

1. 以下描述的哪一項性質是表明該化合物含有離子鍵？

Which of the following properties is specifically indicative that the compound contains ionic bond?

- (a) It is easily soluble in water. 它易溶于水。
- (b) It dissolves in water and produces ions. 它溶于水能產生離子。
- (c) It has high melting point. 它具有較高的熔點。
- (d) It can conduct electricity in molten state. 它在熔融狀態下能夠導電。
- (e) It can form hydrogen bonding. 它可以形成氫鍵。

2. 若以 61.3 g  $\text{Cl}_2$  ( $M = 70.91 \text{ g/mol}$ ) 與過量  $\text{PCl}_3$  反應, 得到 119.3 g  $\text{PCl}_5$  ( $M = 208.2$

$\text{g/mol}$ ), 反應式  $\text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow \text{PCl}_5(\text{g})$ ; 則產率為多少?

What is the percent yield for the reaction  $\text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow \text{PCl}_5(\text{g})$  if 119.3 g of  $\text{PCl}_5$  ( $M = 208.2 \text{ g/mol}$ ) are formed when 61.3 g of  $\text{Cl}_2$  ( $M = 70.91 \text{ g/mol}$ ) react with excess  $\text{PCl}_3$ ?

- (a) 195%    (b) 85.0%    (c) 66.3%    (d) 51.4%    (e) 43.7%

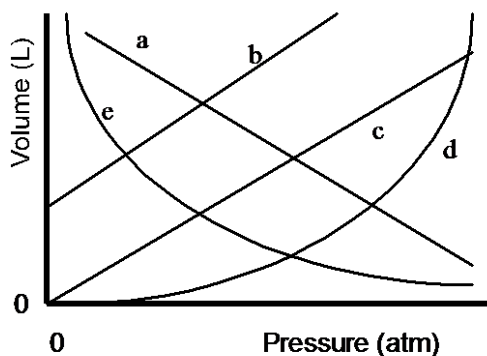
3. 下列何者的水溶性最差?

Which of the following will be least soluble in water?

- (a) potassium sulfate,  $\text{K}_2\text{SO}_4$     (b) ammonium nitrate,  $\text{NH}_4\text{NO}_3$
- (c) chloromethane,  $\text{CH}_3\text{Cl}$     (d) calcium chloride,  $\text{CaCl}_2$
- (e) ethanol,  $\text{C}_2\text{H}_6\text{O}$

4. 下圖中那一條線最能表示某固量空氣之體積與壓力的關係？考慮其溫度不變。

Which of the lines on the figure below is the best representation of the relationship between the volume of a gas and its pressure, other factors remaining constant?



- (a) a      (b) b      (c) c      (d) d      (e) e

5. 在氣壓 469 torr，溫度 29.3°C 下，一甲烷氣體占有 60.3L。當氣壓為 243 torr，體積仍為 60.3L 時，溫度是多少？

A sample of methane gas,  $\text{CH}_4(\text{g})$ , occupies a volume of 60.3 L at a pressure of 469 torr and a temperature of 29.3°C. What would be its temperature at a pressure of 243 torr and volume of 60.3 L?

- (a) -116.5°C      (b) 15.2 °C      (c) 15.5°C      (d) 57.7°C  
 (e) 310.6°C
6. 理想氣體定律在何種情況下不適用

The ideal gas law tends to become inaccurate when

- (a) 壓力降低且分子間作用力明顯  
 the pressure is lowered and molecular interactions become significant  
 (b) 壓力提升且溫度下降  
 the pressure is raised and the temperature is lowered  
 (c) 溫度上升並超過標準狀態  
 the temperature is raised above the temperature of STP  
 (d) 大量的氣體體積存在  
 large gas samples are involved  
 (e) 體積膨脹超過標準莫耳體積  
 the volume expands beyond the standard molar volume

7. 市面上販售的氨水重量百分濃度為 28%，則此溶液中氨的莫耳分率為多少？

Aqueous ammonia is commercially available in a solution that is 28% (w/w) ammonia. What is the mole fraction of ammonia in such a solution?

- (a) 0.017 (b) 0.023 (c) 0.012 (d) 0.24 (e) 0.29

8. 根據拉午耳定律，溶液中溶劑的蒸氣壓和溶劑的莫耳分率有關，下列敘述何者正確？

Raoult's Law relates the vapor pressure of the solvent above the solution to its mole fraction in the solution. Which of the following is an accurate statement?

