SAT II Chemistry Guides:

Test Basics

Scoring, Timing, Number of Questions		
Points	Minutes	Questions
200-800	60	85 (Multiple Choice)

PART A

(必考題型 判斷酸鹼)

Questions 1-3 refer to the following aqueous solutions.

(A) 0.1 M HCl

(B) 0.1 M NaCl

(C) 0.1 M $HC_2H_3O_2$

(D) 0.1 M CH_3OH

(E) 0.1 M KOH

1. Is weakly acidic

2. Has the highest pH

3. Reacts with an equal volume of 0.05 M $Ba(OH)_2$ to form a solution with pH = 7.

1(C)

2(E)---SB

3(A)----SASB的ion在水中為中性,前提要中和完全 SOL: 判斷酸鹼技巧:

1 區分 酸為(H^+), 鹼為(金+OH^-)

(NH_3例外視為 NH_4OH 為 WB)

($C_nH_{2n+1}OH$ 為 alcohol 為中性)

($C_nH_{2n+1}COOH$ 為 alcohol 為 WA or $HC_nH_{2n+1}CO_2$)

2 區分是否為

SA ($HClO_4$ > HI > HBr > HCl > HNO_3 > H_2SO_4 > H_3O^+ (hydronium))

SB (IA, Ca, Sr, Ba)

SA SB 會完全解離 Keq 很大>>1,所以解離後的 conjugate Ions $[A]^-$ $[B]^+$的 ions 在水中很安定,幾乎不會行水解反應,故 SA SB 的 conjugate ions 在水中為中性 $Keq_{(水解)}$極小 $<<10^{-14}$.

反之, WA WB 本身解離越弱 Keq 小(ex. 10^{-8}),則本身安定, 而 WA WB 的 conjugate ions 在水中則越不安定,易水解, 呈現相反性質, $Keq_{(水解)}$(ex. 10^{-6})會較強.但不會到 SA SB 程度. <Keq* $Keq_{(水解)}=10^{-14}$(25°C)>

3 區分是否為 Salt(金+非金(OH 之外的 ions)) 看水解(hydrolysis) 越弱的 Acid conjugate ions 為越強的 base,反之亦然.

Questions 4-5

(A) 1

(B) 6

(C) 9

(D) 10

(E) 14

4. The atomic number of an atom with an electron dot arrangement similar to

找halogens

5. Is primarily responsible for the hardness of diamond

ANS: Network bonding

Questions 6-8 refer to the following information.

Na2CrO4, a soluble yellow solid PbCrO4, an insoluble yellow solid NaNO3, a soluble white solid Pb(NO3)2, a soluble white solid

(A) Yellow solid and colorless solution

(B) Yellow solid and yellow solution

(C) White solid and colorless solution

(D) No solid and yellow solution

(E) No solid and colorless solution

6. Observed when 1.0 mol of Na2CrO4 and 2.0 mol of Pb(NO3)2are mixed with 1 L of water (A)

7. Observed when 3.0 mol of Na2CrO4 and 1.0 mol of Pb(NO3)2 are mixed with 1 L of water (B)

8. Observed when 1.0 mol of NaN03 and 1.0 mol of Pb(NO3)2 are mixed with 1 L of water (E)

$PbCrO_4$(S) 黃色 CrO_4^-水溶液也是黃色

$XCrO_4$(S) 沉澱幾乎都黃色

Questions 9-11

(A) 1 +

(B) 1-

(C) 0

(D) 2+

(E) 3+

9. Oxidation number of O in H_2O_2 (B)

10. Oxidation number of F in HF (B)

11. Oxidation number of O in O_3 (C)

Questions 12-14refer to the following.

(A) Nucleic acids 核酸

(B) Proteins

(C) Carbohydrates

(D) Lipids

(E) Electrolytes

12. Deoxyribose in DNA nucleotides belongs to this family of biologically important molecules

13. Always ionic in nature

14. Tend not to be water soluble, and aggregate into droplets or molecular bilayers

40(C) Deoxyribose(脫氧核糖) is a ribose sugar molecule missing an oxygen atom. As with all molecules with the suffix -ose, ribose(核糖) is a carbohydrate. In general, proteins tend to have the suffix -in (or -ase if they are an enzyme) and nucleic acids have the suffix -ine (except for uracil).

