

高雄醫學大學九十二學年度學士後醫學系招生考試試題

科目:化學

考試時間: 80 分鐘

共七頁

說明:一. 選擇題用 2B 鉛筆在「答案卡」上作答, 修正時應以橡皮擦拭, 切勿使用修正液(帶), 未遵照正確作答方法而致無法判讀者, 考生自行負責。

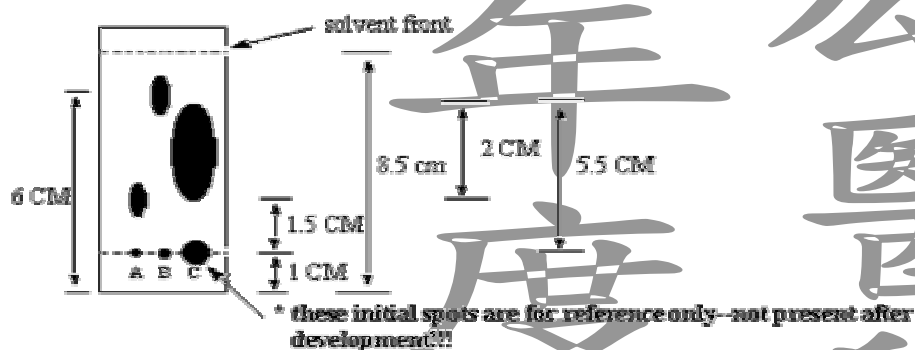
二. 試卷必須繳回, 不得攜出試場。

I. Choose one correct answer for the following questions, 60%.

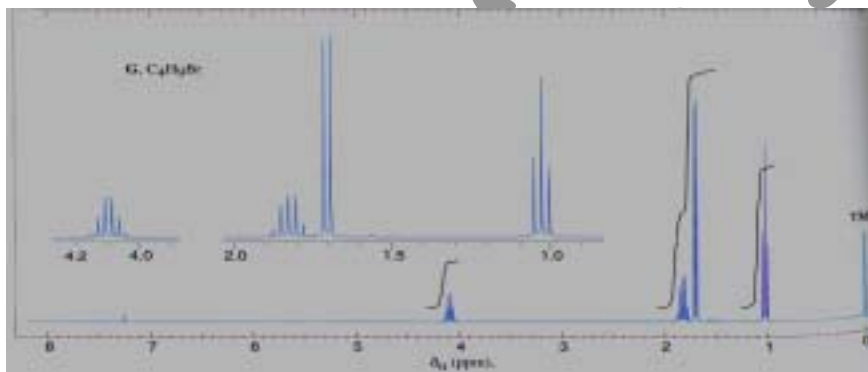
每題 1 分, 答錯一題倒扣 0.25 分, 倒扣至本大題零分為止, 未作答, 不給分亦不扣分。

