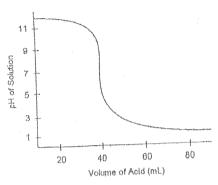
科目: 綜合化學(2001) 校系所組: 中大化學學系 交大應用化學系甲組 清大化學系

### 選擇題(單選,每題2分,答錯不倒扣分數)

1-3 爲題組



- 1) Examine the titration curve shown above. Which of the following titrations could it represent?
  - A) HCl by NaOH
  - B) HCl by NH<sub>3</sub>
  - C) H<sub>2</sub>SO<sub>4</sub> by NaOH
  - D) NH3 by HCl
- 2) Examine the titration curve shown above. What is the pH at the equivalence point?
  - A) 1
  - B) 3
  - C) 7
  - D) 10
  - E) 12
- 3) Examine the titration curve shown. The curve represents the titration of a 100.0mL sample of NaOH by 0.20M HCl. What was the concentration of the original solution?
  - A) 0.020M
  - B) 0.080M
  - C) 0.057M
  - D) 0.20M
  - E) 0.0080M
- 4) Arrhenius Acid-base Theory is limited in that it
  - A) applies only to aqueous solutions
  - B) applies only to large concentration
  - C) defines bases as proton acceptors
  - D) defines acid as proton donors
  - E) describe HCl as an acid
- 5) Which of the following is the strongest base?
  - A) F
  - B) Cl
  - C) Br
  - D) I
  - E) None of these are bases

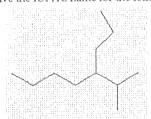
注:背面有試題

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- 6) Which of the following chemical formula is called Prussian blue
  - A) KFe[Fe(CN)<sub>6</sub>]
  - B) K<sub>3</sub>[Co(NO<sub>2</sub>)<sub>6</sub>].6H<sub>2</sub>O
  - C)  $[Cu(NH_3)_4(H_2O)_2]^{2+}$
  - D) [Ag(NH<sub>3</sub>)<sub>2</sub>]Cl
- 7) Which of the following ligands can not act as an ambidentate ligand
  - A) H<sub>2</sub>NNH<sub>2</sub>
  - B) [NO<sub>2</sub>]
  - C) NO
  - D) [SCN]
- 8) The notation for complex [Co(EDTA)] (EDTA = ethylenediaminetetracetato) is
  - A) ΛΔΔ-(ethylenediaminetetracetato)cobaltate(III)
  - B) ΛΔΛ-(ethylenediaminetetracetato)cobaltate(III)
  - C)  $\Lambda\Delta\Delta$ -(ethylenediaminetetracetato)cobaltate(III)
  - D)  $\Delta \Lambda \Delta$ -(ethylenediaminetetracetato)cobaltate(III)
- 9) The largest of the alkali metal cations, Cs+, is trapped most effectively by the
  - A) 18-crown-6-ether
  - B) cryptand ([3,2,2])
  - C) cryptand ([2,1,1])
  - D) metallacrown
- 10) The element
  - A) 12Mg
  - B) Al
  - C) 10B
  - $D)^2D$

has been developed for use in the treatment of cancerous tumors.

11) Give the IUPAC name for the following structure:



- A) 5-Isopropyloctane
- B) 3-ethyl-2-methylheptane
- C) 4-Isopropyloctane
- D) 2-methyl-3-ethylheptane
- E) 2-methyl-3-propylheptane

