## **Prerequisite Knowledge Test**

## **Part A Multiple Choice**

- 1. An approximately 1 M aqueous HCl solution can best be prepared by adding:
  - A) 100 mL of 10 M aqueous HCl to 10 mL of Water
  - B) 100 mL of 10 M aqueous HCl to 990 mL of Water
  - C) 10 mL of 10 M agueous HCl to 100 mL of Water
  - D) 90 mL of 10 M aqueous HCl to 10 mL of Water
  - E) 10 mL of 10 M aqueous HCl to 90 mL of Water
- 2. Hydrogen cyanide, HCN, is a poisonous gas that is also important in industrial chemical synthesis. It is produced from methane, ammonia and oxygen according to

 $2 \text{ CH4(g)} + 2 \text{ NH3(g)} + 3 \text{ O2(g)} \rightarrow 2 \text{ HCN(g)} + 6 \text{ H2O(g)}$ 

What mass of oxygen (in kg) is required to produce 200 kg of hydrogen cyanide?

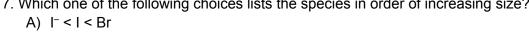
- A) 149
- B) 423
- C) 257
- D) 317
- E) 355
- 3. What is the chemical formula of sodium carbonate?
  - A) NaCO<sub>3</sub>
  - B) NaClO<sub>3</sub>
  - C)  $Na(CO_3)_2$
  - D) Na<sub>2</sub>CO<sub>3</sub>
  - E) Na<sub>2</sub>CO<sub>2</sub>
- 4. What is the empirical formula of the compound formed by gallium and oxygen?
  - A) GaO<sub>3</sub>
  - B) Ga<sub>2</sub>O
  - C)  $Ga_3O_2$
  - D) GaO
  - E) Ga<sub>2</sub>O<sub>3</sub>
- 5. Balance the reaction (unbalanced as written),

 $OCI-(aq) + H2CO(aq) \rightarrow CI-(aq) + HCOO-(aq)$ 

under basic conditions. If 1 mol of H2CO is consumed, how much OH-(aq) is consumed/produced?

- A) 1 mol of OH-(aq) is consumed
- B) 3 mol of OH-(aq) is produced
- C) 1 mol of OH-(aq) is produced
- D) 2 mol of OH-(aq) is produced
- E) 2 mol of OH-(aq) is consumed

6. Which one of the following atoms has two unpaired electrons in its ground state electronic
configuration?
A) B
B) He
C) N
D) C
E) Be
7. Which one of the following choices lists the species in order of increasing size?



- B)  $F^- < F < CI$
- C)  $F^- < Cl^- < Cl$
- D)  $Cl^+ < Cl^- < Cl$
- E) F < F<sup>-</sup> < Cl<sup>-</sup>
- 8. The cation <sup>33</sup>S<sup>+</sup> contains
  - A) 17 neutrons, 16 protons, 17 electrons
  - B) 33 neutrons, 17 protons, 16 electrons
  - C) 16 neutrons, 16 protons, 15 electrons
  - D) 17 neutrons, 17 protons, 16 electrons
  - E) 17 neutrons, 16 protons, 15 electrons
- 9. What mass (in g) of CaO(s) is produced when 6.80 g of calcium metal reacts with 2.00 L of oxygen at 298 K and 1.00 atm pressure?
  - A) 6.89
  - B) 9.17
  - C) 10.1
  - D) 9.87
  - E) 8.14
- 10. For the following pure substances, identify the one incorrect chemical name from among the following:
  - A) Li2CO3, lithium carbonate
  - B) Fe2O3, iron(III) oxide
  - C) HF, hydrogen fluoride
  - D) Ca(H2PO4)2, calcium dihydrogen phosphate

## **Part B Application Question**

- 1. Calculate the number of moles of silver present in 1.505 \* 10<sup>23</sup> atoms of Ag.
- 2. For 415.68g of Ca(OH)<sub>2</sub>, determine the follow
  - a) The moles of Ca(OH)<sub>2</sub>
  - b) Determine the moles of oxygen atoms from a)

- 3. A student conducted an experiment for which the theoretical yield of the product was 1.7g. Upon completion, the student reported an actual yield of 1.2g.
  - a) Determine the percentage yield
  - b) Is the student's actual yield possible? Justify your answer, including an explanation of how this result may have been obtain within 1-3 lines

- 4. A new employee is asked to make Al(OH)3 using the following balanced reaction:  $Al_2S_3 + 6H_2O => 2Al(OH)_3 + 3H_2S$ . The employee decides to use 270.2g of  $Al_2S_3$  and 151.2g of  $H_2O$ .
  - a) Demine the limiting reactant
  - b) Determine the mass of excess reactant that will be left over
  - c) In 1-2 sentence, explain why the employee's supervisor was NOT pleased with this work and how the employee can improve their work next time?