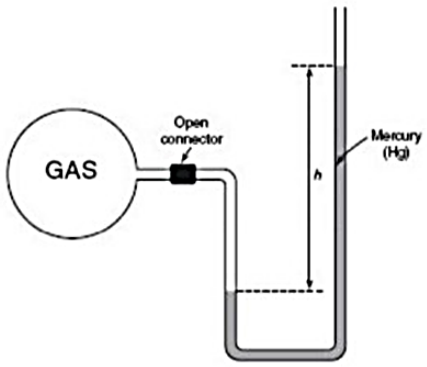
41(E) 42(D) 脂雙層球狀

PARTB

$HC_2H_3O_2 + H_2O \leftrightarrows C_2H_3O_2^- + H_3O^+$ 101. If some acetic acid, $HC_2H_3O_2$, is added to the equilibrium mixture represented by the equation above, the concentration of H_3O^+ decreases.	BECAUSE	the equilibrium constant of a reaction changes as the concentration of the reactants changes.
F		F , Keq 只受 T 影響
102. The bonds found in a molecule of N_2 are nonpolar covalent	BECAUSE	there is an equal sharing of electrons between the nitrogen atoms.
T	CE	T, 相同 element ,有相同的 electronegativity = equal sharing of electrons.
103. Neutrons and protons are classified as nucleons	BECAUSE	neutrons and protons are both located in the principal energy levels of the atom.
T		F, the principal energy levels 為 electron 填入的 shell
104. As pressure on a gas increases, the volume of the gas decreases	BECAUSE	pressure and volume have a direct relationship.
T		F .direct relationship 正比 Reverse relationship 反比
105. A mixture of two different liquids can be separated via distillation.	BECAUSE	different liquids have different boiling points.

PART C

(氣體類型)



25. In the above laboratory setup to measure the pressure of the confined gas, what will be true concerning the calculated pressure on the gas?

(A)The gas pressure will be the same as the atmospheric pressure.

(B)The gas pressure will be less than the atmospheric pressure.

(C)The gas pressure will be greater than the atmospheric pressure.

(D)The difference in the height (h) of mercury levels is equal to the pressure of the gas.

(E)The height (h) of mercury has no effect on the pressure calculation since the column of mercury is only used to enclose the gas volume.

(C) gas P = atmosphere + h of mercury

26. If the molecular mass of NH_3 is 17, what is the density of this compound at STP?

(A) 0.25 g/L

(B) 0.76 g/L

(C) 1.52 g/L

(D) 3.04 g/L

(E) 9.11 g/L

PM=dRT 1*17 = d * 22.4 (B)

27. From 2 moles of $KClO_3$ how many liters of O_2 can be produced at STP by decomposition of all the $KClO_3$?

(A) 11.2

(B) 22.4

(C) 33.6

(D) 44.8

(E) 67.2

2 $KClO_3 \rightarrow KCl + 3\ O_2$ 單看兩項mol比2:3 所以(E)

28. hat piece of apparatus can be used to introduce more liquid into a reaction and serve as a pressure

valve?

