(d) $LD_{50(70\ kg)} = 0.07\ g/kg \times 70\ kg$
$LD_{50(70\ kg)} = 4.9\ g = 4900\ mg$

(e) number of cans of diet pop $= \dfrac{4900\ mg}{21.8\ mg/can}$
$= 220$ cans

TAKE A STAND: HEALTH BENEFIT OR HEALTH HAZARD?

(Page 232)

(a) Student answers will vary.
Aspartame:
Reasons for its use: reducing caloric intake, to counter obesity; for sugar-reduced or sugar-free diets, e.g., for diabetic patients; to reduce incidence of tooth-decay

(b) Student answers will vary.
Factors to consider: experimental design, e.g., use of controlled variables; type of system tested, e.g., tests done on mice, and the information transferred to human applications; size of population tested; number of independent research groups reporting findings; funding of the research group, e.g., whether the research is funded by the manufacturer of the product.

(c) [Sample answer] Risks are still uncertain and debatable. In some cases, benefits outweigh the risks, as in sugar-free diets prescribed by doctors. In other cases, any possible risk should be reduced by minimizing the daily use of aspartame.

3.17 ACTIVITY: CLASSIFYING PLASTICS

(Pages 233–236)

Observations

(a)

Table 2 Summary of Observations and Possible SPI Codes (sample answer)

Sample tested	Density	Flame colour	Acetone	Melting	Possible SPI code
1	floats in water, in alcohol solution, and in corn oil				code 5: PP
2	floats in water and in alcohol solution, and sinks in corn oil				code 4: LDPE
3	floats in water, and sinks in alcohol solution				code 2: HDPE
4	sinks in water	green			code 3: PVC
5	sinks in water	not green	increased softness in acetone		code 6: PS
6	sinks in water	not green	no increased softness in acetone	increased softness in boiling water	code 1: PETE

Analysis

(b) **Part 1**
In water: Samples that float may be resin codes 2, 4, or 5 (less dense than water, whose density is 1 g/mL). Samples that sink may be resin codes 1, 3, or 6.

In alcohol solution: Samples that float may be resin codes 4 or 5 (less dense than alcohol solution). Samples that sink may be resin code 2.

In oil: Samples that float may be resin code 5 (less dense than resins 4 and 5). Samples that sink may be resin code 4.

Part 2
Flame test: Of possible resin codes 1, 3, or 6, resin code 3 contains chlorine atoms. The sample that produces a green flame is resin code 3.

Part 3

Acetone test: Of possible resin codes 1 or 6, resin code 6 softens in acetone. The samples that soften in acetone are resin code 6. The samples that did not soften may be resin code 1.

Part 4

Melting test: This sample may have resin code 1. If the sample softens in boiling water, it has resin code 1.

Evaluation

(c) [Sample answer] Repeat the procedure using known resin samples, codes 1 to 6, to confirm test results.

Synthesis

(d) Student answers will vary.

Recycling operation at school

- Types of materials collected: paper, plastic water bottles, plastic pop bottles, glass drink bottles, aluminum cans
- Amounts: approximately four large garbage bags of paper each week, five large garbage bags of each type of bottle and cans each week
- Participation rate: approximately 30% of students recycle
- Problems encountered: "recycling containers" do not keep bottles and cans separate, so bottles and cans need to be sorted by hand; collection containers also contain garbage, sometimes making collected materials unusable
- Destination: collected by city recycling facility; some items are destined for sorting locally, and some items are transported to a large city nearby

(e) Issues related to use of plastics:

- There is a growing demand for petroleum as raw materials for the manufacture of plastics.
- Petroleum, a fossil fuel, is a non-renewable resource that cannot be replaced when the source is exhausted.
- Most plastic products are non-biodegradable; that is, these products, when discarded, occupy large areas of land for an indefinite length of time. Since they do not decompose, the atoms and molecules in plastics are not returned to the environment to be used in other systems.

Suggestions for non-synthetic substitutes:

- cotton fibres instead of polyester
- reusable metal cutlery instead of plastic
- washable glasses instead of Styrofoam cups
- washable cloth diapers instead of disposable synthetic polymers

(f) Student answers will vary. Posters should show types of recycled products, flow charts of recycling resources, benefits to environment, location and dates of collections.

(g) Student answers will vary.

- PET: 56% of recycled PET is made into fibre for carpet and clothing, 13% into strapping, and 14% into food or non-food containers.
- HDPE: 29% of recycled HDPE (mostly from bottles) is made into new bottles. HDPE is also recycled into lawn and garden products, such as flowerbed edging, and into plastic lumber for use in decks, benches, and picnic tables.

(h) Student answers will vary, but may include one of the following careers: recycling truck driver, planner for recycling routes, organizer of recycling facility. Other related fields include environmental enforcement, policy and planning, community relations, and other support services.

Qualifications and training to be a waste systems manager:

- an understanding of environmental issues
- a background in environmental studies or waste management, or a degree in public administration
- courses or qualifications in finance

3.18 POLYMERS

TRY THIS ACTIVITY: SKEWERING BALLOONS

(Page 238)

(a) The intermolecular attractions between polymer chains allow the long molecules to move aside to allow the skewer to push through without breaking, analogous to the noodles moving over each other.