- (a) 拉午耳定律適用於所有溶液

Raoult's Law applies exactly to all solutions

- (b) 拉午耳定律較適用於濃度較大的溶液

Raoult's Law works best when applied to concentrated solutions

- (c) 拉午耳定律較適用於稀薄溶液

Raoult's Law works best when applied to dilute solutions

- (d) 拉午耳定律僅用於非理想溶液

Raoult's Law applies only to non-ideal solutions

- (e) 以上皆非

None of these choices is correct

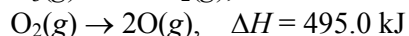
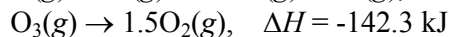
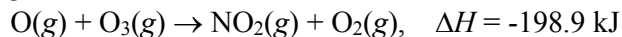
9. 將 15.0g 0.0°C 冰塊和 150.0g 70.0°C 的水放入咖啡杯卡計中，假設熱量沒有流失或增加，請計算最後達平衡的溫度為多少？

15.0 g of ice cubes at 0.0°C are combined with 150. g of liquid water at 70.0°C in a coffee cup calorimeter. Calculate the final temperature reached, assuming no heat loss or gain from the surroundings. (Data: specific heat capacity of  $H_2O(l)$ ,  $c = 4.18 J/g \times ^\circ C$ ;  $H_2O(s) \rightarrow H_2O(l) \Delta H = 6.02 kJ/mol$ )

- (a) 0.0 (b) 10.6 (c) 30.7 (d) 43.2 (e) 56.4

10. 由下列三種反應之反應熱數據，計算出反應  $NO(g) + O(g) \rightarrow NO_2(g)$  之反應焓的變化(enthalpy change)

Calculate the enthalpy change for the reaction  $NO(g) + O(g) \rightarrow NO_2(g)$  from the following data:



- (a) -551.6 kJ (b) -304.1 kJ (c) 190.9 kJ (d) 153.8 kJ  
(e) 438.4 kJ

11. 反應式  $A(g) + 2B(g) \rightarrow 2C(g) + 2D(g)$  在固定溫度下測得下列數據，則此反應的反應速率式(rate law)為何?

For the reaction  $A(g) + 2B(g) \rightarrow 2C(g) + 2D(g)$ , the following data were collected at constant temperature. Determine the correct rate law for this reaction.

Trial	Initial [A] (mol/L)	Initial [B] (mol/L)	Initial Rate (mol/(L·min))
1	0.125	0.200	7.25
2	0.375	0.200	21.75
3	0.250	0.400	14.50
4	0.375	0.400	21.75

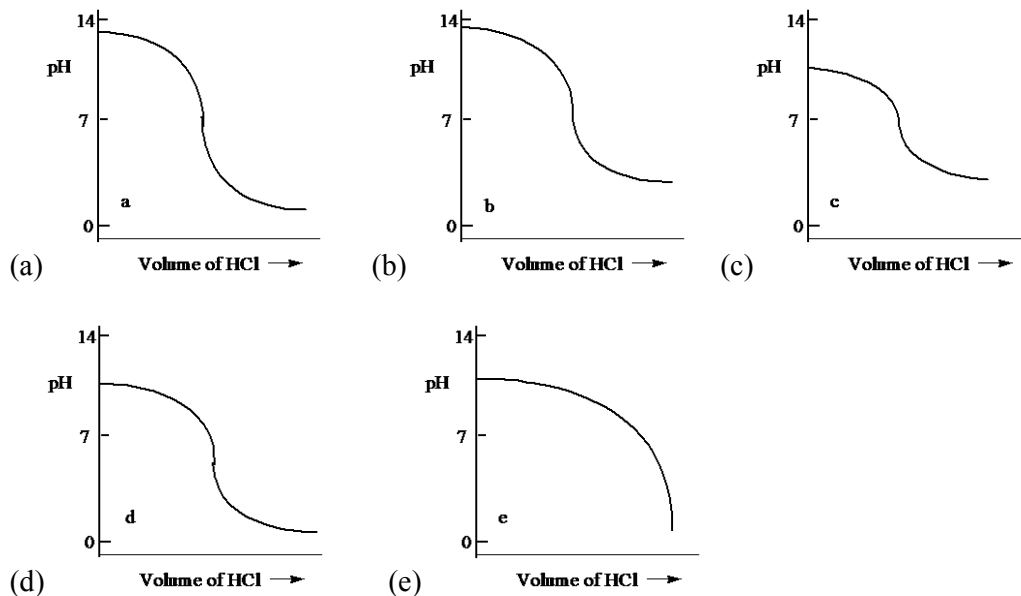
- (a) Rate =  $k[A][B]$       (b) Rate =  $k[A]^2[B]$       (c) Rate =  $k[A][B]^2$   
 (d) Rate =  $k[A]$       (e) Rate =  $k[A]^3$
12. 根據  $8A(g) + 5B(g) \rightarrow 8C(g) + 6D(g)$  之反應式，假如[C]增加速率為  $4.0 \text{ mol L}^{-1}\text{s}^{-1}$ ，則[B]速率變化為多少?

