Reaction of Non-metals with Air (Oxygen) and Water

A. Fill in the Blanks

Complete the following sentences with the correct word or phrase.

1. Non-metals react with oxygen to form _____ oxides.

2. The reaction of a non-metal with oxygen is an example of an _____ reaction.

3. Most non-metals _____ react with water at room temperature.

4. An acidic solution will turn _____ litmus paper to _____.

5. The acid formed when sulfur dioxide dissolves in water is called _____ acid.

B. Match the Following;

Match the items in Column A with the most appropriate description in Column B.

Column A	Column B
1. Carbon	A. Forms sulfurous acid in water.
2. Sulfur Dioxide	B. A highly reactive non-metal stored in water.
3. Phosphorus	C. The main element in coal and charcoal.
4. Carbonic Acid	D. Is a neutral oxide of a non-metal.
5. Carbon Monoxide	E. Formed when CO_2 dissolves in water.

1. _____ 2. _____ 3. _____ 4. _____ 5. _____

C. Practice Problems

Apply your knowledge to solve these problems. Write word equations where required.

1. When a piece of charcoal (which is mostly carbon) is burned in the air, it glows red. Write the word equation for this reaction.

2. Sulfur powder is burned in a spoon. It burns with a blue flame and produces a gas with a pungent, choking smell. What is the name of the gas produced?

3. Write the word equation for the reaction of sulfur burning in oxygen.

4. If the gas from question 2 (sulfur dioxide) is dissolved in water, what type of substance is formed (acid, base, or salt)?

5. Write the word equation for the reaction of carbon dioxide with water.

6. What is the name of the acid formed when carbon dioxide dissolves in water?

7. A student observes that a solution turns blue litmus paper red. What can she conclude about the nature of the solution?

8. Why is white phosphorus, a highly reactive non-metal, stored under water?

9. Name the acid formed when sulfur dioxide reacts with water.

10. A non-metal 'X' burns in oxygen to form an oxide. When this oxide is dissolved in water, the resulting solution feels slippery and turns red litmus blue. Is 'X' a typical non-metal? Explain your answer.

D. Warm-up Questions

Answer these quick questions to refresh your memory.

1. Name any two non-metals.

2. What is the main gas in the air that substances burn in or react with?

3. When a non-metal reacts with oxygen, what type of compound is generally formed?

4. Are the oxides of non-metals typically acidic, basic, or neutral?

5. What color does blue litmus paper turn in an acidic solution?

E. Challenge Questions

Think critically to answer these more difficult questions.

1. Nitrogen is a non-metal and makes up about 78% of the air. Oxygen makes up about 21%. Why don't nitrogen and oxygen react with each other under normal conditions? What special condition can cause them to react (e.g., in the atmosphere)?

2. A student burns magnesium ribbon (a metal) and sulfur powder (a non-metal) separately. They collect the oxide from each reaction and dissolve it in water. They then test each solution with red and blue litmus paper. Predict the results for both solutions in a table format.

3. Some non-metal oxides are neutral, meaning they are neither acidic nor basic. Can you name one such neutral oxide?

4. Write the balanced chemical equation for the reaction of carbon with excess oxygen. (Hint: Carbon is C, Oxygen is O_2, Carbon Dioxide is CO_2).

5. Explain the entire process of how burning coal in factories can lead to the formation of acid rain. Mention the non-metals, the oxides, and the acids involved.

F. Word Problems & Application

Connect your knowledge to real-world scenarios.

1. **Fizzy Drinks:** The fizz in carbonated drinks like soda is caused by a dissolved gas. When you open the bottle, this gas escapes. This gas is an oxide of a non-metal. What is this gas, and what acid does it form in the water to give the drink its slightly sharp taste?
2. **Fire Safety:** Carbon dioxide is used in some fire extinguishers. Based on what you know about the reaction of non-metals with oxygen, explain why carbon dioxide is effective at putting out fires.
3. **Gardening:** A gardener's soil is too alkaline (basic). To make it more neutral, they need to add something acidic. They are told that adding sulfur powder and mixing it into the soil can help over time. Explain the chemical reactions that would allow sulfur to make the soil more acidic.
4. **Lab Accident:** Imagine a small amount of acid is spilled on a lab bench. The teacher sprinkles a white powder on it, which fizzes and neutralizes the acid. This powder is a metal compound (sodium bicarbonate). Now, imagine a non-metallic oxide gas like sulfur dioxide was accidentally released. Why would you not use water to try and "wash" the gas out of the air in a small, enclosed room?
5. **Breathing:** We breathe in air (containing oxygen) and breathe out a mixture of gases that is rich in carbon dioxide. Is the carbon dioxide we exhale acidic? How could you test this?

G. True or False

1. Carbon dioxide is a basic oxide. _____
2. Non-metals react with water to produce hydrogen gas. _____
3. Sulfur dioxide dissolved in water will turn red litmus paper blue. _____
4. Phosphorus is stored in oil because it is a highly reactive non-metal. _____
5. Acid rain is caused by metallic oxides dissolving in rainwater. _____