

State of Matter

Give the following graphs a meaningful title, label the axes and indicate the phases present on each portion of the graph. No scale needs to be specified for the time axis

1. Benzene melts at 6°C and boils at 80°C . Plot a graph showing the temperature vs. time behaviour of benzene as its temperature is raised from 0°C to 100°C .



2. Water freezes at 0°C and boils at 100°C . Plot a graph showing the temperature vs. time behaviour of steam as its temperature is lowered from 120°C to -20°C .



3. Ammonium carbamate sublimes at 60°C . Plot a graph showing the temperature vs. time behaviour of ammonium carbamate as its temperature is raised from 0°C to 100°C .



Classify Molecules, Atoms, Ions

1.) Classify each of the following as an atom, molecule, or ion.

S _____
S²⁻ _____
O _____
O₂ _____
Al³⁺ _____
Sb _____
NH₃ _____

2.) A clear glass bottle contains white sand, some nails, salt water with some dye dissolved in it, and a layer of gasoline on top.

How many phases are present in this system excluding the bottle and lid? _____

3.) Classify each of the following as heterogeneous or homogeneous.

Diamond _____
Tree _____
Egg _____

4.) If you had 10 g of gold, should you refer to it as an atom or an element? _____

5.) In what way are a true solution and a compound similar? In what ways do they differ?

6.) Which of the following are the possible classifications (element, compound, true solution, or mechanical mixture) for the items listed below?

(There may be more than one answer for each example.)

a.) A clear liquid which can be boiled away to leave a white solid. _____

b.) A collection of solid particles, some of which are white and some are red.

c.) A solid which melts at 170°C. _____

d.) A gas. _____

e.) A liquid. _____

f.) A liquid which boils away completely at 136°C. When the liquid is strongly heated in a closed container, a yellow gas and solid are produced. _____

7.) Which of sugar, dirt, and air are pure substances and which are mixtures?

8.) How many phases are present in a regular pencil? _____

9.) Classify each of the following as a mixture or a compound.

- a.) Alcohol ($\text{CH}_3\text{CH}_2\text{OH}$) _____
- b.) Soda pop _____
- c.) CH_3OH in H_2O _____
- d.) Vinegar _____
- e.) Mini-Wheats _____
- f.) Pizza _____
- g.) Baking soda _____
- h.) Peanut butter cookies _____
- i.) Popcorn with salt and butter _____
- j.) Milk _____

Filtration Techniques

1.) A red-brown solution of bromine in water (density = 1.01 g/cm³) is poured into a separatory funnel. Trichloroethane (density = 1.34 g/cm³) is added and the mixture is shaken thoroughly. Afterwards, two liquid layers are seen in the funnel: a clear layer of water and a reddish-orange layer of bromine in trichloroethane. Which layer will be on the top? Why?

2.) If you wished to completely remove and save the liquid from a solid/liquid solution, which separation method(s) could be used? If you didn't want to save the liquid, which method(s) could be used?

3.) Why shouldn't the solvent completely evaporate in the recrystallization method of purification?

4.) How can you separate all the components in a mixture containing sand, iron filings, water, and gasoline?

5.) How can you separate a mixture of white sand (density = 2.2 g/cm^3), black sand (density = 5.2 g/cm^3), liquid methanol (m.p. -94°C , b.p. 65°C), and liquid hexanol (m.p. -47°C , b.p. 158°C)? Methanol and hexanol are miscible.

6.) How can you separate a mixture of three solids: potassium sulphate (m.p. 1069°C , soluble in water, insoluble in alcohol), calcium carbonate (m.p. $>1000^\circ\text{C}$, insoluble in water and alcohol), and naphthalene (m.p. 81°C , insoluble in water, soluble in alcohol)?