

Problem Set II

SECTION 1C

19. Acidic: c. Basic: a, b. Neutral: d.

20. a. A soft drink
b. Coffee
c. Milk of magnesia
21. 100 times more acidic
22. Impaired fish-egg development, increased concentrations of toxic metals, and dissolution of skin and scales
23. Polar molecules have uneven distribution of electrical charge; nonpolar molecules have uniform distribution of electrical charge.
24. Lamp oil; nonpolar solvents dissolve nonpolar solutes
25. NaCl is an ionic substance whose charged particles are attracted by and dissolved in polar solvents, like water, but not in nonpolar solvents, like cooking oil.
26. Polar solvents tend to dissolve polar and ionic solutes, due to the attraction of charged particles and partially charged molecules. Nonpolar solvents and solutes tend to mix in the dissolving process.
27. Water molecules are polar; they cannot dissolve and remove nonpolar grease from dishes.
28. It decreases.
29. About 20 mg
30. It causes a corresponding increase in the amount of dissolved gas in their blood.
31. The solubility of CO₂ in cola decreases as the cola temperature increases. As a result, there is a greater release of excess dissolved CO₂ from warmer cola than from colder cola.
32. a. Green sunfish
b. About 2.8 mg/L more

Solutions can be characterized as acidic, basic, or chemically neutral on the basis of their observed properties.

17. What ion is found in many bases?
18. What element is found in most acids?
19. Classify each sample as acidic, basic, or chemically neutral:
a. seawater (pH = 8.6)
b. drain cleaner (pH = 13.0)
c. vinegar (pH = 2.7)
d. pure water (pH = 7.0)
20. Using Figure 1.44 on page 70, decide which is more acidic:
a. a soft drink or a tomato
b. black coffee or pure water
c. milk of magnesia or household ammonia
21. How many times more acidic is a solution at pH 2.0 than a solution at pH 4.0?
22. List three negative effects of inappropriate pH levels on aquatic organisms.

The solubility of a molecular substance in water depends on the relative strength of solute-water attractive forces, compared to competing solute-solute and water-water attractive forces:

23. Distinguish between polar and nonpolar molecules.
24. Would you select ethanol, water, or lamp oil to dissolve a nonpolar molecular substance? Explain.
25. Why does table salt (NaCl) dissolve in water but not in cooking oil?
26. Explain the phrase "like dissolves like."
27. Explain why you cannot satisfactorily clean greasy dishes with just plain water.

The solubility of a gaseous substance in water depends on the water temperature and the external pressure of the gas.

28. With increasing water temperature, how does the solubility of oxygen change?
29. How many milligrams of O₂ will dissolve in 1000.0 g water at 2.5 atm? (Hint: Use Figure 1.49 on page 76.)
30. As scuba divers descend, the pressure increases on the gases they breathe. How does the increasing pressure affect the amount of gas dissolved in their blood?
31. Given your knowledge of gas solubility, explain why a bottle of warm cola produces more fizz when opened than does a bottle of cold cola.
32. Using the graph on page 77, determine
a. which type of fish requires more dissolved oxygen in water in the winter than in the summer.
b. how much more dissolved oxygen in water is required by yellow perch in the summer than in the winter.

Connecting the Concepts

33. Many mechanics prefer to use waterless hand cleaners to clean their greasy hands. Explain
a. what kind of materials are likely to be found in these cleaners.
b. why using these cleaners is more effective than washing with water.
34. From each of these pairs, select the water source more likely to contain the higher concentration of dissolved oxygen. Give a reason for each choice.
a. a river with rapids or a calm lake
b. a lake in spring or the same lake in summer
c. a lake containing only black crappie fish or a lake containing only black bullhead fish
35. Fluorine has the highest electronegativity of any element. Fluorine and hydrogen form a polar bond. Which atom in HF would you expect to have a partial positive charge? Explain.
36. Suppose there are two identical fish tanks with identical conditions except for temperature. Tank A is maintained at a temperature 5 °C higher than is Tank B. Which tank could support the greater number of similar fish? Explain.
37. Using Figure 1.48 on page 75,
a. determine the solubility of oxygen at 20 °C.
b. express the answer you obtained in ppm.

Connecting the Concepts

33. a. They are likely to contain nonpolar materials.
b. Because they can dissolve nonpolar greases and oils
34. a. A river with rapids, which promote mixing water with air
b. The lake in spring; it would be cooler, thus increasing the solubility of oxygen.
c. Overall, black crappies require more oxygen than black bullheads to survive. Therefore, the lake containing the black crappies probably has more dissolved oxygen.

35. Hydrogen, because the electron density would be larger around fluorine due to its higher electronegativity
36. Tank B, because the lower temperature would allow for a greater concentration of dissolved oxygen
37. a. Approx. 9 mg/1000 g water
b.
$$\frac{9 \text{ mg O}_2}{1000 \text{ g water}} \times \frac{1 \text{ g water}}{1000 \text{ mg water}} = \frac{9 \text{ mg O}_2}{1\,000\,000 \text{ mg water}} = 9 \text{ ppm O}_2$$

Key #