

Section 70 – Spontaneity

70-1. What is a spontaneous reaction?

Solution

A reaction has a natural tendency to occur and takes place without the continual input of energy from an external source.

70-2. What is a nonspontaneous reaction?

Solution

A reaction that has no natural tendency to occur and takes place only with the continual input of energy from an external source.

70-3. Indicate whether the following processes are spontaneous or nonspontaneous.

- (a) Liquid water freezing at a temperature below its freezing point
- (b) Liquid water freezing at a temperature above its freezing point
- (c) The combustion of gasoline
- (d) A ball thrown into the air
- (e) A raindrop falling to the ground
- (f) Iron rusting in a moist atmosphere

Solution

- (a) spontaneous; (b) nonspontaneous; (c) spontaneous; (d) nonspontaneous; (e) spontaneous; (f) spontaneous

70-4. A helium-filled balloon spontaneously deflates overnight as He atoms diffuse through the wall of the balloon. Describe the redistribution of matter and/or energy that accompanies this process.

Solution

The process involves a greater dispersal of matter as the He atoms transfer from a relatively small initial volume (the balloon) to a much larger final volume (the room, or house, or ultimately earth's atmosphere).

70-5. Many plastic materials are organic polymers that contain carbon and hydrogen. The oxidation of these plastics in air to form carbon dioxide and water is a spontaneous process; however, plastic materials tend to persist in the environment. Explain.

Solution

Although the oxidation of plastics is spontaneous, the rate of oxidation is very slow. Plastics are therefore kinetically stable and do not decompose appreciably even over relatively long periods of time.