RLP-PSA · RLP Physical Science A — Matter, Bonding, Reactions and the Nucleus

Unit 2: Bonding and the Properties of Substances

Practice Workbook. The same problems, in the same order, as the Practice sections of the online lessons.

Name _____ Period _____

Lesson 2.1 — Salt on Missouri Roads: Forces Between Particles

FLUENCY

1. Electronegativities: Na 0.93, Cl 3.16. Find the difference and classify the Na–Cl bond.

2. Electronegativities: H 2.20, Cl 3.16. Find the difference and classify the H–Cl bond.

3. Electronegativities: C 2.55, H 2.20. Classify the C–H bond.

4. Electronegativities: K 0.82, F 3.98. Classify the bond in KF.

5. Classify the bond in Cl_2.

6. Electronegativities: N 3.04, H 2.20. Classify the N–H bond and say which atom carries the partial negative charge.

7. Name the type of bonding (ionic, covalent or metallic) in: copper wire, table salt, water, sugar, aluminum foil.

APPLICATION

8. Magnesium oxide (Mg^{2+}, O^{2-}) melts at about 2,852 °C and sodium chloride (Na^{+}, Cl^{-}) at 801 °C. Use the idea that electrical force grows with the size of the charges to explain the difference.

9. MoDOT-style anti-icing brine is close to 23.3% sodium chloride by mass, the strength the federal anti-icing manual recommends. A student lets 250 g of this brine evaporate in a shallow dish. About how much salt should remain?

10. A student says the white salt stays behind on a dried highway because salt is heavier than water, so it cannot float up into the air. Explain what is wrong and give the particle-level reason.

CHALLENGE

11. Silicon (1.90) bonds to oxygen (3.44) in quartz sand. Classify the Si–O bond, then explain why sand does not melt in boiling water even though its bonds are covalent, not ionic.

REVIEW

12. Convert 100 g to kg.

13. Predict the ions formed by magnesium and by oxygen, and write the formula of their compound.

14. Which is more reactive, calcium or magnesium? Give the periodic-table reason.

Lesson 2.2 — Mystery White Solids

FLUENCY

1. A solid dissolves in water and the solution lights the LED. What kind of particles does the solution contain?

2. A solid dissolves in water but the solution does not conduct. What can you infer?

3. Which of salt, sugar, wax and sand melted in the 70 °C water, and what does that tell you?

4. Name the independent variable, the dependent variables and two controlled variables in the mystery-solids lab.

5. Order salt (801 °C), sugar (about 186 °C), wax (about 60 °C) and quartz (about 1,700 °C) from weakest to strongest forces between particles.

APPLICATION

6. About 35.9 g of salt dissolves in 100 g of water at 20 °C, and about 202 g of sugar does. How much of each would dissolve in 250 g of water at 20 °C?

7. A student's sugar solution made the LED glow faintly, the same brightness as the tap-water control. Should the student conclude sugar is ionic? Explain.

8. Unknown X: dissolves completely, LED bright (2), does not melt in the bath. Unknown Y: does not dissolve, LED dark (0), does not melt in the bath. Identify each from the four lab solids and give your reasoning.

CHALLENGE

9. Design a test to decide whether an unknown white solid is sugar or baking soda (sodium hydrogen carbonate, an ionic compound), using only equipment from this lab. Say what result would identify each.

REVIEW

10. What volume does 13.5 g of aluminum (density 2.7 g/cm^3) occupy?

11. Bromine is 50.69% Br-79 (78.9183 u) and 49.31% Br-81 (80.9163 u). Find its average atomic mass.

Lesson 2.3 — Why Water Boils So High: Arguing About Intermolecular Forces

FLUENCY

1. Which boils at a higher temperature, krypton or neon? Name the force responsible.

2. Which molecules can form hydrogen bonds with each other: CH_4, NH_3, H_2O, H_2S, HF?

3. How many degrees higher does water (100.0 °C) boil than H_2S (−60.3 °C)?

4. Rank all intermolecular attractions from generally weakest to strongest: hydrogen bonds, dispersion forces between small molecules, forces between polar molecules without N–H, O–H or F–H bonds.

