

Atoms and Elements

1. One basic assumption in the Bohr theory of the structure of the hydrogen atom was that
- (A) the electron could have any of a continuous range of energies.
- (B) the electron could exist in any one of a set of discrete energy levels.
- (C) the electron could move from a higher to a lower energy orbit by absorbing a quantum of energy.
- (D) electromagnetic radiation would be given off as the electron moved in orbit around the nucleus.

2. Which experiment led to the belief that the atom contained an extremely small, positively charged nucleus?
- (A) Millikan's oil drop experiment
- (B) Rutherford's scattering experiment
- (C) Thomson's cathode ray tube experiment
- (D) Moseley's experiment on X-ray emission by metals

3. Relative atomic and molar masses are determined with a mass spectrometer utilizing the fact that
- (A) the velocity of the particles can be accurately determined.
- (B) a definite fraction of the particles is formed in a charged state.
- (C) all particles with the same charge to mass ratio follow the same curved path.
- (D) the force with which the accelerated particles strike a target can be measured.

4. If a neutral atom has an atomic number of 29 and a mass number of 61, then the atom must contain
- (A) 90 neutrons (B) 61 electrons
- (C) 29 neutrons (D) 29 electrons

5. Atom X has 9 protons, 9 electrons, and 10 neutrons. Atom Y has 10 protons, 10 electrons, and 9 neutrons. It can therefore be concluded that
- (A) atom X and Y are isotopes.
- (B) atom X is more massive than atom Y.
- (C) atoms X and Y have the same mass number.
- (D) atoms X and Y have the same atomic number.

6. ^{40}Ca , ^{39}K , and ^{41}Sc all have the same
- (A) number of electrons.
- (B) atomic number.
- (C) mass number.
- (D) number of neutrons.

7. The charge of the nucleus of a calcium ion, Ca^{2+} , in terms of the magnitude of charge of an electron, e , is
- a. $+20e$ b. $+18e$ c. 0 d. $-18e$

8. Listed below are the charges and masses of four

particles. Which one will be deflected the **least** in a mass spectrometer?

- a) $+2, 2 \text{ amu}$ c) $+1, 1 \text{ amu}$
- b) $+4, 4 \text{ amu}$ d) $+1, 4 \text{ amu}$

9. