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1 H 1.0																	2 He 4.0
3 Li 6.9	4 Be 9.0											5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2
11 Na 23.0	12 Mg 24.0											13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.0	17 Cl 35.5	18 Ar 40.0
19 K 39.1	20 Ca 40.1	21 Sc 45.0	22 Ti 47.9	23 V 50.9	24 Cr 52.0	25 Mn 54.9	26 Fe 55.8	27 Co 58.9	28 Ni 58.7	29 Cu 64.0	30 Zn 65.4	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 80.0	36 Kr 83.8

选择题 (100 分；每题 4 分)

1. 3.04 g 的某铁氧化物(含有 FeO 和 Fe_2O_3)溶于足量盐酸中。在准状况下向此溶液加入 224 mL 的 Cl_2，恰好將 Fe^{2+}完全氧化。试问氧化物中 Fe^{2+}的百分比是多少？
   3.04 g of iron oxide (containing both FeO and Fe_2O_3) is dissolved completely in HCl solution. Under standard condition, 224 mL of Cl_2isrequired to oxidize Fe^{2+} completely. What is the percentage of Fe^{2+} in the iron oxide?

   (A) 18.4%　(B) 36.7%　(C) 23.6%　(D) 47.2%　(E) 90.0%

2. 下列有关物质特性之比较，何者不正确?
   Which of the following statement is False?

   (A) 键角(bond angle) : SO_2> BF_3　(B) 熔点(melting point) : MgO>NaF
   (C) 键能(bond energy) : N_2> O_2　(D) 极性(polarity): NH_3> CH_4
   (E) 沸点(boiling point) :顺-1, 2-二氯乙烯(Cis-1,2-dichloroethene) >反-1, 2-二氯乙烯(Trans-1,2-dichloroethene)

3. 下列有关错合物的叙述，何者正确?
   Which of the following statement is Correct?
   (A) $[Ni(CO)_4]$的形状为四面体 (The shape of $[Ni(CO)_4]$ is tetrahedral)
   (B) $EDTA^{4-}$有四牙配位子 ($EDTA^{4-}$ has four coordination sites)
   (C) 叶绿素是含有 Fe^{2+}离子的一种错合物 (Chlorophyll is complex containing Fe^{2+} ion)
   (D) CH_4能当作配位子与金属离子生成错合物 (CH_4 can be a ligand to form a bond with metal ion)
   (E) 错合物$[VO_2(H_2O)_4]^+$中心金属原子的氧化数及配位数分别为+5、4
   The oxidation and coordination number for the metal atom of $[VO_2(H_2O)_4]^+$ are +5 and 4, respectively

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4. 已知反应 $Cu^{2+} + I^- \rightarrow CuI + I_2$ (未平衡)。今有某铜(II)矿试样 2.54 克，经间接碘滴定分析，共耗 0.1*M* $Na_2S_2O_3$ 溶液 40 mL。求该试样中含铜量为多少?

The amount of copper in a copper ore can be determined using iodometric titration (iodine/sodium thiosulfate titration) based on the reaction of $Cu^{2+} + I^- \rightarrow CuI + I_2$ (not balanced). The I_2 formed can be quantified by titration with standard$Na_2S_2O_3$ solution. In an experiment to find out the amount of copper in a 2.54 g copper ore using iodometric titration, 40 mL of 0.1*M* $Na_2S_2O_3$ are used to quantify the iodine formed. What is the mass percentage of copper in this ore?

(A) 6.4%　　(B) 10.1%　　(C) 12.5%　　(D) 18.0%　　(E) 21.7%

5. 有关电子组态与元素週期表，下列观念何者正确?

With reference to the electronic configuration and the Periodic Table of Elements, which of the following statement is Correct?

.(A) 水溶液中之 Ag^+、Zn^{2+}、I^-、Mn^{2+}皆为无色
The aqueous solutions of Ag^+, Zn^{2+}, I^-, and Mn^{2+} are colorless.

(B) 基态时，最外层的电子組态为 $4s^1$ 者之元素仅有 K 一元素
The element K has electronic configuration of $4s^1$ at the outer most orbital.

