

國立高雄大學 107 學年度研究所碩士班招生考試試題

科目：普通化學

系所：應用化學系

是否使用計算機：否

考試時間：100 分鐘

本科原始成績：100 分

請注意: 1-20 為選擇題，每題 2.5 分

21-28 為問答題，21-26 題，每題 6 分；27-28 題，每題 7 分

1. Using the rules of significant figures, calculate the following:

$$12.67 + 13.005 =$$

- a. 25.675
- b. 25
- c. 20
- d. 25.68
- e. 26

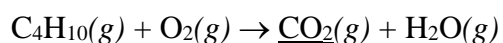
2. How many significant figures should there be in the answer when you divide 4.1 by 7.464?

- a. 7
- b. 4
- c. 3
- d. 2
- e. 1

3. The correct name for FeO is

- a. iron oxide
- b. iron(II) oxide
- c. iron(III) oxide
- d. iron monoxide
- e. iron(I) oxide

4. When the following equations are balanced using the smallest possible integers, what is the number in front of the underlined substance?



- a. 2
- b. 4
- c. 6
- d. 8
- e. 10

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5. The elements chlorine and iodine have similar chemical properties because they

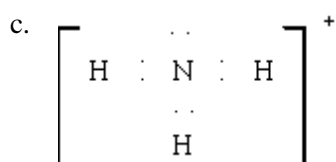
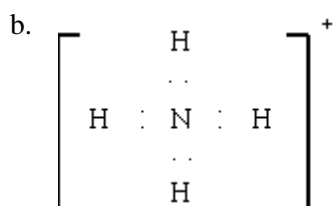
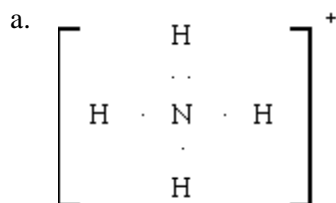
- a. are both metals
- b. are in the same chemical period
- c. have the same number of electrons in their outer energy levels
- d. have the same number of stable isotopes
- e. none of these

6. Order the following species from **smallest to largest ionization energy**.

Ca, Ca⁺, Ca²⁺

- a. Ca⁺ < Ca < Ca²⁺
- b. Ca²⁺ < Ca⁺ < Ca
- c. Ca < Ca⁺ < Ca²⁺
- d. Ca²⁺ < Ca < Ca⁺
- e. Ca < Ca²⁺ < Ca⁺

7. Choose the correct Lewis structure for the NH₄⁺ ion.



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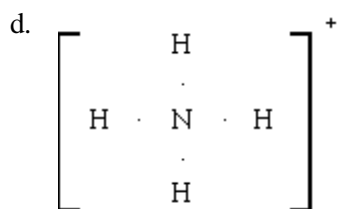
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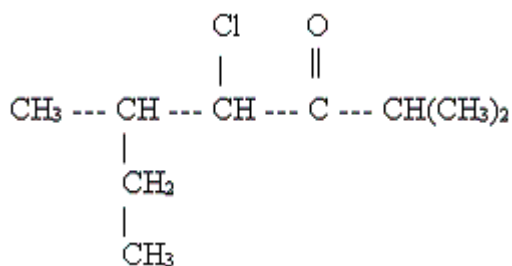
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e. none of these

8. Name the following.



- 2-chloro-3-ethyl-1-isopropylbutanone
- isopropyl-chloromethylbutyl ketone
- 2-butylchloroisobutanoyl methane
- 4-chloro-2,5-dimethyl-3-heptanone
- 3-methyl-4-chloro-1-isopropylpentanone

9. Doping Se with As would produce a(n) _____ semiconductor with _____ conductivity compared to pure Se.

- n*-type, increased
- n*-type, decreased
- p*-type, increased
- p*-type, decreased
- intrinsic, identical

10. In deciding which of two acids is the stronger, one must know:

- the concentration of each acid solution
- the pH of each acid solution
- the equilibrium constant of each acid
- all of the above
- both a and c must be known

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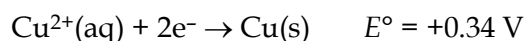
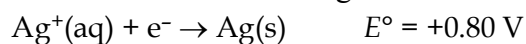
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11. A strip of copper is placed in a 1 M solution of copper nitrate and a strip of silver is placed in a 1 M solution of silver nitrate. The two metal strips are connected to a voltmeter by wires and a salt bridge connects the solutions. The following standard reduction potentials apply:



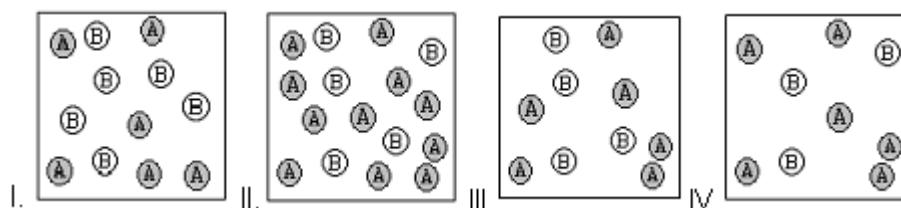
When the voltmeter is removed and the two electrodes are connected by a wire, which of the following does not take place?

