

1.8 CASE STUDY: QUALITATIVE ANALYSIS OF CONCRETE

CAREER CONNECTION: GEOLOGICAL TECHNICIAN

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- (i) Spectroscopy is a good technique for determining the type of mineral found in a sample because it is based on the principle that electrons absorb energy and jump to higher energy levels. When they return to the ground state, they emit their excess energy in the form of light that we can detect. Since each mineral is a different element with a characteristic electron configuration, it absorbs and releases characteristic quanta of energy. We can therefore identify the type of mineral using spectroscopy.
- (ii) Programs are offered at Cambrian College in Sudbury as well as at Sir Sanford Fleming College in Peterborough. The programs are both two years in duration. At Cambrian College, you must have one credit in computer studies, one (C) or (U) English credit, and one (C) or (U) math credit, although MCT4C is highly recommended. In addition, a Grade 12 physics or chemistry course is recommended. At Sir Sanford Fleming College, you are required to have two (C) English courses and two (C) or (UC) math courses. Also recommended are a Grade 12 math course for college technology and a senior college-level science course.

CASE STUDY 1.8 QUESTIONS

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Understanding Concepts

1. In flame emission spectroscopy, a substance is detected or identified by exciting its electrons using a hot flame and then analyzing the light emitted when the electrons return to their ground state. The wavelength of light emitted is detected and recorded. The substance is then identified by comparing the wavelength of light it emits with the wavelengths of identified substances.
2. Alkali metals in concrete react with minerals found in concrete. The gel aggregate that forms can absorb water and expand, leading to cracks, which compromise the strength of a structure.
3. Atmospheric carbon dioxide reacts with calcium hydroxide found in concrete in the presence of water to form calcium carbonate. Calcium carbonate is less basic than calcium hydroxide. The decrease in pH increases the potential for corrosion of any steel reinforcements found within the concrete.
4. The carbonation of concrete is detected using the acid–base indicator phenolphthalein. Phenolphthalein is colourless in acidic and neutral solutions, and is pink in a basic solution. To test whether carbonation is occurring, phenolphthalein is applied to a bore of concrete. If the indicator turns pink, carbonation has not occurred. If the indicator does not change colour, carbonation has occurred. This test is a qualitative analysis technique because it detects the presence of carbonation but does not determine the extent of carbonation.

Making Connections

5. (a) Nerve and muscle cells must contain a high concentration of potassium ions and a low concentration of sodium ions in order to function properly. A metabolic pump pumps potassium ions from the surrounding fluid into a cell while pumping sodium ions out of the cell into the surrounding fluid. The right balance of these electrolytes in nerve cells allows the nervous system to transmit messages efficiently from one nerve cell to another. Muscle cell contraction is regulated by the right balance of these electrolytes within and outside the cell.
- (b) Low levels of potassium may result in fatigue, cramping legs, muscle weakness, slow reflexes, and an irregular heartbeat. High levels of potassium are toxic and are dangerous if there is kidney failure. Low levels of sodium may lead to nausea, dizziness, poor concentration, and muscle weakness. High levels of sodium can lead to a depletion of calcium in the body.