(C) 第三列元素中，氧化物溶於水成碱性的物质共有三个，仅 Na_2O、MgO、Al_2O_3
For the oxides of third periodic elements, only Na_2O, MgO, and Al_2O_3 formbasic aqueous solution.

(D) 原子序为 84 的元素，其电子組态为$[Xe]4f^{14}5d^{10}6s^26p^4$
The electronic configuration of element with atomic number 84 is $[Xe]4f^{14}5d^{10}6s^26p^4$.

(E) P : $[Ne]3s^23p_x^23p_y^13p_z^0 \rightarrow$ P : $[Ne]3s^23p_x^13p_y^13p_z^1$，此過程應為吸熱反應
The process of $[Ne]3s^23p_x^23p_y^13p_z^0$ to $[Ne]3s^23p_x^13p_y^13p_z^1$ is endothermic.

6. 在 25°C、1 atm 下，已知下列各热化学方程式：

$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta H = -395kJ$

$C_{(s)} + 2H_{2(g)} \rightarrow CH_{4(g)}$ $\Delta H = -75kJ$

$H_2O_{(g)} \rightarrow H_2O_{(l)}$ $\Delta H = -45\ kJ$

$2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)}$ $\Delta H = -570\ kJ$

则在该温度及压力下，将 1 莫耳甲烷完全氧化，生成水蒸气和二氧化碳的反应热(ΔH)为多少 kJ?

Under 25°C and1 atm, given the above thermal chemical equations, calculate the heat of reaction (ΔH) for burning 1 mole of $CH_4$to generate water vapor and carbon dioxide.

(A) -564 kJ (B) -605 kJ (C) -800 kJ (D) -891 kJ(E) -520 kJ

7. 某水溶液中含有 K^+、Mg^{2+}、Cu^{2+}、Pb^{2+}、Ag^+等五种金属离子，若加入(A) $NaOH_{(aq)}$、(B) $Na_2S_{(aq)}$、(C) $Na_2SO_{4(aq)}$、(D) $HCl_{(aq)}$四种试剂使金属离子沉淀、过滤以分离之，则加入试剂的顺序为何?

An aqueous solution contains K^+, Mg^{2+}, Cu^{2+}, Pb^{2+}, and Ag^+ metal ions. Four reagents of (A) $NaOH_{(aq)}$, (B) $Na_2S_{(aq)}$, (C) $Na_2SO_{4(aq)}$, (D) $HCl_{(aq)}$ are used to separate these metal ions by precipitation and filtration. What is the order of adding these regents?

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

8. 根据下表的资料，判断 HCHO 与 CO_3^{2-}之碳-氧键的键长依序为若干 pm?

Based on the data shown in the table below, estimate the bond length between C and O in HCOH and CO_3^{2-}, respectively.

化学键(chemical bond)	C-O	C=O	C≡O
键长(bond length, pm)	143	123	109

(A) 123，136 (B) 123，115 (C) 109，143 (D) 143，136
(E) 143，115

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9. 有五种溶液 A、B、C、D、E，已知它們分为 $AgNO_3$，HCl，$BaCl_2$, Na_2CO_3，Na_2SO_4 的其中一种，现将兩兩混和观察到的现象如下表，下列推断化合物的化学是正确的为:

混和情形 (Mixing status)	A+B	D+C	A+C	D+E	C+E	A+D
现象 (observation results)	放出气体 (gas bubbling)	产生沉淀 (forming precipitate)	无明显反应(no obvious reaction)	产生沉淀 (forming precipitate)	产生沉淀 (forming precipitate)	产生沉淀 (forming precipitate)

Five solutions, $AgNO_3$, HCl, $BaCl_2$, Na_2CO_3, andNa_2SO_4, were assigned to A, B, C, D, and E randomly (without knowing which is which). When mixing any two solutions, the observed results were shown in the above table. Based on the observations, which of the following statement is Correct?

(A) A 为 $AgNO_3$; (A is $AgNO_3$)　　(B) B 为 HCl; (B is HCl)
(C) C 为 Na_2SO_4; (C is Na_2SO_4)　　(D) D 为 Na_2CO_3; (D is Na_2CO_3)
(E) E 为 $BaCl_2$; (E is $BaCl_2$)

10. 已知 NH_3 之 $K_b = 1 \times 10^{-5}$，CH_3COOH 之 $K_a = 1 \times 10^{-5}$。下列有关盐类的叙述，何者正确?
The K_b of NH_3 is 1×10^{-5} and K_a of CH_3COOH is 1×10^{-5}. Which of the following statements are Correct?