5. True or false: boiling water breaks the O–H bonds inside water molecules.

APPLICATION

6. HF boils at 19.5 °C and HCl at −85.1 °C, even though HCl is the larger molecule. Find the difference and write a claim with evidence and reasoning.

7. Group 16 hydrides boil at H_2S −60.3 °C, H_2Se −41.3 °C and H_2Te −2.2 °C. Describe the trend and say what it predicts for water if only dispersion forces mattered.

8. Sketch a graph with period (2 to 5) on the x-axis and boiling point on the y-axis for the group 16 hydrides, and circle the anomaly. Write one sentence describing what the graph shows that the list does not.

CHALLENGE

9. Ice floats on water. Use hydrogen bonding to explain why solid water is less dense than liquid water, and why this matters for fish in a Missouri farm pond in winter.

REVIEW

10. What volume does 13.5 g of aluminum (density 2.7 g/cm^3) occupy?

11. An ion has 8 protons and 10 electrons. Write its symbol.

Lesson 2.4 — Structure and Function in Designed Materials

FLUENCY

1. How many valence electrons do H, C, N, O and Cl have?

2. How many bonds does each atom usually form: H, O, N, C?

3. Give the shape of CO_2, H_2O and CH_4.

4. Which are polar molecules: CO_2, H_2O, CH_4, NH_3?

5. How many lone pairs are on the oxygen in water, and on the nitrogen in ammonia?

APPLICATION

6. Graphite and diamond are both pure carbon. Use their structures to explain why graphite conducts and marks paper, while diamond is an insulator and the hardest natural material.

7. A superabsorbent polymer absorbs far less water from salty soil water than from pure water. Offer a particle-level explanation.

8. Write a structure-force-function explanation for why rainwater beads up on a car waxed with a long-chain hydrocarbon wax.

CHALLENGE

9. Polyethylene grocery bags are soft and stretchy, but a heavily cross-linked plastic is rigid. Explain using what cross-links do to polymer chains.

REVIEW

10. Convert 60 mL to L.

11. Gallium is 60.11% Ga-69 (68.9256 u) and 39.89% Ga-71 (70.9247 u). Find its average atomic mass.

Unit 2 checkpoint

1. Electronegativities: Li 0.98, F 3.98. The bond in LiF is
   A. nonpolar covalent
   B. polar covalent
   C. ionic
   D. metallic
2. Which property is the best evidence that a dissolved substance is ionic?
   A. It dissolves quickly
   B. Its solution conducts electricity
   C. It is white
   D. It has a crystal shape
3. Wax melts in hot water but salt does not. This shows that
   A. wax has stronger forces between its particles
   B. salt has stronger forces between its particles
   C. salt is heavier
   D. wax is ionic
4. Water boils at 100 °C and H₂S at −60.3 °C. The main reason is
   A. water is heavier
   B. hydrogen bonding between water molecules
   C. H₂S is ionic
   D. water has more electrons
5. Attractions caused by momentary shifts in electron clouds are called _____ forces, and they are stronger for _____ molecules.
6. True or false: Water and carbon dioxide both contain polar bonds, but only water is a polar molecule.
7. Graphite conducts electricity because
   A. it is a metal
   B. electrons can move along its carbon sheets
   C. it contains ions
   D. it is a polymer
8. True or false: Melting sugar breaks the covalent bonds inside sugar molecules.

9. Which structural feature makes a superabsorbent polymer hold water?
   A. Fluorine atoms on the chain
   B. Many charged groups that attract polar water
   C. Double bonds
   D. A metallic lattice

10. A trial with only water, used as a baseline for the conductivity test, is called a _____.

11. Two soil additives each win on different criteria. What makes a recommendation defensible?
   A. Picking the cheaper one
   B. Ranking the criteria by priority and stating the trade-offs
   C. Choosing the newer technology
   D. Counting the number of advantages only

12. True or false: Magnesium oxide melts at a much higher temperature than sodium chloride partly because its ions carry larger charges.

Sejal Learning Systems · Royal Legacy Preparatory School · Generated from the course's practice files; generated problems are checked by computer, authored problems by their author.