- The most widely used mobile phase for supercritical-fluid chromatography is  
(A) helium (B) nitrogen (C) argon (D) carbon dioxide (E) air
- What is the color change of the end point in the iodometry using starch as an indicator?  
(A) colorless to blue (B) colorless to violet (C) blue to red (D) blue to colorless (E) brown to blue
- Which one can be used as a spectroscopic source in the UV region?  
(A) D<sub>2</sub> lamp (B) Tungsten lamp (C) Nernst glower (D) Globalar (E) Nichrome wire
- Which of the following detectors for gas chromatography has the lowest detection limit?  
(A) flame ionization (B) thermionic (C) electron capture (D) mass spectrometer (E) photoionization
- Which of the following detector has the lowest detection limit for liquid chromatography?  
(A) absorbance (B) fluorescence (C) electrochemical (D) refractive index (E) mass spectrometry
- The end point in the Volhard Method is when  
(A) the solution turns red (B) the red precipitate forms (C) the precipitate turns red  
(D) the solution turns blue (E) the white precipitate forms
- Dimethylglyoxime is a specific precipitating reagent for  
(A) Ni<sup>2+</sup> (B) Pb<sup>2+</sup> (C) Cu<sup>2+</sup> (D) Cd<sup>2+</sup> (E) Mg<sup>2+</sup>
- Karl Fischer titration method is based on a/an ( ) reaction that is relatively specific for water.  
(A) neutralization (B) precipitation (C) oxidation-reduction (D) complexation (E) substitution
- The property of fluorescence of following compounds: A, fluorobenzene; B, chlorobenzene; C, bromobenzene; and D, iodobenzene.  
(A) A > B > C > D (B) D > C > B > A (C) B > C > D > A (D) D > B > C > A (E) A = B = C = D
- What is the unit of absorptivity in Beer's law when the path length is given in cm and the concentration is expressed in parts per million?  
(A) ppm<sup>-1</sup> L cm<sup>-1</sup> (B) ppm<sup>-1</sup> cm<sup>-1</sup> (C) cm ppm<sup>-1</sup> (D) ppm cm<sup>-1</sup> (E) cm ppm
- The difference between spectrophotometer and photometer is in the  
(A) source (B) wavelength selector (C) sample container (D) detector (E) signal processor and readout
- How many moles of Br<sub>2</sub> will be produced when 1 mole of potassium bromate is used as a source of bromine?  
(A) 1 (B) 1.5 (C) 2 (D) 2.5 (E) 3
- Which of the following methods is applicable to nonvolatile and thermally unstable compounds that contain no chromophoric functional groups?  
(A) capillary electrophoresis (B) supercritical-fluid chromatography (C) gas chromatography  
(D) thin-layer chromatography (E) high-performance liquid chromatography
- The order of the end point sharpness for titration of 50-mL of I<sup>-</sup>, BrO<sub>3</sub><sup>-</sup>, Br<sup>-</sup> and Cl<sup>-</sup> with AgNO<sub>3</sub> in the same concentration is  
(A) I<sup>-</sup> > BrO<sub>3</sub><sup>-</sup> > Br<sup>-</sup> > Cl<sup>-</sup> (B) I<sup>-</sup> > Br<sup>-</sup> > BrO<sub>3</sub><sup>-</sup> > Cl<sup>-</sup> (C) I<sup>-</sup> > Br<sup>-</sup> > Cl<sup>-</sup> > BrO<sub>3</sub><sup>-</sup> (D) BrO<sub>3</sub><sup>-</sup> > I<sup>-</sup> > Br<sup>-</sup> > Cl<sup>-</sup>  
(E) BrO<sub>3</sub><sup>-</sup> > Cl<sup>-</sup> > I<sup>-</sup> > Br<sup>-</sup>
- Which one is not correct about standard electrode potential, E<sup>0</sup>?  
(A) E<sup>0</sup> is a relative reduction potential  
(B) The reactants and products are at unit activity  
(C) E<sup>0</sup> is dependent of the number of moles of reactant and product shown in the balanced half-reaction  
(D) A positive electrode potential indicates that the half-reaction is spontaneous with respect to the standard hydrogen electrode half-reaction  
(E) E<sup>0</sup> is temperature dependent

16. Calculate the volume of 0.0500 M EDTA needed to titrate the Ca in 0.2000 g of  $\text{CaCO}_3$  (100.1 g/mol)  
 (A) 20 mL (B) 25 mL (C) 30 mL (D) 35 mL (E) 40 mL
17. What is the maximum  $K_{sp}$  of  $\text{AgX}$  needed for quantitative titration of  $\text{X}^-$  with  $\text{AgNO}_3$  at 0.1 M level sample?  
 (A)  $10^{-7}$  (B)  $10^{-8}$  (C)  $10^{-9}$  (D)  $10^{-10}$  (E)  $10^{-11}$
18. Select a suitable acid/base pair to prepare a buffer with a pH of 3.5.  
 (A)  $\text{NH}_4\text{Cl}/\text{NH}_3$  ( $K_a = 5.7 \times 10^{-10}$ ) (B) Malic acid/Na hydrogen malate ( $K_a = 3.48 \times 10^{-4}$ )  
 (C) Salicylic acid /Na salicylate ( $K_a = 1.06 \times 10^{-3}$ ) (D) HAc/NaAc ( $K_a = 1.75 \times 10^{-5}$ )  
 (E) Benzoic acid/ Na benzoate ( $K_a = 6.28 \times 10^{-5}$ )
19. Select the correct expression.  
 (A)  $1 \text{ pg} = 10^{-15} \text{ g}$  (B)  $1 \text{ fg} = 10^{-18} \text{ g}$  (C)  $1 \text{ ag} = 10^{-12} \text{ g}$  (D)  $1 \text{ ng} = 10^{-6} \text{ mg}$  (E)  $1 \text{ mg} = 10^{-4} \text{ g}$
20. What is the ionic strength of a 0.1 M  $\text{Na}_3\text{PO}_4$  solution?  
 (A) 0.1 M (B) 0.2 M (C) 0.3 M (D) 0.4 M (E) 0.6 M
21. Calculate the  $R_f$  values for C on the following TLC plate:



