Experimental Design

Hard water is run through a pipe to a tap, and samples are tested for hardness, with and without a magnet being attached to the pipe.

(b) **Evaluation**

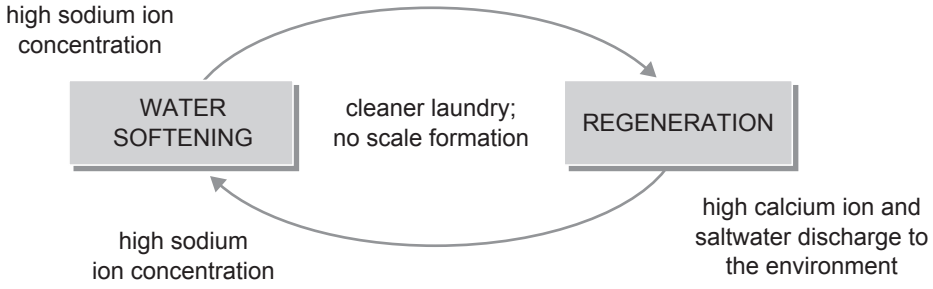
The original design is obviously useless in light of the new understanding of the claim made for the magnet; it is not testing the claimed result.

New Experimental Design

Hard water is run through identical piping that has and has not magnets attached. After several months, the piping is cut and the ease of removing the scaling from the inside of the pipe is determined.

Making Connections

7.



7.3 REACTIONS IN SOLUTION

PRACTICE

(Page 332)

Understanding Concepts

1. (a) silver sulfide: low solubility
   (b) magnesium nitrate: high solubility
   (c) zinc carbonate: low solubility
2. (a) Precipitate forms: $SrSO_{4(s)}$
   (b) No precipitate forms
   (c) Precipitate forms: $CuSO_{3(s)}$

PRACTICE

(Page 335)

Understanding Concepts

3. $Sr(NO_3)_{2(aq)} + Na_2CO_{3(aq)} \rightarrow SrCO_{3(s)} + 2\ NaNO_{3(aq)}$

   $Sr^{2+}_{(aq)} + 2\ NO^-_{3(aq)} + 2\ Na^+_{(aq)} + CO^{2-}_{3(aq)} \rightarrow SrCO_{3(s)} + 2\ Na^+_{(aq)} + 2\ NO^-_{3(aq)}$

   $Sr^{2+}_{(aq)} + CO^{2-}_{3(aq)} \rightarrow SrCO_{3(s)}$

4. (a) Compounds could be any four of:
   copper(II) nitrate, copper(II) sulfate, copper(II) acetate, copper(II) chloride, copper(II) bromide, or copper(II) iodide.

   Choose copper(II) nitrate as the example:

   (b) $2\ Al_{(s)} + 3\ Cu(NO_3)_{2(aq)} \rightarrow 3\ Cu_{(s)} + 2\ Al(NO_3)_{3(aq)}$

   (c) $2\ Al_{(s)} + 3\ Cu^{2+}_{(aq)} + 6\ NO^-_{3(aq)} \rightarrow 3\ Cu_{(s)} + 2\ Al^{3+}_{(aq)} + 6\ NO^-_{3(aq)}$

   (d) $2\ Al_{(s)} + 3\ Cu^{2+}_{(aq)} \rightarrow 3\ Cu_{(s)} + 2\ Al^{3+}_{(aq)}$

5. $Cl_{2(g)} + 2\ Br^-_{(aq)} \rightarrow Br_{2(l)} + 2\ Cl^-_{(aq)}$

6. $Ca^{2+}_{(aq)} + OOCCOO^{2-}_{(aq)} \rightarrow CaOOCCOO_{(s)}$

or (if the oxalate ion formula is written in condensed form)

$Ca^{2+}_{(aq)} + C_2O^{2-}_{4(aq)} \rightarrow CaC_2O_{4(s)}$

7. $Pb_{(s)} + 2\,Ag^{+}_{(aq)} \rightarrow Pb^{2+}_{(aq)} + 2\,Ag_{(s)}$

Making Connections

8. (a) $Fe^{3+}_{(aq)} + 3\,OH^{-}_{(aq)} \rightarrow Fe(OH)_{3(s)}$

   (b) Filtration to remove the precipitate is the most likely process.

Explore an Issue

Debate: Producing Photographs

(Page 336)

(a) At first glance, it seems that digital cameras are more environmentally friendly than film cameras: they don't require film, film canisters, developing paper, or processing chemicals. However, this conclusion is based upon the assumption that only the final products affect the environment.

(b) To argue against the proposition you need to recognize that the whole story of a product must be considered, including everything from the extracting of resources to manufacturing through disposal. For example, are there components of the digital camera that during manufacture cause the emission of toxins into the environment, or, when the camera must be disposed of, are there environmental concerns?

(c) Recognize that the resolution requires an environmental perspective only; you need not consider, for example, economic, social, and technological arguments. In your investigation, you could look at subtopics such as raw materials, manufacturing, the developing process, the developing technology (and its environmental impact back to its origins), and disposal.

(d) Consider the logic of the presentation and the quantity of evidence used to support the position taken. Were all stages from pre-manufacturing through post-disposal considered?

SECTION 7.3 QUESTIONS

(Page 336)

Understanding Concepts

1. $Pb^{2+}_{(aq)} + SiO^{2-}_{3(aq)} \rightarrow PbSiO_{3(s)}$
2. $3\,Ca^{2+}_{(aq)} + 2\,PO^{3-}_{4(aq)} \rightarrow Ca_3(PO_4)_{2(s)}$
3. $Cu_{(s)} + 2\,Ag^{+}_{(aq)} \rightarrow Cu^{2+}_{(aq)} + 2\,Ag_{(s)}$

Making Connections

4. Student answers will vary widely, as they will be specific to the regulations controlling local hazardous waste facilities.

   GO TO www.science.nelson.com, Chemistry 11, Teacher Centre.

7.4 WASTE WATER TREATMENT

PRACTICE

(Page 340)

Understanding Concepts

1. Problems from the release of untreated sewage include: transmission of disease, lowering of oxygen levels, and rapid growth of aquatic plant life.
2. A high BOD reading is an indication that bacteria are using up oxygen to decompose organic material in the water. This is a problem for any oxygen-using life form in the water.