(A) Stopcock

(B) Pinchcock

(C) Thistle tube

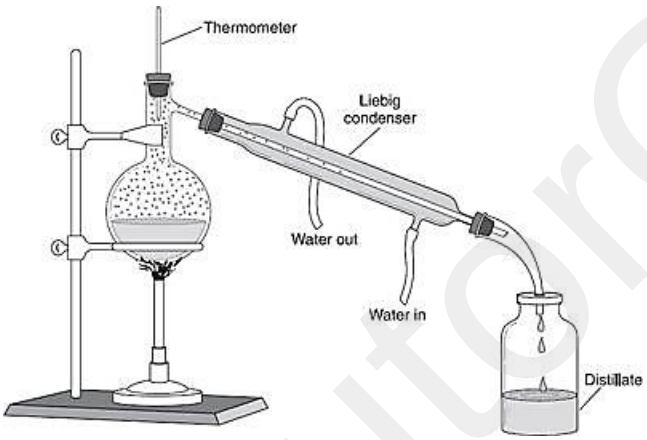
(D) Flask

(E) Condenser

Stopcock

Pinchcock

Thistle tube



29. Which mixture is correctly paired with a method for separation of the mixture?

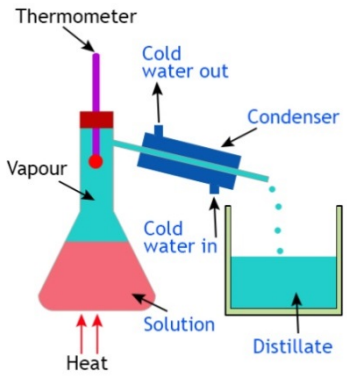
(A) Oil and water—filler paper

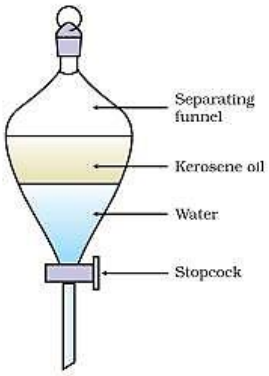
(B) Salt water—distillation

(C) Sand and water—separatory funnel

(D) Sand and sugar—tweezers

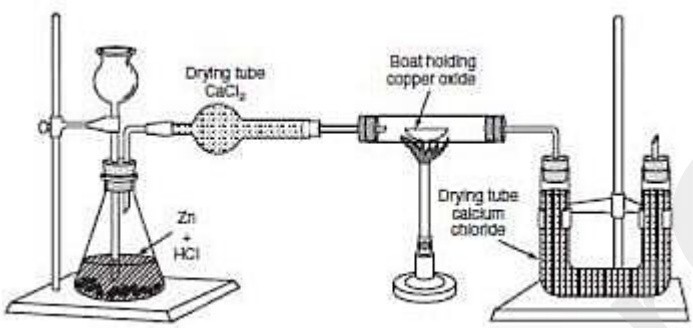
(E) Sugar water—filter paper





distillation 取vapor 低b.p 液體　　separatory funnel 分離分層液體

Tweezers 鑷子



Recorded data:

Weight of U-tube ..... 20.36 g

Weight of U-tube and calcium chloride before 39.3

Weight of U-tube and calcium chloride after.....57.32

Weight of boat and contents (copper oxide) before.....g

Weight of boat and contents after..... 14.23g

Weight of boat .....5.00 g

30. What conclusion can be derived from the data collected?

(A) Oxygen was lost from the CaCl2.

(B) Oxygen was generated in the U-tube.

(C) Water was formed from the reaction.

(D) Hydrogen was absorbed by the CaCl2.

(E) CuO was formed in the decomposition.

兩個乾燥 $CaCl_2$都是吸水用

第一步產生 H_2

第二步 H_2與 CuO →Cu +H_2O　　(C)

31. From the heats of reaction of these individual reactions:

a. A + B →2CΔH = -500 kJ,

b. D + 2B→EΔH = -700kJ,

c. 2D + 2A→FΔH = +50 kJ

Find the heat of reaction for F + 6B → 2E + 4C.

(A) +450 kJ

(B) -1,100 kJ

(C) +2,350 kJ

(D) -350 kJ

(E) -2,450 kJ

(E) a*2+b*2+c*(-1)

32. Which of these statements is NOT correct?

(A) In an exothermic reaction, ΔH is negative and the enthalpy decreases.

(B) In an endothermic reaction, ΔH is positive and the enthalpyincreases.

(C) In a reaction where ΔG is negative, the forward reaction is spontaneous.

(D) In a reaction where ΔG is positive, ΔS may also be positive.

(E) In a reaction where ΔH is positive and ΔS is negative, the forward reaction is spontaneous.

(E)

33. Choose the answer below that accurately describes the correct molecular shape for the molecule XeOF4.

(A) Tetrahedral

(B) Trigonal pyramidal

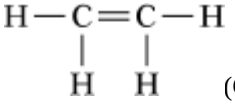
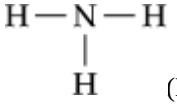
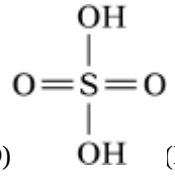
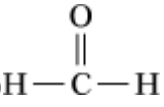
(C) Trigonal bipyramidal

(D) Square pyramidal

(E) Flat

(D) (8+0+4)/2 = 6 ---sp^3d^2 (6-5)

34. Which structure below demonstrates a violation of the octet rule?

(A) (B)  (C)  (D)  (E) 

(D) 滿足 FC=0 常常會超過 octets, 或算中心共用的電子有沒有超出 8 個.

35. Equilibrium

(A) is defined as equal concentrations of reactants and products

(B) is defined as equal rates for forward and reverse reactions

(C) can be shifted by adding a catalyst

(D) can exist for chemical changes but not physical changes

(E) must always favor the formation of products

(B)Equilibrium 為 reactants products 濃度不變化時

Keq >1 表示 spontaneous 傾向 products 方,濃度也會較高.

Keq 大小與正逆反應速度無關,但平衡時正逆 Rate 相等

例如 $C_{graphite} \rightarrow C_{diamond}$ Keq>1,自發,但速度極慢.