22. Choose the structure consistent with the  $^1\text{H}$  NMR spectrum shown below.



- (A) CCCCBr (B) CC(Br)CC (C) CC(C)CCBr (D) CC(Br)C (E) C1CC1Br

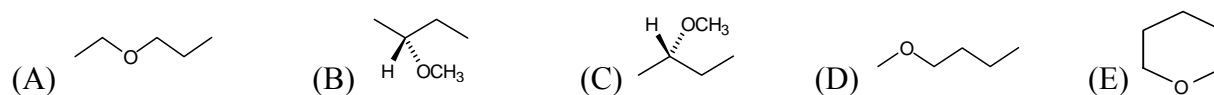
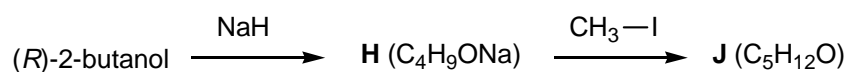
23. Carbon monoxide is toxic because it binds much more strongly to the iron in hemoglobin than  $\text{O}_2$  does. The equilibrium constant for the binding of CO is about 200 times that for the binding of  $\text{O}_2$ . That is, for the reactions



$K_{\text{CO}}/K_{\text{O}_2} = 2.1 \times 10^2$ . Calculate the difference in  $G^0$  for the binding of CO and  $\text{O}_2$  to hemoglobin at 25 .

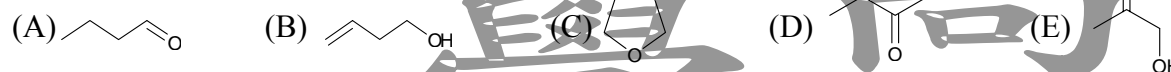
- (A)  $-6.5 \text{ kJ/mol}$  (B)  $-13 \text{ kJ/mol}$  (C)  $-19.5 \text{ kJ/mol}$  (D)  $-26 \text{ kJ/mol}$  (E)  $-39 \text{ kJ/mol}$
24. Caffeine consists of carbon, hydrogen, oxygen, and nitrogen. When 0.1920 g of caffeine is burned in an excess of oxygen, 0.3482 g of carbon dioxide and 0.0891 g water are formed. Caffeine is 28.84% nitrogen by mass. Its molar mass is between 190 and 200 g/mol. What is the formula for caffeine?  
 (A)  $\text{C}_4\text{H}_5\text{N}_2\text{O}$  (B)  $\text{C}_3\text{H}_2\text{N}_2\text{O}_2$  (C)  $\text{C}_6\text{H}_4\text{N}_4\text{O}_4$  (D)  $\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$  (E) none of these
25. When  $\text{C}_4\text{H}_8$  is treated with water,  $\text{H}_2\text{SO}_4$  a tertiary alcohol is produced. Which of the following structures could represent  $\text{C}_4\text{H}_8$  in the reaction?  
 (A)  $\text{CH}_3\text{CH}=\text{CHCH}_3$  (B)  $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$  (C)  $\begin{array}{c} \text{H}_3\text{C}-\text{C}=\text{CH}_2 \\ | \\ \text{CH}_3 \end{array}$   
 (D)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$  (E) none of these

26. Choose the structure J produced in the following reaction sequence.

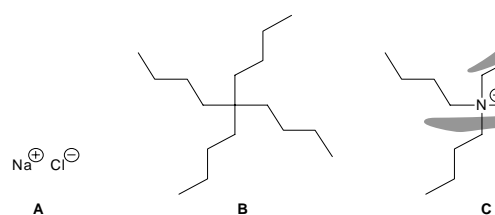


27. Choose the structure consistent with the following data.

$\text{C}_4\text{H}_8\text{O}$  :  $^1\text{H}$  NMR spectrum,  $\delta$  1.05 (t, 3H), 2.13 (s, 3H), 2.47 (q, 2H)  
IR spectrum (strong peak near  $1720\text{ cm}^{-1}$ )

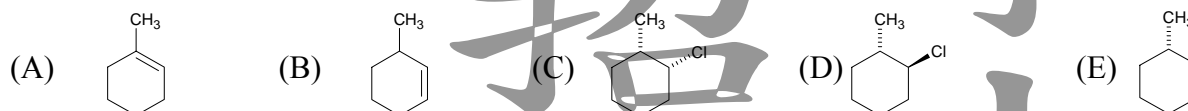
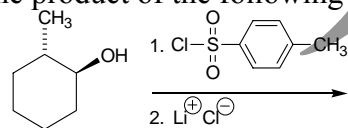


28. Choose the correct order of molecular structures with respect to their ease for passing into the lipid bi-layer of a cell membrane. (the most difficult one is on the right)

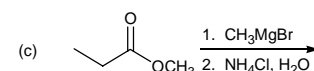
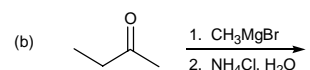
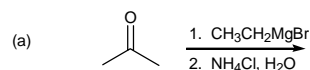


