

Science Watch Answers

1. Two subatomic particles made up of quarks are protons and neutrons.
2. The charge on two up quarks and one down quark adds up to 1, which is the charge on the proton. Similarly, the charge on two down quarks and one up quark adds up to 0, the charge on a neutron.
3. Individual quarks are never found alone because the strong force, which binds quarks, increases in strength as quarks get farther apart. This holds quarks together.

Checking Concepts

1. Greek philosophers considered the idea of a smallest piece of matter, which gave rise to the modern word "atom."
2. Alchemists were researchers who worked in Europe and the Middle East during the Middle Ages who tried to turn common metals like lead and mercury into gold.
3. Two atoms of gold in Dalton's model would have the same mass and size.
4. Atoms of gold and lead would have different sizes and masses and might link together in different kinds of ways.
5. J. J. Thomson discovered that atoms were themselves made up of other particles, such as the electron.
6. Rutherford's gold foil experiment led to the discovery of the nucleus, the dense, positively charged centre of an atom.
7. Mass and electric charge
8. Protons and neutrons
9. Electrons

Understanding Key Ideas

10. (a) Alchemists conducted research by doing experiments, while the Greek philosophers tended to spend more efforts on debating.
(b) Alchemists combined their investigations with mystical thinking and often worked in secret. This slowed progress.
11. Thomson's studies showed that Dalton's idea that atoms cannot be divided into smaller particles was incorrect.
12. Rutherford exposed a thin sheet of gold to a stream of high speed, heavy particles that had a positive charge, called alpha particles. Most particles went right through the gold, but some bounced back, indicating the presence of a dense, tiny, positive centre with great mass, which he called the nucleus.
13. (a) Proton
(b) Neutron (the proton is a close second)
(c) Electron
(d) Proton
(e) Electron
(f) Neutron
(g) Electron
(h) Neutron
14. Atoms have equal numbers of protons and electrons.
15. The whole atom would be larger than the baseball park and its surroundings.

Pause and Reflect Answer

Answers may vary but will likely include the following points: The current model of the atom contains three particles, the proton (positive), the neutron (neutral), and the electron (negative). The proton and neutron have nearly equal mass and exist together in the nucleus, a tiny, dense region in the centre of the atom. The electrons occupy specific energy levels around the nucleus.