36. What is the molar mass of a nonionizing solid if 10.grams of this solid, dissolved 200. grams of water, formed a solution that froze at -3.72°C?

(A) 25. g/mol

(B) 50. g/mol

(C) 100. g/mol

(D) 150. g/mol

(E) 1,000. g/mol

(A)

沸點上升 = +Kb*Cm*i Kb=0.52(背)

凝固點下降 = -Kb*Cm*i Kf=1.86(背)

蒸氣壓下降量 = $P_{(solvent)}$*$X_{(solute)}$

37. All of the following can act as Brønsted-Lowry acids (proton donors) in aqueous solution EXCEPT

(A) HI (B) NH_4+ (C) HCO_3^-

(D) H_2S (E) NH_3

(E)NH_3為base 為接受H^+

Conjugate pairs = 主體相同,差一個H^+

有H^+的為Acid.

38. An aqueous solution with pH 5 at 25°C has a hydroxide ion (OH^-) concentration of

(A) 1 x 10^{-11}molar

(B) 1 x 10^{-9}molar

(C) 1 x 10^{-7} molar

(D) 1 x 10^{-5} molar

(E) 1 x 10^{-3} molar

(B) 基本－log 運算 PH+POH=14 (25 度 C)

39. When excited electrons cascade to lower energy levels in an atom,

(A) visible light is always emitted (UV ,infrared….)

(B) the potential energy of the atom increases (無關)

(C) the electrons always fall back to the first energy level (不一定)

(D) the electrons fall indiscriminately to all levels (要軌域中無電子才行,H原子是因為單電子才都可)

(E) the electrons fall back to a lower unfilled energy level

(E)

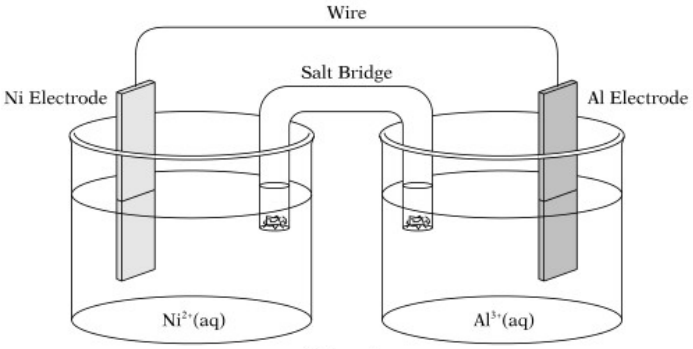


Figure 2

$Al \rightarrow Al^{3+} + 3e^-$ +1.66V

$Ni \rightarrow Ni^{2+} + 2e^-$ +0.26V一共为1.4V

40. Which statement is true about the setup above?

(A) The electrode potential for this cell is 1.40 V.

(B) The electrode potential for this cell is 2.54 V.

(C) Electrons will be carried by the salt bridge.

(D) Ions will be carried through the wire.

(E) The reaction is nonspontaneous.

(A) $E^0 = E^0ox + E^0re$ 注意不隨係數改變

41. A voltaic cell is set up and a chemical reaction proceeds spontaneously. Which of the following will not occur in this reaction?

(A) The electrons will migrate through the wire.

(B) The cations in the salt bridge will migrate to the anode half cell.

(C) The cathode will gain mass.

(D) The anode will lose mass.

(E) Reduction will occur at the cathode.

(B)the anions in the salt bridge will migrate to the anode half cell.

42. Which compound is matched up with its correct name?

(A) CO—monocarbon monoxide

(B) CaF_2—calcium difluoride

(C) CCl_4—carbon tetrachloride

(D) PCl_3—potassium trichloride

(E) TiF_4—tin(IV) fluoride

(A) CO—~~mono~~carbon monoxide 首字為一不寫

(B) CaF_2—calcium ~~di~~fluoride ionic 不寫perfix

(C) CCl_4—carbon tetrachloride

(D) PCl_3—~~potassium~~ trichloride → phosphorous

(E) TiF_4—~~tin~~(IV) fluoride → titanium

43. Which functional group below does not contain a carbonyl group?

(A) Aldehydes

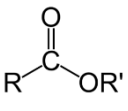
(B) Ketones

(C) Esters

(D) Ethers

(E) Carboxylic acids

Carbonyl group: -C=O

(C)酯  C (D)醚 C-O-C

-OH **Alcohol** =**hydroxyl**

-COH  **Aldehyde**

-COOH **Carboxyl= carboxylic acid**