(A)  $A > B > C$  (B)  $B > A > C$  (C)  $B > C > A$  (D)  $C > B > A$  (E)  $C > A > B$

29. Choose the product of the following reaction.

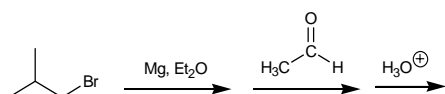


30. Choose those reactants and reagents that would produce 2-methyl-2-butanol as the major product.

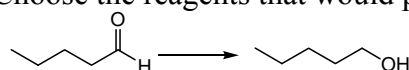


(A) (a) + (b) + (c) (B) (a) + (b) (C) (a) + (c) (D) (a) (E) (c)

31. Choose the major product formed in the following reaction.

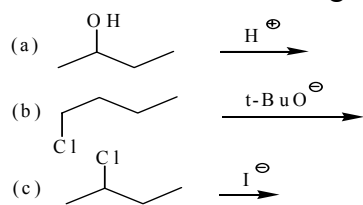


32. Choose the reagents that would perform the following transformation.



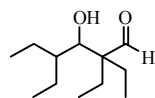
(A) PCC (B) 1.  $\text{LiAlH}_4/\text{Et}_2\text{O}$ , 2.  $\text{H}_2\text{O}/\text{H}_2\text{SO}_4$  (C)  $\text{LiCu}(\text{CH}_3)_2$  (D)  $\text{CH}_3\text{MgBr}$  (E)  $\text{H}_3\text{PO}_4$

33. Choose the reactants and reagents that would produce 1-butene as the major product.



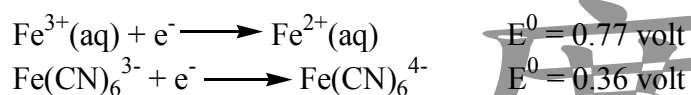
- (A) (a) + (b) (B) (b) (C) (a) (D) (c) (E) (a) + (c)

34. Normally, heating an initial aldol product (the  $\beta$ -hydroxyaldehyde) causes dehydration. However, heating the compound below with base does not cause dehydration, but rather, decomposition to form 2-ethylbutanal. This is because:



- (A) There are no protons  $\alpha$  to the carbonyl.  
 (B) There are no protons adjacent to the OH, and the dehydration reaction requires E1 conditions.  
 (C) There are no protons  $\alpha$  to the carbonyl, and aldol condensations are reversible.  
 (D) Heating any organic compound above room temperature causes decomposition.  
 (E) None of these is true.

35. Choose the correct statement given the following information:



- (A)  $Fe^{2+}(aq)$  is more likely to be oxidized than  $Fe^{2+}$  complexed to  $CN^-$ .  
 (B)  $Fe^{3+}(aq)$  is more likely to be reduced than  $Fe^{3+}$  complexed to  $CN^-$ .  
 (C) Both A and B are true.  
 (D) Complexation of Fe ion with  $CN^-$  has no effect on their tendencies to become oxidized or reduced.  
 (E) None of these is true.

36. Which of the following additions to 2-methylpropene occurs with anti-Markovnikov orientation?

- (A) Catalytic hydrogenation ( $H_2/Pt$ ) (B) Addition of  $HOBr$  (C) Addition of  $HI$   
 (D) Addition of  $HBr$  in the presence of  $ROOR$  (E) Oxymercuration-Demercuration

37. Which of the following alcohols will react most rapidly with the Lucas reagent?

- (A)  $(CH_3)_3COH$  (B)  $CH_3CH_2CH_2CH_2OH$  (C)  $CH_3CH(OH)CH_2CH_3$   
 (D)  $(CH_3)_2CHCH_2OH$  (E)  $(CH_3)_3CCH_2OH$

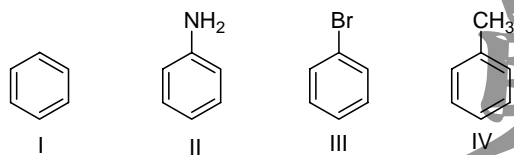
38. Which of the following dienes would undergo a Diels-Alder reaction?