I: 1M $H_3PO_{4(aq)}$与 2M $NaOH_{(aq)}$等体积混合后，因生成酸式盐 Na_2HPO_4，溶液呈酸性。
Mixing equal volume of 1M $H_3PO_{4(aq)}$ and 2M $NaOH_{(aq)}$ form an acidic salt of Na_2HPO. Therefore, the solution is acidic.

II : 1M $H_3PO_{3(aq)}$与 2M $NaOH_{(aq)}$等体积混合后，因生成正盐 Na_2HPO_3，溶液呈碱性。
Mixing equal volume of 1M $H_3PO_{3(aq)}$ and 2M $NaOH_{(aq)}$ forms Na_2HPO_3 salt.
The solution is alkaline.

III : 十二水合硫酸鋁鉀 $KAl(SO_4)_2 \cdot 12H_2O$ 为复盐，因 Al^{3+}发生水解，其水溶液呈酸性。
$KAl(SO_4)_2 \cdot 12H_2O$ is a complex salt. Its aqueous solution is acidic due to the hydrolysis of Al^{3+}

IV : CH_3COONH_4 为正盐，因 CH_3COO^-与 NH_4^+均不会发生水解，其水溶液呈中性。
CH_3COONH_4 is a neutral salt because CH_3COO^- and NH_4^+cannot undergo hydrolysis. Therefore, its aqueous solution is neutral.

(A) I　　(B) I, II　　(C) II, III　　(D) III, IV　　(E) I, III, IV

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11.下列何者是氧化还原反应?

Which of the following is a redox reaction?

(I) $CH_3COOH + CN^- \rightarrow CH3COO^- + HCN$

(II) $2KI + H_2O_2 + H_2SO_4 \rightarrow K_2SO_4 + I_2 + 2H_2O$

(III) $CuSO_4 + 4NH_3 \rightarrow [Cu(NH_3)_4]SO_4$

(III) $HF + I^- \rightarrow F^- + HI$

(A) I,II,III (B) I, III (C) II,IV (D) II (E)以上皆非 None of the above.

12. 将小量 $NH_3(aq)$加入 $Cu^{2+}(aq)$则有一沉淀物产生，此沉淀物为何?

When a small amount of $NH_3(aq)$ is added to $Cu^{2+}(aq)$, a precipitate is formed. What is the precipitate?

(A) CuO (B) $Cu(NH_3)$ (C) $Cu(OH)_2$ (D) Cu(NO3)2 (E) $Cu(NH_3)_2^{2+}$

13. 当催化剂加入反应混合, 它的功能是 …

When a catalyst is added in a reaction, its function is to ….

(A) 可增加反应物分子的碰撞速率

Increases the rate of collision between the reactant molecules

(B) 可提供反应物更多的能量

Provides reactant molecules with more energy

(C) 降低逆反应速率

Reduces the rate of reverse reaction

(D) 提供反应新的路径(机构)

Provides a new path (mechanism) for the reaction

(E) 以上皆非 None of the above.

14.下列哪一个水溶液可与同体积的 0.10 M $NH_3(aq)$会产生緩冲溶液?

Which of the following aqueous solution, when mixed with an equal volume of 0.10 M aqueous NH_3, will form a buffer solution?

(A) 0.10 M HCl (B) 0.20 M HCl (C) 0.10 M CH_3COOH

(D) 0.05 M NaOH (E) 0.20 MNH_4Cl.

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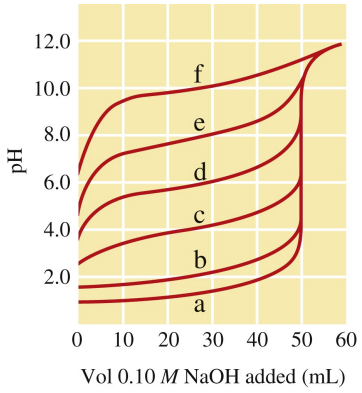
15. 下列何叙述不是关于气体动力论的假定?
Which is not an assumption in the kinetic-molecular theory of gases?

