

3. Base
4. Acid
5. Cesium
6. Sodium, zinc, copper, gold
7. Calcium carbonate is a base (even though it has no OH in the formula), and it is used to neutralize acid rain in the lake water.
8. (a) Hydrogen
(b) Carbon dioxide

Understanding Key Ideas

9. (a) Acid
(b) Base
(c) Base
(d) None of these
(e) Salt
(f) Acid
(g) Salt
10. (a) $\text{HF} + \text{NaOH} \rightarrow \text{NaF} + \text{H}_2\text{O}$
(b) $\text{H}_3\text{PO}_4 + 3\text{KOH} \rightarrow \text{K}_3\text{PO}_4 + 3\text{H}_2\text{O}$
(c) $\text{H}_2\text{SO}_4 + \text{Ca}(\text{OH})_2 \rightarrow \text{CaSO}_4 + 2\text{H}_2\text{O}$
(d) $\text{CH}_3\text{COOH} + \text{NaOH} \rightarrow \text{NaCH}_3\text{COO} + \text{H}_2\text{O}$
(e) $3\text{H}_2\text{CO}_3 + 2\text{Al}(\text{OH})_3 \rightarrow \text{Al}_2(\text{CO}_3)_3 + 6\text{H}_2\text{O}$
11. Blue. Magnesium burns to form magnesium oxide, and metal oxides form bases in water, making the resulting solution basic. Litmus is blue in basic solutions.
12. Yellow. Sulfur burns to form sulfur oxides, and non-metal oxides form acids in water, making the resulting solution acidic. Bromothymol blue turns yellow in acidic solutions.

Pause and Reflect Answer

Students' answers may include some of these points.

- The environmental concern from smelting sulphur containing ores is acid precipitation due to the production of sulfur oxides that mix with atmospheric water to produce sulfuric and sulfurous acids.
- Sulfur capture during the smelting process will prevent the escape of sulfur oxides into the environment. Removing sulfur oxides from the smelting exhaust is likely the most practical approach, though students would not be expected to know this.

Other Assessment Opportunities

- Assessment Checklist 1, Making Observations and Inferences
- Assessment Checklist 4, Laboratory Report

- Assessment Checklist 25, Safety Checklist
- Process Skills Rubric 7, Predicting
- Process Skills Rubric 8, Interpreting Data
- Process Skills Rubric 10, Measuring and Reporting
- Assessment Rubric 5, Conduct an Investigation Rubric
- Assessment Rubric 11, Communication Rubric
- Assessment Rubric 12, Using Tools, Equipment, and Materials Rubric

5.3 ORGANIC COMPOUNDS

BACKGROUND INFORMATION

This section introducing organic chemistry to students is of particular value to those students who take further courses in biology before taking further courses in chemistry. Given that over half the known compounds are organic compounds, no introduction to chemistry could be considered complete without reference to it. The advent of this branch of chemistry involved one of the greatest paradigm shifts in western scientific thought. The world view 200 years ago of scientists and many others was that materials involved with life processes (i.e., organic) were fundamentally different from those of the non-living world (i.e., inorganic). It was assumed also that the divide was so complete that inorganic materials could not be made into organic ones. Historically, Fritz Wohler was the chemist who discovered that two entirely inorganic salts could be reacted together to produce the chemical known as urea, an organic substance. It was not this particular transformation that was so shattering but that such a transformation could occur at all. From this point on in the minds of western scientists, there was no absolute separation between matter that composed the biological world and matter that composed the non-biological world.

Yet, the terms "organic" and "inorganic" still have meaning. Organic compounds, with a few exceptions such as carbonates, carbides, and oxides, are compounds containing carbon. Inorganic compounds are all other compounds, including the exceptions just listed. The starting point for the study of organic chemistry is the class of compounds known as hydrocarbons, which contain only carbon and hydrogen. These compounds are components of natural gas, camping fuels, gasoline, and beeswax. These substances are simply composed of ever-lengthening chains of carbon atoms, with associated hydrogens attached as well. Even sandwich wrap is derived from extremely long (5000 or so) chains of carbon.