- (A) 3-methylenecyclohexene (B) 3-methyl-1,4-cyclohexadiene (C) 2-methyl-1,3-cyclohexadiene  
 (D) 1,4-cyclohexadiene (E) 4-methylenecyclohexene

39. Which of the following is the strongest acid?

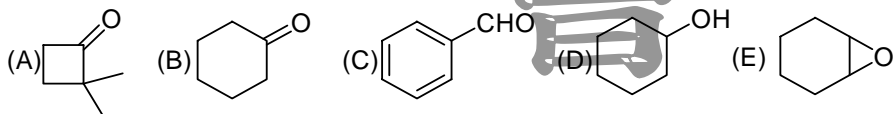
- (A) 1-pentene (B) 2-pentene (C) 1,4-pentadiene (D) cyclopentadiene (E) cycloheptatriene

40. The correct decreasing order of reactivity with  $X^+$  is



- (A)  $IV > III > II > I$  (B)  $II > IV > III > I$  (C)  $III > I > IV > II$  (D)  $II > IV > I > III$  (E)  $III > I > II > IV$

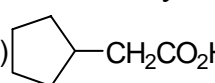
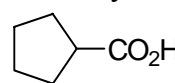
41. Which compound would be expected to show intense IR absorption at  $1780 \text{ cm}^{-1}$ ?

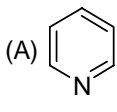
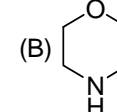
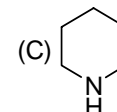
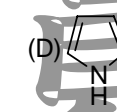
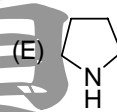
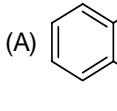
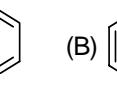
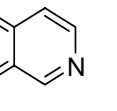
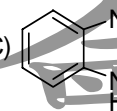
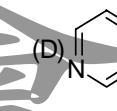





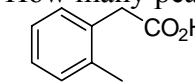


42. Which compound would be expected to show an intense peak in the mass spectrum at  $m/z$  58?

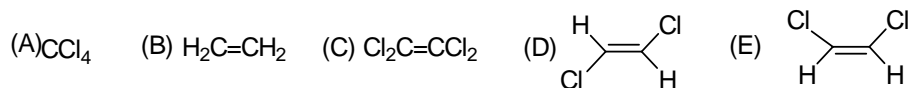
- (A)  $CH_3C(O)CH_2CH_2CH_3$  (B)  $CH_3CH_2C(O)CH_2CH_3$  (C)  $(CH_3)_3CCHO$   
 (D)  $(CH_3)_2CHC(O)CH_3$  (E)  $(CH_3)_2CHCH_2CHO$

43. The acid which could not be prepared by the reaction of an organic halide with cyanide ion followed by acid hydrolysis of the nitrite.

- (A)  $CH_3CH_2CO_2H$  (B)  $PhCH_2CO_2H$  (C)  $(CH_3)_3CCO_2H$  (D)  (E) 

