CARBON AND ITS COMPOUNDS

CHEM II

THEORY: physical and chemical properties; organic chemistry's principle element: Carbon

INTRODUCTION:

Carbon exists in allotropic forms: diamond, graphite, and in amorphous (micro-crystalline) forms such as charcoal, coke, and carbon black. The term allotropy is used to designate the existence of an element in two or more forms in the same physical state.

Amorphous solids lack the definite ordered arrangement of internal structure that crystalline solids have.

Carbon is the first member of Group IVA of the periodic table. It has 4 valence electrons, and has a maximum oxidation state of +4. Carbon nearly always combines with other atoms by sharing electrons. It is almost chemically inert toward most reagents at ordinary temperatures.

When any form of carbon is burned in an excess of oxygen, carbon dioxide is produced. Many carbonates give off carbon dioxide when they are heated. Carbon dioxide is a colorless and odorless gas, present in the atmosphere in the range 0.03 to 0.04%. In combination with water it forms the weak acid, carbonic acid. Carbon dioxide is extremely important in biochemistry; it is not only an essential raw material for photosynthesis-the mechanism of production of energy-rich nutrient molecules in the universe-but also a vastly important regulator in human respiratory systems, and substantial contributor to an important buffer system in the body.

PURPOSE: To become familiar with the properties of C and CO_2.

PROCEDURE:

PART A. CARBON

1. SOME SOURCES OF CARBON: Light a small birthday candle and drip some wax onto a penny. Stand the lit candle upright. What is the black smoke? Observe and record your result. (1) Add a drop of 2 of conc. sulfuric acid to a few crystals of sucrose contained in an evaporating dish. Record your result. (2)

2. PROPERTIES OF CARBON:

A. REDUCTION OF METAL OXIDES - Mix 1.00g of manganese (IV) oxide with an equal volume of powdered charcoal (C). Place this mixture in a test tube and fit a stopper and a delivery tube bent at right angle.

Heat the mixture and bubble the evolved gas through clear limewater (saturated calcium hydroxide). The change in the appearance of the limewater constitutes a test for carbon dioxide. Record your observations.(3)

Now, remove the tube containing the limewater and continue to heat the reaction tube strongly for a time. Empty the contents into an evaporating dish and add water; wash away the less dense parts of the residue. What is left? Record your observations.(4)

B. ADSORPTION: Dissolve a small amount of brown sugar in 10 mL of water, add an equal amount of activated charcoal. Heat the mixture almost to boiling. Shake the mixture frequently during the heating. After a few minutes, filter the mixture. Note the color of the filtrate and any other observations during this test. (5)

PART B: CARBON DIOXIDE

SOURCES OF CARBON DIOXIDE

A. RESPIRATION: Using a glass tube, blow your breath through 5 mL of clear limewater. Record (6)

B. ACTION OF ACIDS ON CARBONATES: Treat small amount of solid calcium carbonate (use mortar and pestle, if needed) with approx. 5 mL of 4 M HCl in a test tube fitted with a stopper carrying a delivery tube. Pass the evolved gas into limewater. Record your results. (7)

PART C: HYDROCARBON MODELS

Use the model kits to make: Propane, Butane, pentane, cyclohexane, ethene, 1,2-dichloroethene, butene, ethyne, benzene. Sketches are the structural diagrams and any structural or geometric isomers.

DATA: Make a data table and be sure to include your results from (1)- (7) in the procedure.

Propane Molecular Formula_____ Structural Formula: Sketch: Other isomers?	Butane Molecular Formula_____ Structural Formula: Sketch(es):
Pentane Molecular Formula_____ Structural Formula(s): Sketch(es):	Cyclohexane Molecular Formula_____ Structural Formula: Sketch: Conformations Boat Chair Rotation around C-C bond?
Ethene Molecular Formula_____ Structural Formula: Sketch: Rotation around C= C bond?	1,2-Dichloroethene Molecular Formula_____ Structural Formula: Sketch: Cis Trans
Butene molecular formula_____ Structural Isomers: Structural Formula(s): Sketch(es): :	Ethyne Molecular Formula_____ Structural Formula: Sketch: Shape? Rotation around triple C bond?

Butene Geometric Isomers Sketches	Benzene molecular formula_____ Structural Formula: Sketch: Is the molecule planar? Chair and boat conformations?

DISCUSSION:

1. Write the equation for the reaction in REDUCTION OF METAL OXIDES.
2. What is a candle made of and why can we use it to test positively for C?
3. Why is calcium hydroxide called limewater?
4. Why would a scientist what to test for carbonate?
5. Where is activated charcoal used? Why is it used?

ERROR ANALYSIS:

RESOURCES:

CONCLUSION: