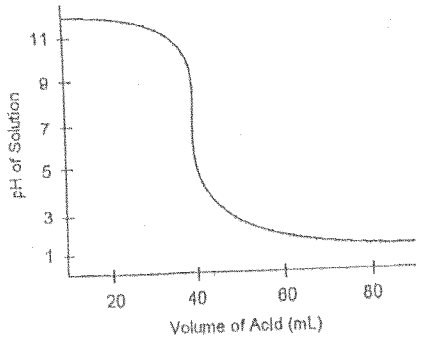
科目：綜合化學(2001)　　校系所組：中大化學學系　交大應用化學系甲組　清大化學系

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_3
   C) H_2SO_4 by NaOH
   D) NH_3 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

注意：背面有試題

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6) Which of the following chemical formula is called Prussian blue

A) $KFe[Fe(CN)_6]$

B) $K_3[Co(NO_2)_6].6H_2O$

C) $[Cu(NH_3)_4(H_2O)_2]^{2+}$

D) $[Ag(NH_3)_2]Cl$

7) Which of the following ligands can not act as an ambidentate ligand

A) H_2NNH_2

B) $[NO_2]^-$

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) ΛΔΔ-(ethylenediaminetetracetato)cobaltate(III)

D) ΔΛΔ-(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) ^{12}Mg

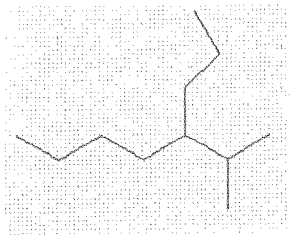
B) Al

C) ^{10}B

D) ^{2}D

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) CH_2=$CHCH_2CH_3$

B) HOCH=$CHCH_2CH_3$

C) CH_3CH=$CHCH_2OH$

D) CH_2=$CHCH_2CH_2OH$

E) CH_2=$CHCH_2OCH_3$

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_{60} 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) $\triangle G < 0$

E) None of the above

20) How many atoms does a Fe nanoparticle have?

A) 1~10

B) 100 ~200

C) 1000~2000

D) 10000~20000

E) 50000~100000

21) Which of the following compounds may react with water to liberate organic molecules

A) SiO_4

B) SiH_4

C) CaC_2

D) HN_3.

22) Which of the following compounds is a diamagnetic molecule

A) NO

B) O_2

C) NO_2

D) N_2O_4.

23) Which of the following hydrohalic acids is the weakest in aqueous solution

A) HF

B) HCl

C) HBr

D) HI

24) Solvation of the ions is certainly a factor in solubilities. Which of the following ions is the most strongly solvated in aqueous solution

A) F^-

B) Cl^-

C) Br^-

D) I^-

25) Compound listed in the following has the largest bond angle

A) NCl_3

B) PCl_3

C) $AsCl_3$

D) $SbCl_3$

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26) For an endergonic reaction step, the Hammond postulate allows one to say that _____.

A) the reaction containing this step is overall first order
B) the transition state of the step resembles the reactants of the step
C) the transition state is precisely symmetric with bond-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 E_a

27) What type of isomers are $CH_3CH_2OCH_3$ and $CH_3CH_2CH_2OH$?

A) configurational
B) stereochemical
C) symmetrical
D) constitutional
E) conformational

28) Which of the following is chiral?

A) *cis*-1,4-dimethylcyclohexane
B) *trans*-1,3-dimethylcyclohexane
C) *trans*-1-bromo-3-chlorocyclobutane
D) *cis*-1,3-dimethylcyclohexane
E) *cis*-1-bromo-3-chlorocyclobutane

29) The reagent needed to convert 2-butyne to cis-2-butene is:

A) H_2/Pt
B) H^+/Zinc dust
C) Na/NH_3
D) Li/NH_3
E) H_2/Lindlar's catalyst

30) In the S_N1 hydrolysis mechanism of $(CH_3)_3CBr$, there are _____ elementary steps, _____ distinct transition states, and _____ distinct 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^{-2}
C) 6.3×10^{-12}
D) 1.6×10^{-3}
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^{-6}
B) 1.3×10^{-10}
C) 4.8×10^{-2}
D) 2.1×10^{-5}
E) 8.4×10^{-18}

33) Vitamin C is ascorbic acid, $H_2C_6H_6O_6$, a diprotic acid. What would be the pH of a 0.50M solution of ascorbic acid?($Ka_1=7.9\times10^{-5}$, $Ka_2=1.6\times10^{-12}$)

A) 1.80　B)2.20　C) 6.05　D)7.95　E)11.80

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34) Which of the following species is not amphiprotic?

