 - α -chain of hemoglobin
 - β -chain of hemoglobin
 - collagen
47. Proteins that aid in the correct and timely folding of other proteins are called
- motifs.
 - chaperones.
 - liposomes.
 - cooperative.
48. The oxygen binding curve of which of the following is the closest to that of myoglobin?
- hemoglobin at pH 6.8
 - hemoglobin that lacks BPG
 - maternal hemoglobin
 - fetal hemoglobin

49. Which of the following codons does not code for an amino acid?

- a. AUG
- b. UGA
- c. CAU
- d. GUU
- e. All of these code for an amino acid

50. The majority of protein synthesis occurs in the

- a. nucleus
- b. mitochondrion
- c. ribosome
- d. nucleolus