44. The conversion of butanoic acid to 2-pentanone is best accomplished with  
 (A) 1. thionyl chloride; 2. methyl magnesium bromide (B) 1. methyllithium; 2.  $\text{H}_3\text{O}^+$   
 (C) 1.  $\text{CH}_3\text{OH}$ ,  $\text{H}_2\text{SO}_4$ ; 2. methyllithium (D) 1. thionyl chloride; 2. methanol  
 (E) 1. diazomethane; 2.  $\text{H}_3\text{O}^+$
45. The conversion of 2-butanone to propanoic acid is best accomplished with  
 (A) 1. ozone; 2. hydrogen peroxide (B) sodium hydroxide, iodine (C) silver oxide, bromine  
 (D) lithium aluminum hydride (E)  $\text{CO}_2$ ,  $\text{H}_3\text{O}^+$
46. For the following compounds the correct order for decreasing reactivity toward nucleophilic acyl substitution is  
 $\text{CH}_3\text{C}(\text{O})\text{N}(\text{CH}_3)_2$      $\text{CH}_3\text{C}(\text{O})\text{Cl}$      $(\text{CH}_3\text{C}(\text{O}))_2\text{O}$      $\text{CH}_3\text{CO}_2\text{CH}_3$   
 I                      II                      III                      IV  
 (A) II > III > IV > I    (B) I > IV > II > III    (C) III > II > I > IV    (D) I > IV > III > II    (E) IV > III > II > I
47. The expected product of the reaction below.  
 $\text{CH}_3\text{CH}_2\text{C}(\text{O})\text{OCHO} + \text{CH}_3\text{NH}_2 \longrightarrow$   
 (A)  $\text{CH}_3\text{NHCHO}$     (B)  $\text{CH}_3\text{CN}$     (C)  $\text{CH}_3\text{NHC}(\text{O})\text{CH}_2\text{CH}_3$     (D)  $\text{CH}_3\text{C}(\text{O})\text{NH}_2$     (E)  $\text{CH}_3\text{CH}_2\text{C}(\text{O})\text{OC}(\text{O})\text{NH}_2$
48. The conversion of acetaldehyde to 2-hydroxypropanoic acid is best accomplished with  
 (A) 1.  $\text{CH}_3\text{Li}$ ; 2.  $\text{CrO}_3$ ,  $\text{H}_2\text{SO}_4$     (B) 1.  $\text{NaCN}$ ; 2.  $\text{H}_3\text{O}^+$ , heat    (C) 1.  $\text{SOCl}_2$ ; 2. Mg, ether; 3.  $\text{CO}_2$   
 (D) 1.  $\text{Br}_2$ ,  $\text{PBr}_3$ ; 2.  $\text{NaOH}$     (E) 1. diazomethane; 2.  $\text{H}_3\text{O}^+$
49. The conversion of benzoic acid to phenylacetic acid is best accomplished with  
 (A) 1.  $\text{LiAlH}_4$ ; 2.  $\text{TsCl}$ ; 3.  $\text{NaCN}$ ; 4.  $\text{H}_3\text{O}^+$ , heat    (B) 1.  $\text{LiAlH}_4$ ; 2.  $\text{TsCl}$ ; 3. Mg, ether; 4.  $\text{CO}_2$   
 (C) 1.  $\text{SOCl}_2$ ; 2.  $\text{Li}(\text{CH}_3)_2\text{Cu}$     (D) 1.  $\text{SOCl}_2$ ; 2.  $\text{NH}_3$ ; 3.  $\text{Br}_2$ ,  $\text{NaOH}$   
 (E) 1. diazomethane; 2.  $\text{H}_3\text{O}^+$
50. The aldehyde which would not undergo a Cannizzaro reaction is  
 (A)  $\text{PhCHO}$     (B)  $\text{CH}_3\text{CH}_2\text{CHO}$     (C)  $\text{CH}_2\text{O}$     (D)  $(\text{CH}_3)_3\text{CCHO}$     (E) none of the above
51. Addition of alanine to distilled water will produce  
 (A) a slightly basic solution    (B) denaturation    (C) a neutral solution  
 (D) a slightly acidic solution    (E) precipitation
52. Amino acid N-terminal analysis of peptides is often done with  
 (A) carboxypeptidase    (B) phenylisothiocyanate    (C) dicyclohexylcarbodiimide  
 (D) ethyl chloroformate    (E) none of them
53. Which of the following arrangements is usually not found in the secondary structure of proteins?  
 (A)  $\alpha$ -helix    (B) double helix    (C) random coil  
 (D) pleated sheet    (E) all of the above arrangements can be found in the secondary structure of proteins
54. The standard amino acids are stereochemically related to  
 (A) D-glucose    (B) L-glyceraldehyde    (C) D-glyceraldehyde    (D) glycine    (E) L-alanine
55. The best reagent to distinguish between  $\text{CH}_3(\text{CH}_2)_{10}\text{CO}_2\text{H}$  and  $\text{CH}_3(\text{CH}_2)_4\text{CH}=\text{CH}(\text{CH}_2)_4\text{CO}_2\text{H}$  is  
 (A)  $\text{NaOH}$ ,  $\text{H}_2\text{O}$     (B) Tollen's reagent    (C)  $\text{H}_2\text{Cr}_2\text{O}_7$     (D)  $\text{Li}$ ,  $\text{NH}_3$     (E)  $\text{Br}_2/\text{CCl}_4$
56. Which of the following is piperidine?  
 (A)     (B)     (C)     (D)     (E) 
57. Which of the following is indole?  
 (A)     (B)     (C)     (D)     (E) 
58. Which of the following is oxetane?  
 (A)     (B)     (C)     (D)     (E) 
59. How many peaks will you expect from  $^{13}\text{C}$  NMR spectrum of  
  
 (A) 5    (B) 6    (C) 7    (D) 8    (E) 9

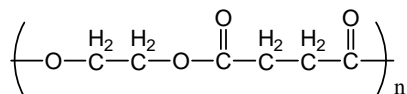
60. Which of the following molecules will have a net dipole moment?



**II. Choose one correct answer for the following questions, 40%.**

每題 2 分，答錯一題倒扣 0.5 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。

61. What monomer(s) is (are) needed to make the polymer shown below?

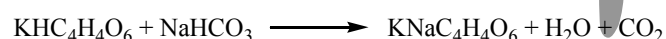


I.  $\text{HOCH}_2\text{CH}_2\text{OH}$  II.  $\text{HOOCCH}_2\text{CH}_2\text{COOH}$  III.  $\text{HOCH}_2\text{CH}_2\text{COOH}$

IV.  $\text{HOCH}=\text{CHOH}$  V.  $\text{HOOCCH}=\text{CHCOOH}$

(A) II (B) III (C) I and II (D) IV and V (E) II and III

62. Baking powder, a mixture of cream of tartar ( $\text{KHC}_4\text{H}_4\text{O}_6$ , molar mass 188 g/mol) and baking soda ( $\text{NaHCO}_3$ , molar mass 84.0 g/mol), undergoes the following reaction at baking temperature:



(The  $\text{CO}_2$  makes the cake rise.) A recipe calls for two level teaspoons (a total of 8.0g) of cream of tartar. How much baking soda must be added for both materials to react completely?