(A) 气体由微小粒子組成且具有固定的不规则运动模式
Gases are made up of tiny particles in constant random motion.
(B) 气体分子小于兩粒子间的平均距离
Gas particles are very small compared to the average distance between the particles
(C) 气体分子对器壁的碰撞属于弹性碰撞
Gas particles are in elastic collisions with the walls of container.
(D) 气体的平均速度与絕对對溫度成正比
The average velocity of gas particles is directly proportional to the absolute temperature.
(E) 已上皆被假定 (All of the above are assumed)

16. 下面酸碱滴定图是以 0.1 *M*NaOH.來滴定 50.0 mL, 0.10 *M* 的不同酸(a-f)而得。則下列哪个叙述是<u>正确</u>的?
The following plot shows the pH curves for the titrations of 0.1 *M*NaOH with 50.0 mL, 0.10M of different acids (a-f).



Which of the following statement(s) is(are) <u>Correct</u>?
I. 滴定曲线 ***a*** 表示此酸是最弱的酸。
The pH curve ***a*** corresponds to the weakest acid.
II.滴定曲線 ***a*** 表示此酸是最強的酸。
The pH curve ***a*** corresponds to the strongest acid.
III.如果滴定的当量点的 pH 值大于 7，表示此被滴定的酸是強酸。
If pH > 7 at equivalence point, the acid is a strong acid
IV. 滴定曲線 ***d*** 的酸的 *K*a 大約是 1×10^{-6}。
The pH curve ***d*** corresponds to an acid with *K*a ≈ $1 \times 10^{-6.}$

(A)I (B) II (C) I, III (D) II、III, IV (E) II, IV

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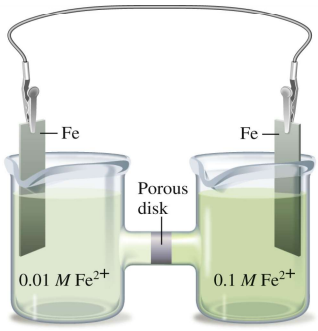
17. 下图是一浓差电池的装制图，则下列叙述何者是正确的?

A concentration cell contains iron electrodes and different concentrations of Fe^{2+} ion in the two compartments as the following set up. Which of the following statement is(are) Correct?



I. 这浓差电池的 E° 大于 0 *V*.

In this concentration cell the E° is greater than 0 *V*.

II. 电子是由右边往左边流动。

The electron flow is from right to left

III. 左边烧杯中 Fe^{2+} 的浓度增加。

The $[Fe^{2+}]$ in the left compartment increases

IV. 右边电极会被镀上铁金属。

The iron metal will be deposited on the right electrode

V. 这浓差电池的电位可由此方程式求得: $E = E^\circ - 0.0591/2 \times \log(0.10/0.01)$

This concentration cell potential at 25°C can be obtained using the equation of $E = E^\circ - 0.0591/2 \times \log(0.10/0.01)$

(A) I, II (B)II, III (C) III, IV

(D)I, III, IV (E) III, IV, V

18. 此反应 3A + B + C → D + E 的反应速率式为 $-\frac{\Delta[A]}{\Delta t} = k[A]^2[B][C]$，反应常数 *k* 是 90 M^{-3}/s. 有一实验在[B] = [C] = 1.00 *M* 及[A] = 3.20×10^{-5}*M* 下进行，则此反应初始速率是多少?

Consider the reaction, 3A + B + C → D + E, where the rate law is given as $-\frac{\Delta[A]}{\Delta t} = k[A]^2[B][C]$ and the rate constant *k* is 90 M^{-3} /s. An experiment was carried out where [B] =[C] = 1.00 *M* and [A] = 3.20×10^{-5}*M*. What is the initial rate of reaction?

(A) $1.14\times 10^{-11} M^{-3} \cdot s$ (B) $9.06\times 10^{-7} M^{-3}/s$

(C) $8.64\times 10^{-7} M^{-3} \cdot s$ (D) $1.53\times 10^{2} M/s$

(E) $9.22\times 10^{-8} M/s$

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19.下列各組有机化合物，何者无法由括弧內的试剂做定性的鉴别?
For the following pairs of organic compounds, which pair cannot be differentiated using the reagent shown in the parenthesis?