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- 12) Consider the three isomeric alkanes n-hexane, 2, 3-dimethylbutane, and 2-methylpentane. Which of the following correctly lists these compounds in order of increasing boiling point?
  - A) 2-methylpentane < n-hexane < 2, 3-dimethylbutane
  - B) 2, 3-dimethylbutane < 2-methylpentane < n-hexane
  - C) 2-methylpentane < 2, 3-dimethylbutane < n-hexane
  - D) n-hexane < 2, 3-dimethylbutane < 2-methylpentane
  - E) n-hexane < 2-methylpentane < 2, 3-dimethylbutane
- 13) In the boat conformation of cyclohexane, the "flagpole" hydrogens are located:
  - A) on the same carbon.
  - B) on C-1 and C-4.
  - C) on adjacent carbons.
  - D) on C-1 and C-3.
  - E) none of the above
- 14) Which of the following is an allylic alcohol?
  - A) CH2=CHCH2CH3
  - B) HOCH=CHCH2CH3
  - C) CH3CH=CHCH2OH
  - D) CH2=CHCH2CH2OH
  - E) CH2=CHCH2OCH3
- 15) Which of the following contributes to make ΔG° more negative?
  - A) a more positive ΔH°
  - B) a larger rate constant
  - C) use of a catalyst
  - D) a more positive ΔS°
  - E) none of the above
- 16) Which of the followings is a zero order reaction?
  - A) Thermal isomerization of cis-stilbene to trans-stilbene
  - B) enzyme oxidation of glucose to gluconic acid.
  - C) decay of radioactivity of 60 Co.
  - D) decay of triplet excited C<sub>60</sub> to ground state.
- 17) Hydrogen bonding between DNA strands occurs between pairs of nitrogen bases. Which of the following is a pair of nitrogen bases where hydrogen bonding in DNA is important?
  - A) guanine-thymine
  - B) cystosine-adenine
  - C) adenine-thymine
  - D) cytosine-thymine
  - E) None of the above
- 18) Draw an energy level diagram for a Fe atom. How many unpaired electrons are present?
  - A) 3
  - B) 2
  - C) 1
  - D) 4
  - E) None of the above

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19) Under which condition will a reaction occur spontaneously?

A)  $\triangle H < 0$ B)  $\triangle S < 0$ C)  $\triangle S > 0$ D)  $\triangle G < 0$ 

A) 1~10 B) 100~200 C) 1000~2000

E) None of the above

20) How many atoms does a Fe nanoparticle have?