(A) 0.45 g (B) 1.8g (C) 3.6g (D) 8.0 g (E) none of these

63. Which of the following is not an oxidation-reduction reaction?

- (A) A precipitation reaction. (B) A reaction in which a metal reacts with a nonmetal.  
(C) A combustion reaction. (D) A metal reacting with an acid.  
(E) All of the above are oxidation-reduction reactions.

64. Aqueous solution of sodium sulfide and copper(II) chloride are mixed together. Which statement is correct?

- (A) Both  $\text{NaCl}$  and  $\text{CuS}$  precipitate from solution. (B) No precipitate forms.  
(C)  $\text{CuS}$  will precipitate from solution (D)  $\text{NaCl}$  will precipitate from solution.  
(E) No reaction will occur.

65. Body temperature is about 308 K. On a cold day, what volume of air at 273 K must a person with a lung capacity of 2.00 L breathe in to fill up the lungs?

(A) 1.13 L (B) 1.77 L (C) 2.26 L (D) 3.08 L (E) 3.54 L

66. Calculate the temperature at which the average kinetic energy of  $\text{O}_2$  gas is twice that of He gas at 10 .

(A) 2.50 (B) 10.0 (C) 20.0 (D) 160 (E) 293

67. The sodium salt,  $\text{NaA}$ , of a weak acid is dissolved in water; no other substance is added. Which of the statements (to a close approximation) is true?

(A)  $[\text{H}^+] = [\text{A}^-]$  (B)  $[\text{H}^+] = [\text{OH}^-]$  (C)  $[\text{A}^-] = [\text{OH}^-]$  (D)  $[\text{HA}] = [\text{OH}^-]$  (E) none of these

68. Arrange following 0.10 M solutions from lowest to highest pH:  $\text{NaF}$ ,  $\text{NaC}_2\text{H}_3\text{O}_2$ ,  $\text{C}_5\text{H}_5\text{NHCl}$ ,  $\text{KOH}$ ,  $\text{HCN}$ . ( $K_a$  for  $\text{HCN}$  is  $6.2 \times 10^{-10}$ ;  $K_a$  for  $\text{HF}$  is  $7.2 \times 10^{-4}$ ;  $K_a$  for  $\text{HC}_2\text{H}_3\text{O}_2$  is  $1.8 \times 10^{-5}$ ;  $K_b$  for  $\text{C}_5\text{H}_5\text{N}$  is  $1.7 \times 10^{-9}$ )

- (A)  $\text{HCN}$ ,  $\text{C}_5\text{H}_5\text{NHCl}$ ,  $\text{NaF}$ ,  $\text{NaC}_2\text{H}_3\text{O}_2$ ,  $\text{KOH}$  (B)  $\text{C}_5\text{H}_5\text{NHCl}$ ,  $\text{HCN}$ ,  $\text{NaF}$ ,  $\text{NaC}_2\text{H}_3\text{O}_2$ ,  $\text{KOH}$   
(C)  $\text{NaF}$ ,  $\text{NaC}_2\text{H}_3\text{O}_2$ ,  $\text{HCN}$ ,  $\text{C}_5\text{H}_5\text{NHCl}$ ,  $\text{KOH}$  (D)  $\text{KOH}$ ,  $\text{NaC}_2\text{H}_3\text{O}_2$ ,  $\text{NaF}$ ,  $\text{HCN}$ ,  $\text{C}_5\text{H}_5\text{NHCl}$   
(E) None of these

69. In the titration of a weak acid  $\text{HA}$  with 0.100 M  $\text{NaOH}$ , the stoichiometric point is known to occur at a pH value of approximately 11. Which of the following indicators would be best to use to mark the endpoint of this titration?