Consider this reaction:  $8A(g) + 5B(g) \rightarrow 8C(g) + 6D(g)$ , If [C] is increasing at the rate of  $4.0 \text{ mol L}^{-1}\text{s}^{-1}$ , at what rate is [B] changing?

- (a)  $-0.40 \text{ mol L}^{-1}\text{s}^{-1}$       (b)  $-2.5 \text{ mol L}^{-1}\text{s}^{-1}$   
 (c)  $-4.0 \text{ mol L}^{-1}\text{s}^{-1}$       (d)  $-6.4 \text{ mol L}^{-1}\text{s}^{-1}$   
 (e) 以上皆非，因為[B]速率變化必為正值  
 None of these choices is correct, since its rate of change must be positive
13. 含有  $0.45 \text{ M CH}_3\text{COOH}$  和  $0.35 \text{ M CH}_3\text{COONa}$  的緩衝溶液，pH 值為多少?  
 What is the pH of a buffer that consists of  $0.45 \text{ M CH}_3\text{COOH}$  and  $0.35 \text{ M CH}_3\text{COONa}$ ?  $K_a$  of  $\text{CH}_3\text{COOH}$  is  $1.8 \times 10^{-5}$
- (a) 4.49      (b) 4.64      (c) 4.85      (d) 5.00      (e) 5.52

14. 下列那一滴定曲線最能代表用相同濃度的鹽酸去滴定弱鹼( $0.10 \text{ mol L}^{-1}$ )的  
 滴定圖?

Which one of the following is the best representation of the titration curve which will be obtained in the titration of a weak base ( $0.10 \text{ mol L}^{-1}$ ) with HCl of the same concentration?



15. 以下何者不是氧化還原反應?

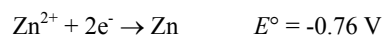
Which one of the following is not a redox reaction?

- (a)  $\text{Al}(\text{OH})_4^-(\text{aq}) + 4\text{H}^+(\text{aq}) \rightarrow \text{Al}^{3+}(\text{aq}) + 4\text{H}_2\text{O}(\text{l})$
- (b)  $\text{C}_6\text{H}_{12}\text{O}_6(\text{s}) + 6\text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$
- (c)  $\text{Na}_6\text{FeCl}_8(\text{s}) + 2\text{Na}(\text{l}) \rightarrow 8\text{NaCl}(\text{s}) + \text{Fe}(\text{s})$
- (d)  $2\text{H}_2\text{O}_2(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$
- (e)  $\text{CO}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g})$

16. 利用下面反應半電位之數據，那一金屬(Al 或 Ni)放置於  $\text{Zn}^{2+}$  溶液中，可將

$\text{Zn}^{2+}$  還原成  $\text{Zn}(\text{s})$  ?

Which metal, Al or Ni, could reduce  $\text{Zn}^{2+}$  to  $\text{Zn}(\text{s})$  if placed in a  $\text{Zn}^{2+}(\text{aq})$  solution?



- (a) Al
- (b) Ni
- (c) 兩種皆可 Both Al and Ni would work
- (d) 兩種皆不可 Neither Al nor Ni would work
- (e) 無法決定 This cannot be determined.

17. 基態鉻Cr 原子的電子組態為何？

The electron configuration for the chromium atom is:

- (a) [Ar] 4s<sup>2</sup>3d<sup>4</sup>    (b) [Ar] 4s13d<sup>5</sup>    (c) [Kr] 4s13d<sup>5</sup>    (d) [Kr] 4s<sup>2</sup>3d<sup>4</sup>

(e) 以上皆非 none of these

18. 有高 n/p 值的同位素會傾向經由下列何種過程衰變？

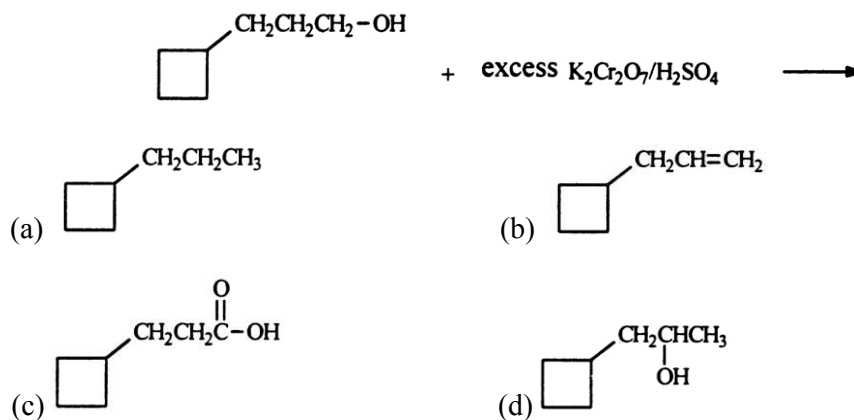
An isotope with a high value of n/p will tend to decay through

- (a) α decay.                      (b) β decay.                      (c) positron decay.  
(d) electron capture.    (e) γ decay.