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D) 10000~20000		
E) 50000~100000		
21) Which of the following compounds may react with water to l	liberate organic molecules	
A) SiO <sub>4</sub>		
B) SiH <sub>4</sub>		
C) CaC <sub>2</sub>		
D) HN <sub>3</sub> .		
22) Which of the following compounds is a diamagnetic molecul	le e	
A) NO		
B) O <sub>2</sub>		
C) NO <sub>2</sub>		
D) N <sub>2</sub> O <sub>4</sub> .		
23) Which of the following hydrohalic acids is the weakest in aq	queous solution	
A) HF		
B) HCl		
C) HBr		
D) HI		
24) Solvation of the ions is certainly a factor in solubilities. Which	ch of the following ions is the most strongly s	solvated in
aqueous solution		
A) F		
B) Cl <sup>-</sup>		
C) Br <sup>-</sup>		
D) $\Gamma$		
25) Compound listed in the following has the largest bond angle		
A) NCl <sub>3</sub>		
B) PCl <sub>3</sub>		
C) AsCl <sub>3</sub>		
D) SbCl <sub>3</sub>		
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A) the reaction containing this step is uverall first order  B) the transition state of the step recembles the resteats of the step  C) the transition state is precisely symmetric with bond-breaking and bond-forming occurring to the came extent  D) the transition state of the step resembles the products of the step  B) the step is rate-determining since it has the smallest Pa  What type of isomers are CH3CH2OCH3 and CH3CH2CH2OH7  A) configurational  B) suescohemical  C) symmetrical  D) constitutional  E) constitutional  E) conformational  Which of the following is chiral?  A) cis-1.4-dimethyleyclobexone  B) trans-1.3-dimethyleyclobexone  C) trans-1-brone-3-distocyclobutane  D) cis-1.3-dimethyleyclobexone  E) cis-1brone-3-distocyclobutane  D) cis-1.3-dimethyleyclobexone  E) ris-1-brone-3-distocyclobutane  E) ris-1-brone-3-distocyclobutane  D) cis-1-brone-3-distocyclobutane  E) ris-1-brone-3-distocyclobutane  E	20)	For an endergonic reaction step, the Har	nmond postulate allows o	one to say that	ungermann se <sup>tt</sup>	
C) the transition state is precisely synumetric with bend-breaking and bond-forming occurring to the same extent  D) the transition state of the step resembles the products of the step  E) the step is rate-determining since it has the smallest Ea  27) What type of isomers are CH3CH2COF43 and CH3CH2CH2CH7  A) configurational  D) stereochemical  C) symmetrical  D) constitutional  E) conformational  Which of the following is chiral?  A) cis-1.4-dimethyleyclohexane  B) trans-1.3-dimethyleyclohexane  C) trans-1-bromen-3-dispose/obstuane  D) cis-1.3-dimethyleyclohexane  E) cis-1-bromen-3-dispose/obstuane  D) cis-1.3-dimethyleyclohexane  E) cis-1-bromen-3-dispose/obstuane  D) cis-1.3-dimethyleyclohexane  E) the reagent needed to convert 2-butyne to cis-2-butene is:  A) H2/P  B) H+/Zinc dust  C) Na/Ni13  D) Li/Ni15  E) H2/Lindlars catalyst  30) In the SN1 hydrolysis mechanism of (CH3)3CBr, there are				Ann		
extent  D) the transition state of the step resembles the products of the step  2) the step is rate-determining since it has the smallest E <sub>B</sub> 27)  What type of isomers are CH <sub>3</sub> CH <sub>2</sub> OCH <sub>3</sub> and CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> OH?  A) configurational  B) stereochemical C) symmetrical D) constitutional E) conformational E) conformational E) the following is chiral? A) cis-1.4-dimethylcyclohexane B) trans-1.3-dimethylcyclohexane C) trans-1.3-dimethylcyclohexane E) cis-1-bromo-3-chiorocyclobutane C) trans-1.3-dimethylcyclohexane E) cis-1-bromo-3-chiorocyclobutane E) cis-1-bromo-3-chiorocyclobutane E) transition dust C) No/NH <sub>3</sub> D) Li/NH <sub>3</sub> E) H <sub>2</sub> /Lindar's ratalyst  30) In the SNI hydrolysis mechanism of (CH <sub>3</sub> ) <sub>3</sub> CBs, there areelementary steps,distinct transition states, anddistinct intermediates. A) 3, 3, 2  B) 2, 2, 2  C) 3, 2, 3  D) 2, 2, 3  E) 2, 3, 2  31) The pH of acid rain may be as low as 2.80. What is the [H3O'] in such acidic rain? A) 1.6 B) 9.7×10 <sup>-2</sup> C) 6.3×10 <sup>-12</sup> D) 1.6×10 <sup>-1</sup> E) 630  32) The pH of a 0.30M solution of HCN is 5.20. Calculate the Ka value for HCN. A) 6.3×10 <sup>-4</sup> B) 13×10 <sup>-16</sup> C) 4.8×10 <sup>-2</sup> D) 2.1×10 <sup>-1</sup>		B) the transition state of the step resen	nbles the reactants of the s	mep	courring to the same	
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D) Li/NF43 E) H2/Lindlar's catalyst  30) In the SN1 hydrolysis mechanism of (CH3)3CBr, there are		B) H+/Zinc dust				
30) In the SN1 hydrolysis mechanism of (CH3)3CBr, there are		C) Na/NH3				
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10. In the SNI hydrolysis mechanism of (Chigh Chr. there are transition states, and		E) H2/Lindlar's catalyst				
transition states, and	20)	In the Carl budgalucie mechanism of (	"Ha)aCBr. there are	elementary steps	distinct	
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C) 6.3×10 <sup>-12</sup> D) 1.6×10 <sup>-3</sup> E) 630  32) The pH of a 0.30M solution of HCN is 5.20. Calculate the Ka value for HCN. A) 6.3×10 <sup>-6</sup> B) 1.3×10 <sup>-10</sup> C) 4.8×10 <sup>-2</sup> D) 2.1×10 <sup>-5</sup>	31)	transition states, and distin A) 3, 3, 2 B) 2, 2, 2  The pH of acid rain may be as low as 2	C) 3, 2, 3		E) 2, 3, 2	
<ul> <li>D) 1.6×10<sup>-3</sup></li> <li>E) 630</li> <li>32) The pH of a 0.30M solution of HCN is 5.20. Calculate the Ka value for HCN.</li> <li>A) 6.3×10<sup>-6</sup></li> <li>B) 1.3×10<sup>-10</sup></li> <li>C) 4.8×10<sup>-2</sup></li> <li>D) 2.1×10<sup>-5</sup></li> </ul>	31)	transition states, and distin A) 3, 3, 2 B) 2, 2, 2  The pH of acid rain may be as low as 2  A) 1.6	C) 3, 2, 3		E) 2, 3, 2	
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C) $4.8 \times 10^{-2}$ D) $2.1 \times 10^{-5}$		transition states, and distin A) 3, 3, 2 B) 2, 2, 2  The pH of acid rain may be as low as 2 A) 1.6 B) $9.7 \times 10^{-2}$ C) $6.3 \times 10^{-12}$ D) $1.6 \times 10^{-3}$ E) 630  The pH of a 0.30M solution of HCN is	C) 3, 2, 3	in such acidic rain?	E) 2, 3, 2	
D) $2.1 \times 10^{-5}$		transition states, and distin A) 3, 3, 2 B) 2, 2, 2  The pH of acid rain may be as low as 2 A) 1.6 B) $9.7 \times 10^{-2}$ C) $6.3 \times 10^{-12}$ D) $1.6 \times 10^{-3}$ E) 630  The pH of a 0.30M solution of HCN is A) $6.3 \times 10^{-6}$	C) 3, 2, 3	in such acidic rain?	E) 2, 3, 2	
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acid?(Ka <sub>1</sub> =7.9×10 <sup>-5</sup> , Ka <sub>2</sub> =1.6×10 <sup>-12</sup> ) 注 · 背面有言	32)	transition states, and distin A) 3, 3, 2 B) 2, 2, 2 The pH of acid rain may be as low as 2 A) 1.6 B) $9.7 \times 10^{-2}$ C) $6.3 \times 10^{-12}$ D) $1.6 \times 10^{-3}$ E) 630 The pH of a 0.30M solution of HCN is A) $6.3 \times 10^{-6}$ B) $1.3 \times 10^{-10}$ C) $4.8 \times 10^{-2}$ D) $2.1 \times 10^{-5}$ E) $8.4 \times 10^{-18}$ Vitamin C is ascorbic acid, $H_2C_6H_6O_6$ ,	C) 3, 2, 3  .80. What is the [H3O <sup>+</sup> ] is 5.20. Calculate the Ka v	in such acidic rain?		132