- (A) an indicator with  $K_a = 10^{-10}$  (B) an indicator with  $K_a = 10^{-8}$  (C) an indicator with  $K_a = 10^{-14}$   
(D) an indicator with  $K_a = 10^{-11}$  (E) an indicator with  $K_a = 10^{-12}$

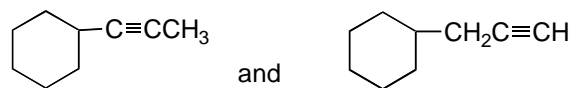
70. Silver acetate ( $\text{AgC}_2\text{H}_3\text{O}_3$ ) is a sparingly soluble salt with  $K_{sp} = 1.9 \times 10^{-3}$ . Consider a saturated solution in equilibrium with the solid salt. Compare the effects on the solubility of adding to the solution either the acid  $\text{HNO}_3$  or the base  $\text{NH}_3$ .

- (A) Either substance would decrease the solubility.  
(B) Either substance would increase the solubility.  
(C)  $\text{NH}_3$  would increase the solubility, but  $\text{HNO}_3$  would decrease it.  
(D)  $\text{NH}_3$  would increase the solubility, but  $\text{HNO}_3$  would have virtually no effect.  
(E)  $\text{NH}_3$  would decrease the solubility, but  $\text{HNO}_3$  would increase it.

71. Rank the following solvent in order of decreasing polarity:

- A. Ethyl acetate    B. Methanol    C. Methylene Chloride    D. Hexane    E. Acetone  
(A) B>E>A>C>D    (B) B>A>E>C>D    (C) B>A>C>E>D    (D) B>C>E>A>D    (E) B>A>C>D>E

72. The two compounds below can be differentiated with :



- (A)  $\text{Ag}(\text{NH}_3)_2^+\text{OH}^-$     (B)  $\text{Br}_2/\text{CCl}_4$     (C)  $\text{H}_2\text{CrO}_4$     (D)  $\text{KMnO}_4$     (E) Tollens reagent

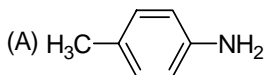
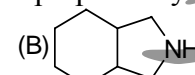
73. Which compound would be expected to show intense IR absorption at  $3300\text{ cm}^{-1}$  ?

- (A) butane    (B) 1-butene    (C) 2-butene    (D) 1-butyne    (E) 2-butyne

74. Which compound would be expected to show IR absorption at  $2250\text{ cm}^{-1}$  ?

- (A)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$     (B)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$     (C)  $\text{CH}_3\text{C}(\text{O})\text{O}(\text{O})\text{CCH}_3$   
(D)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}(\text{O})\text{NH}_2$     (E)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CN}$

75. The amine which can be prepared by a Gabriel synthesis is

- (A)     (B)     (C)  $(\text{CH}_3)_3\text{CNH}_2$     (D)  $\text{CH}_3\text{CH}_2\text{NHCH}_2\text{CH}_3$     (E)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$

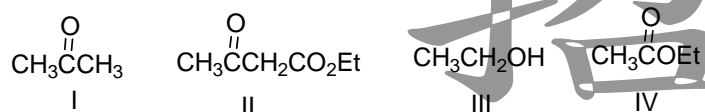
76. Penicillins contain

- (A) a  $\beta$ -lactam ring    (B) a  $\beta$ -lactone ring    (C) a thioester group    (D) a  $\alpha$ -lactam ring    (E) a  $\alpha$ -lactone ring

77. Which of the following alcohols would undergo dehydration most rapidly ?

- (A)  $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$     (B)  $(\text{CH}_3)_2\text{C}(\text{OH})\text{CH}_2\text{CH}_3$     (C)  $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$   
(D)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$     (E)  $\text{PhCH}_2\text{CH}_2\text{OH}$

78. The correct order of decreasing acidity of the following compounds.

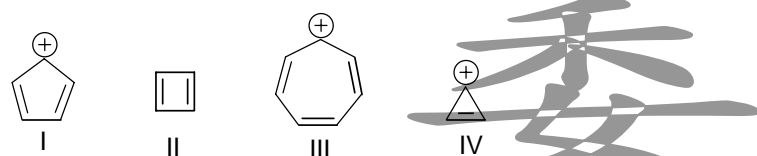


- (A) III > I > IV > II    (B) II > III > I > IV    (C) IV > I > III > II    (D) III > II > I > IV    (E) II > IV > I > III

79. The conversion of  $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{CO}_2\text{H}$  to  $\text{CH}_3(\text{CH}_2)_{16}\text{CO}_2\text{H}$  is best accomplished with

- (A)  $\text{H}_2$ , Ni    (B) Li,  $\text{NH}_3$     (C)  $\text{B}_2\text{H}_6$     (D)  $\text{LiAlH}_4$     (E)  $\text{NaBH}_4$

80. Which of the structures below would be aromatic?



- (A) I and II    (B) I, III and IV    (C) III and IV    (D) II and III    (E) none of them