19. 3-cyclobutyl-1-propanol 與過量的 potassium dichromate 在硫酸中反應(如下之

反應)後之產物為何？

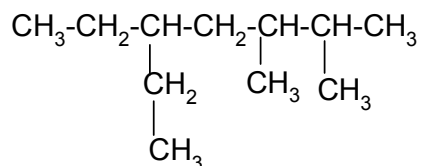
Identify the organic product when 3-cyclobutyl-1-propanol reacts with excess potassium dichromate in sulfuric acid.



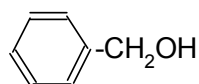
(e) 以上皆非 None of these choices is the organic product of the reaction

20. 某种含有一个三键的炔烃，加氢反应完成后，产生了以下的烷烃。此炔烃有多少个可能的结构？

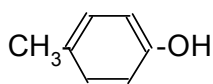
A certain alkyne has one triple bond, which after complete hydrogenation can produce an alkane of the following structure. There are how many possible structures of the alkyne?



- (a) 5            (b) 4            (c) 3            (d) 2            (e) 1
- 21.



(X)



(Y)

X 和 Y 两种化合物有相同的分子式  $\text{C}_7\text{H}_8\text{O}$ 。以下哪一项描述是正确的？  
The two compounds, X and Y, have the same molecular formula of  $\text{C}_7\text{H}_8\text{O}$ .  
Which of the following description is correct?

- (a) Both X and Y can react with sodium metal.  
X 和 Y 都可以与金属钠起反应。
- (b) Both X and Y can dissolve in NaOH solution.  
X 和 Y 都能溶于氢氧化钠溶液。
- (c) Both X and Y can react with  $\text{FeCl}_3$  solution.  
X 和 Y 都可以与  $\text{FeCl}_3$  溶液发生反应。
- (d) Both X and Y can decolorize bromine water.  
X 和 Y 都可以令溴水脱色。
- (e) Both X and Y are corrosive to our skin.  
X 和 Y 对我们的皮肤都有腐蚀性。

22. 单体  $\text{NH}_2(\text{CH}_2)_5\text{COOH}$  形成的聚合物是...

The polymer formed from  $\text{NH}_2(\text{CH}_2)_5\text{COOH}$  monomer is a .....

- (a) 聚乙烯 Polyethylene      (b) 聚酰胺 Polyamide    (c) 聚酯 Polyester  
(d) 有机玻璃 Organic glass    (e) 蛋白质 Protein

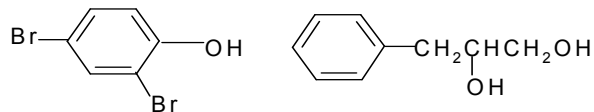
23. 下面关于棕榈油的描述中，哪个是不正确的？

Which of the following descriptions about palm oil is false?

- (a) 棕榈油是甘油三酯。Palm oil is a triglyceride.  
(b) 它是由脂肪酸与甘油酯化形成的。  
It is composed of fatty acids esterified with glycerol.  
(c) 它与热 NaOH 溶液起反应生产肥皂。  
It can react with hot NaOH solution to produce soap.  
(d) 它是主要天然维生素 C 的来源 it is a main natural source of vitamin C.  
(e) 棕榈油可用于制造生物柴油 Palm oil can be used for producing biodiesel.

24. 那一項試劑可以檢驗分別以下的两个有机化合物？

Which reagent could differentiate the following two organic compounds?



- (I)  $\text{KMnO}_4$  溶液 solution      (II)  $\text{AgNO}_3$  溶液 solution  
(III)  $\text{NaOH}$  溶液 solution      (IV) 金属钠 sodium metal

- (a) I,II,III      (b) I, III      (c) II,IV  
(d) IV      (e) 其他的组合 None of the above.

25. 下列哪一项能与新配制的  $\text{Cu}(\text{OH})_2$  溶液形成砖红色沉淀？

Which of the following can react with freshly prepared  $\text{Cu}(\text{OH})_2$  solution to form a brick red color precipitate?

- (I) 葡萄糖溶液 Glucose solution  
(II) 蔗糖溶液 Sucrose solution  
(III) 稀硫酸煮沸后的淀粉溶液。  
Solution of starch after boiling in dilute sulfuric acid.  
(IV) 稀氢氧化钠煮沸后的棕榈油。  
Palm oil after boiling with dilute sodium hydroxide.

- (a) I,II,III      (b) I, III      (c) II,IV  
(d) IV      (e) 其他的组合 None of the above.