D)7.95

C) 6.05

A) 1.80

E)11.80

### 科目:綜合化學(2001) 校系所組:中大化學學系 交大應用化學系甲組 清大化學系

- 34) Which of the following species is not amphiprotic?
  - A) H<sub>2</sub>PO<sub>4</sub>
  - B) SO<sub>4</sub>2-
  - C) H<sub>2</sub>O
  - D) HCO3-
  - E) HC<sub>2</sub>O<sub>4</sub>
- 35) The pH of a solution was found to be less than 7. Which of the following salt solutions could produce such a solution?
  - A) NaCl
  - B) CH3COONa
  - C) NH<sub>4</sub>Cl
  - D) KNO<sub>2</sub>
  - E) KNO<sub>3</sub>
- 36) Consider the following half-reactions and voltages.

$$2H^{+}_{(eq)} + 2e^{-} -> H_{2(g)}$$

$$\tilde{E} = 0.0 \text{ V}$$

$$Na^{+}_{(nq)} + 1e^{-} \rightarrow Na_{(s)}$$

$$\hat{E} = -2.71 \text{ V}$$

$$O_{2(g)} + 4H^{\dagger}_{(aq)} + 4e^{-} -> 2H_{2}O_{(l)}$$

$$E = 1.23 \text{ V}$$

$$Cl_{2(g)} + 2e^- \rightarrow 2Cl^-_{(aq)}$$

$$\dot{E} = 1.36 \text{ V}$$

What is the product produced at the Hg cathode when a current is passed through an NaCl aqueous solution?

- A) Sodium
- B) Chlorine
- C) Hydrogen
- D) Oxygen
- E) None of the above
- 37) Given the following values of the  $\triangle G_{fl}$  in kJ mol<sup>-1</sup>:

$$CH_{4(g)} = -50.8$$
  $CCl_{4(l)} = -65.3$   $HCl_{(g)} = -95.3$ 

What is the value of  $\triangle G_f$  for the reaction,

$$4Cl_{2(g)} + CH_4 \longrightarrow CCl_{4(l)} + 4HCl_{(g)}$$
?

- A) 282 kJ mol<sup>-1</sup>
- B) -282 kJ mol<sup>-1</sup>
- C) -396 kJ mol-1
- D) -425 kJ mol<sup>-1</sup>
- E) None of the above
- 38) The  $K_a$  for acetic acid,  $CH_3COOH$ , is  $1.0 \times 10^{-5}$ . What is the  $K_b$  for the fluoride ion, F-7
  - A)  $\sim 1.7 \times 10^{-11}$
  - B)  $\sim 1.0 \times 10^{-9}$
  - C)  $-3.5 \times 10^9$
  - D)  $\sim 1.0 \times 10^{-10}$
  - E) None of the above

## 科目: 綜合化學(2001) 校系所組: 中大化學學系 交大應用化學系甲組 清大化學系

	A) 3-promo-3-ethylpentane
	B) (R)-2-bromo-3-ethylpentane
	C) (R)-3-bromo-2-methylpentane
	D) (S)-2-bromo-3-ethylpentane
	E) (S)-3-bromo-2-methylpentane
40)	The mass spectra of alcohols often fail to exhibit detectable M peaks but instead show relatively larg

39). Which of the following alkyl bromides undergoes solvolysis in methanol without rearrangement?