(A) 正庚烷、甲苯 (热的过錳酸鉀溶液)
n-heptane and toluene (hot $KMnO_4$ solution)
(B) 丙醛、丙酮 (斐林试剂)
Propanal and acetone (Fehling's reagent)
(C)1-丁炔、2-丁炔 (氯化亚銅的氨水溶液)
But-1-yne and But-2-yne ($CuCl/NH_3$ solution)
(D)环己烯、环己烷 (溴的四氯化碳溶液)
Cyclohexene and cyclohexane (Br_2/CCl_4 solution)
(E) 二甲苯、甲苯 (热的过錳酸鉀溶液)
Xylene and Toluene (hot $KMnO_4$ solution)

20. 下列物质当在空中燃烧，对空气污染最少的是那一个?
When the following materials are burnt in air, which one contributes the least to air pollution?

(A) 汽油 petrol
(B) 甲烷 methane
(C) 柴油 diesel
(D) 氫气 hydrogen
(E) 生物柴油 biodisel

21.下列哪一些物质可以检测到清晰的熔点 ?
Which of the following matter has clear detectable melting points?

(I) 玻璃 glass
(II) 棕榈油 palm oil
(III) 天然橡胶 natural rubber
(IV) 聚乙烯 polyethylene

(A) I, II, III
(B) I, III
(C) II, IV
(D) IV
(E) 其他的組合 Other combination

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22.一個玻璃容器含有相同体积的甲烷与氯气，在紫外线照射了三个小時。下列哪一些化合物可能形成 ？

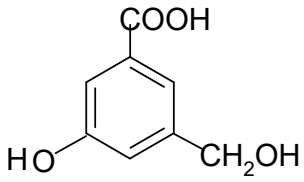
A mixture containing same volume of methane and chlorine in a closed glass container was irradiated with UV-light for three hours. Which of the following compound could be produced?

(I) CH_3Cl (II) CH_2Cl_2 (III) $CHCl_3$ (IV) C and H_2

(A) I, II, III (B) I, II (C) II, III
(D) IV (E) 其他的組合 Other combination

23. 右图显示某有机化合物的分子结构。它的性质包括….

The molecular structure of an organic compound is given on the right. Properties of the compound include….

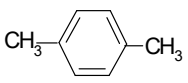


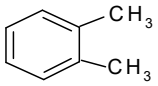
(I) 它可溶于水。 It is soluble in water.
(II) 它与 $FeCl_3$ 溶液起反应。 Itcan react with $FeCl_3$ solution.
(III)它与 $KMnO_4$ 溶液起反应。 It can react with $KMnO_4$ solution.
(IV) 它不能与氨反应。 It cannot react with ammonia.

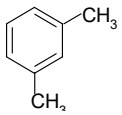
(A) I, II, III (B) I, III (C) II, IV
(D) IV (E) 其他的組合 Other combination

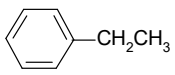
24. 苯环上的氫原子被溴原子替換，哪一个的一溴化物 C_8H_9Br 有二种异构体?

When one hydrogen of the benzene ring is replaced by a bromine, which of the mono-bromo compound(s) C_8H_9Brhas (have)2 structural isomers?

(I) 

(II) 

(III) 

(IV) 

(A) I, II, III (B) I, III (C) II, IV
(D) IV (E) 其他的組合 other combination

25. 下列关于有机化合物异构物数目，何者正确?

Which of the following statement is Correct regarding the number of the isomers of the compound?

(A) C_6H_{14} 的异构物共有 5 种; C_6H_{14}has 5 structural isomers.

(B) C_5H_{10} 含有一組顺反异构物; C_5H_{10} has one set of cis/trans stereoisomers.

(C) $C_5H_{10}O$ 的醇类异构物中，属于 2 級醇异构物有 2 种

$C_5H_{10}O$ contains two isomers as 2^o-alcohols.

(D) 二氯硝基苯 $C_6H_3Cl_2NO_2$ 的异构物共有 10 种

$C_6H_3Cl_2NO_2$ has 10 structural isomers.

(E) C_6H_{10} 含有参键的异构物共有 6 种

C_6H_{10} has 6 structural isomers containing triple bond