- Electrons flow in the external circuit from the copper electrode to the silver electrode.
- The silver electrode increases in mass as the cell operates.
- There is a net general movement of silver ions through the salt bridge to the copper half-cell.
- Negative ions pass through the salt bridge from the silver half-cell to the copper half-cell.
- Some positive copper ions pass through the salt bridge from the copper half-cell to the silver half-cell.

12. The Fe-56 nucleus is known to be stable. What is the most likely decay for the Fe-59 nucleus?

- β decay
- positron emission
- α decay
- γ -ray emission
- two of these

13. A chemical reaction has the equation: $2\text{A} + \text{B} \rightarrow \text{C}$. In which case is B the limiting reactant?



- I
- II
- III
- IV
- B is limiting in at least two cases.

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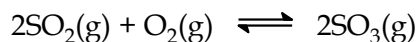
14. The radius of a Pb atom.

- a) 1.74 pm
- b) 17.4 pm
- c) 174 pm
- d) 1740 pm
- e) none of these

15. Rank the following compounds according to increasing solubility in water.

- I. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3$
 - II. $\text{CH}_3\text{-CH}_2\text{-O-CH}_2\text{-CH}_3$
 - III. $\text{CH}_3\text{-CH}_2\text{-OH}$
 - IV. $\text{CH}_3\text{-OH}$
- a) I < III < IV < II
 - b) I < II < IV < III
 - c) III < IV < II < I
 - d) I < II < III < IV
 - e) No order is correct.

16. Consider the reaction:



at constant temperature. Initially a container is filled with pure $\text{SO}_3(\text{g})$ at a pressure of 2 atm, after which equilibrium is reached. If y is the partial pressure of O_2 at equilibrium, the value of K_p is:

- a) $\frac{(2 - 2y)^2}{(y^2)(2y)}$
- b) $\frac{(2 - y)^2}{(y^2)(y/2)}$
- c) $\frac{(2 - y)^2}{(2y)^2(y)}$
- d) $\frac{(2 - 2y)^2}{(2y)^2(y)}$
- e) none of these

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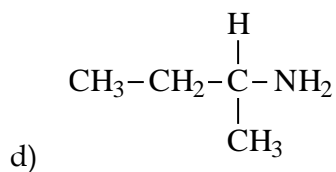
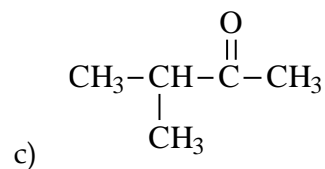
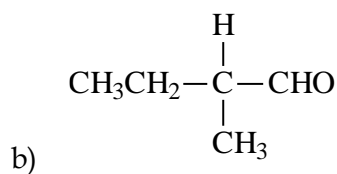
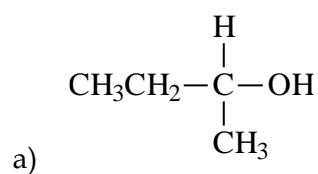
17. Methyl orange is an indicator with a K_a of 1×10^{-4} . Its acid form, HIn , is red, while its base form, In^- , is yellow. At pH 6.0, the indicator will be

- a) red.
- b) orange.
- c) yellow.
- d) blue.
- e) not enough information

18. For which of the following compound(s) are *cis* and *trans* isomers possible?

- a) 2,3-dimethyl-2-butene
- b) 3-methyl-2-pentene
- c) 4,4-dimethylcyclohexanol
- d) ortho-chlorotoluene
- e) All can exhibit *cis/trans* isomers.

19. Which structure represents an optically active aldehyde?



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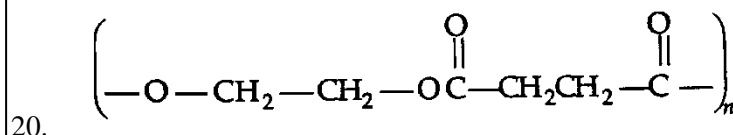
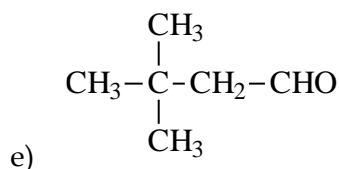
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What monomer(s) is (are) needed to make the polymer shown above?

- I. $\text{HOCH}_2\text{CH}_2\text{OH}$
 - II. $\text{HOOCCH}_2\text{CH}_2\text{COOH}$
 - III. $\text{HOCH}_2\text{CH}_2\text{COOH}$
 - IV. $\text{HOCH}=\text{CHOH}$
 - V. $\text{HOOCCH}=\text{CHCOOH}$
- a) II
 - b) III
 - c) I and II
 - d) IV and V
 - e) II and III

21. Oxalic acid is often used to remove rust stains. What properties of oxalic acid allow it to do this?

22. What is the difference between ΔH and ΔE in Thermochemistry?

23. A best buffer has about equal quantities of weak acid and conjugate base present as well as having a large concentration of each species present. Explain

24. How can one construct a galvanic cell from two substances, each having a negative standard reduction potential?

25. If you had a group of hydrocarbons, what structure features would you look at to rank the hydrocarbons in order of increasing boiling point?