D) M+2 B) M-16 C) M-17 A) M+1 B) M-18

41) Consider the electrochemical cell,

Cu(s)|Cu<sup>2+</sup>(0.25M)||Co<sup>3+</sup>(0.75 M)|Co<sup>2+</sup>(1.25 M).

If E<sup>0</sup> for the cell is 1.47 V, what is E(volts) for the cell?

- A) 1.45 V
- B) 1.57 V
- C) 1.63 V
- D) 1.31 V
- E) None of the above
- 42) Which one of the following gases has the highest binding affinity towards hemoglobin?
  - A) O<sub>2</sub>
  - B) N<sub>2</sub>
  - C) CO
  - D) CO<sub>2</sub>
  - E) Ar
- 43) Which of the following equations is not correct?
  - A) dG= Vdp SdT
  - B)  $\varepsilon = \varepsilon^{\circ} (nF/RT) \ln(Q)$
  - C)  $(\partial S/\partial P)_T = -(\partial V/\partial T)_h$
  - D)  $dP/dT = \triangle H_m/T \triangle V_m$
- 44) Magnetic nuclei, such as,  ${}^{1}H$  and  ${}^{13}C$ , have spins,  $\alpha$  or  $\beta$  spin states. Transition of nuclear spin from  $\alpha$  to  $\beta$  requires absorption of electromagnetic energy. The electromagnetic energy is in which range?
  - A) UV
  - B) Visible
  - C) Infra red
  - D) Microwave
  - E) Radio frequency.
- 45) Which of the following mixtures/ solutions would be a buffer solution?
  - A) 50mL 1M HCl +50mL 1M NH3
  - B) 50mL 1M HCl +50mL 1M NaOH
  - C) 25mL 1M NaOH +50mL 1M CH<sub>3</sub>COOH
  - D) 25mL 1M NaOH +50mL 1M NH<sub>3</sub>

#### 校系所組:中大化學學系 交大應用化學系甲組 清大化學系 科目: 綜合化學(2001)

46) Solid /	gNO3 is added to a solution of	containing 0.1M each of CI	and CrO <sub>4</sub> . \	What is the	concentration of Ci	when
Ag <sub>2</sub> C <sub>1</sub> °	O <sub>4</sub> begins to precipitate? (Ksp	$AgCl = 1.8 \times 10^{-10}$ , Ksp $Ag_2$	$CrO_4=2.4\times10^{\circ}$	-12)		

- A)  $4.9 \times 10^{-6}$
- B) 1.8×10<sup>-9</sup>
- C) 2.4×10<sup>-11</sup>
- D)  $3.7 \times 10^{-5}$
- E)  $6.5 \times 10^{-7}$
- 47) In which aqueous solution will the molar solubility of Ca(OH)2 be smallest?
  - A) pure water
  - B) IM NH<sub>3</sub>
  - C) 1M NH<sub>3</sub> and 1M NH<sub>4</sub>Cl
  - D) 1M NH<sub>4</sub>Cl
  - E) 1M HCl
- 48) Nonpolar molecules still have intermolecular attractive forces acting on them. Small fluctuations in the electron density in such molecules create small temporary dipoles, with extremely short lifetimes. The result is an overall attraction among molecules. These attractive forces are called
  - A) lone pair effect
  - B) London or dispersion forces
  - C) dipole moment
  - D) covalent bonding.
- 49) Which of the following molecules is Infrared (IR) inactive
  - A) CO
  - B) NO
  - C) HCl
  - D) N<sub>2</sub>.
- 50) The highest occupied molecular orbital for O2 molecule is
  - A)  $\sigma_g(2p)$
  - B)  $\pi_u(2p)$
  - C)  $\pi_{g}^{*}(2p)$
  - D)  $\sigma_u^*(2p)$ .