**Properties of Matter misconceptions**

1. Gases are not matter because most are invisible.
2. Gases do not have mass.
3. A "thick" liquid has a higher density than water.
4. Mass and volume, which both describe an "amount of matter" are the same property.
5. Air and oxygen are the same gas.
6. Helium and hot air are the same gas.
7. Expansion of matter is due to expansion of particles rather than to increased particle spacing.
8. Particles of solids have no motion.
9. Relative particle spacing among solids, liquids and gases (1:1:10) is incorrectly perceived and not generally related to the density of the states.
10. Materials can only exhibit properties of one state of matter.
11. Particles possess the same properties as the materials they compose. For example, atoms of copper are "orange and shiny", gas molecules are transparent, and solid molecules are hard.
12. Melting/freezing and boiling/condensation are often understood only in terms of water.
13. Particles are viewed as mini-versions of the substances they comprise.
14. Particles are often misrepresented in sketches. No differentiation is made between atoms and molecules.
15. Particles misrepresented and undifferentiated in concepts involving elements, compounds, mixtures, solutions and substances.
16. Frequent disregard for particle conservation and orderliness when describing changes.
17. Absence of conservation of particles during a chemical change.
18. Chemical changes perceived as additive, rather than interactive. After chemical change the original substances are perceived as remaining, even though they are altered.
19. Failure to perceive that individual substances and properties correspond to certain types of particles (i.e. formation of a new substance with new properties is seen as simple happening rather than as the result of particle rearrangement).