**PROBLEM 3.1**

- two phases are present (liquid and gas).
- not a pure substance because composition is different in each phase.

**PROBLEM 3.2**

The system is a pure substance. Although the liquid is vaporized, the system remains fixed in chemical composition and is chemically homogeneous.

**PROBLEM 3.3**

The system is a pure substance. Although the phases change, the system remains of fixed chemical composition and is chemically homogeneous.

**PROBLEM 3.4**

The system is not a pure substance during the process since the composition of the gas phase changes as water evaporates into the air. Once all of the water evaporates, the gas phase comes to equilibrium and the composition becomes homogeneous. At this point, the gas phase can be treated as a pure substance.