Early Theories of Matter

Aim

- describe early theories of matter and explain why they are no longer accepted
- describe Boyle's theory on the nature of elements
- list Dalton's postulates and describe his model of the atom

Notes

Democritus (Greek Philosopher ~460 BC)

- proposed all matter is composed of particles
- called the particles atoms (Greek for "uncuttable")
- the particles are invisible
- the particles cannot be broken down into smaller parts and cannot be destroyed
- envisioned atoms of different substances as having different geometric shapes
- idea did not gain acceptance

Aristotle

- proposed four elements
  - earth
  - air
  - fire
  - water
- idea gained acceptance because substances appeared to have different degrees of each of these building blocks. For example, a burning, green stick releases:
  - smoke (air)
  - water
  - ash (earth)

Robert Boyle (1661) -Proposed that matter is composed of simple substances called elements that cannot be further decomposed or broken down

- used qualitative experiments to identify substances
- presented persuasive experimental evidence that most of the commonly accepted elements (fire, water, salt, mercury, etc) did not meet the Aristotelian criteria – being the simplest of all substances and also necessary ingredients of all bodies
- showed that air contained simpler substances

Dalton's Atomic Theory

- Proposed atomic theory in 1803 to explain his observations about the relative masses of elements in a compound
- Dalton's Postulates
  - Matter is made of small particles called atoms.
  - Atoms are indestructible. They cannot be created or destroyed during chemical or physical changes.
  - Atoms of an element are identical. They have the same mass.
  - Atoms of different elements have different masses.
  - Compounds are formed by combining atoms of different elements.
- The Dalton model of the atom: a solid, indivisible sphere

Answer the questions below by circling the number of the correct response

1. In 1661, Robert Boyle proposed that matter is composed of simple substances called elements that cannot be broken down by chemical means. His theory was not accepted for over 100 years because (1) he lacked qualitative evidence, (2) he lacked quantitative evidence, (3) he lacked both qualitative and quantitative evidence, (4) he was a philosopher rather than a scientist.

2. How many elements are there according to Aristotle? (1) 1 (2) 2 (3) 3 (4)

3. Boyle proposed that matter is composed of simple substances called elements that cannot be further decomposed or broken down. Aristotle's idea that air was an element did not fit Boyle's definition because air (1) cannot be seen, (2) cannot be broken down, (3) can be decomposed, (4) can react with other substances.