A) $H_2PO_4^-$

B) SO_4^{2-}

C) H_2O

D) HCO_3^-

E) $HC_2O_4^-$

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) CH_3COONa

C) NH_4Cl

D) KNO_2

E) KNO_3

36) Consider the following half-reactions and voltages.

$2H^+_{(aq)} + 2e^- \rightarrow H_{2\,(g)}$　　$\bar{E} = 0.0$ V

$Na^+_{(aq)} + 1e^- \rightarrow Na_{(s)}$　　$\bar{E} = -2.71$ V

$O_{2\,(g)} + 4H^+_{(aq)} + 4e^- \rightarrow 2H_2O_{(l)}$　　$\bar{E} = 1.23$ V

$Cl_{2\,(g)} + 2e^- \rightarrow 2Cl^-_{(aq)}$　　$\bar{E} = 1.36$ 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 $\triangle G_{fj}$ in kJ mol^{-1}:

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

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

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

A) 282 kJ mol^{-1}

B) −282 kJ mol^{-1}

C) −396 kJ mol^{-1}

D) −425 kJ mol^{-1}

E) None of the above

38) The K_a for acetic acid, CH_3COOH, is 1.0×10^{-5}. What is the K_b for the fluoride ion, F^-?

A) $\sim 1.7 \times 10^{-11}$

B) $\sim 1.0 \times 10^{-9}$

C) $\sim 3.5 \times 10^{9}$

D) $\sim 1.0 \times 10^{-10}$

E) None of the above

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

A) 3-bromo-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 large _____ peaks.

A) M+1　B) M-18　C) M-17　D) M+2　E) M-16

41) Consider the electrochemical cell,

$Cu(s)|Cu^{2+}(0.25M)||Co^{3+}(0.75\ M)|Co^{2+}(1.25\ M)$.

If E^0 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_2
B) N_2
C) CO
D) CO_2
E) Ar

43) Which of the following equations is not correct?

A) $dG = Vdp - SdT$
B) $\varepsilon = \varepsilon^0 - (nF/RT)\ln(Q)$
C) $(\partial S/\partial P)_T = -(\partial V/\partial T)_p$
D) $dP/dT = \triangle H_m/T\,\triangle V_m$.

44) Magnetic nuclei, such as, ^1H and ^{13}C, have spins, α or β spin states. Transition of nuclear spin from α to β 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 NH_3
B) 50mL 1M HCl +50mL 1M NaOH
C) 25mL 1M NaOH +50mL 1M CH_3COOH
D) 25mL 1M NaOH +50mL 1M NH_3

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46) Solid $AgNO_3$ is added to a solution containing 0.1M each of Cl^- and CrO_4^{2-}. What is the concentration of Cl^- when Ag_2CrO_4 begins to precipitate? (Ksp AgCl= 1.8×10^{-10}, Ksp Ag_2CrO_4=2.4×10^{-12})

A) 4.9×10^{-6}
B) 1.8×10^{-9}
C) 2.4×10^{-11}
D) 3.7×10^{-5}
E) 6.5×10^{-7}

47) In which aqueous solution will the molar solubility of $Ca(OH)_2$ be smallest?

A) pure water
B) 1M NH_3
C) 1M NH_3 and 1M NH_4Cl
D) 1M NH_4Cl
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_2.

50) The highest occupied molecular orbital for O_2 molecule is

A) $\sigma_g(2p)$
B) $\pi_u(2p)$
C) $\pi_g^*(2p)$
D) $\sigma_u^*(2p)$.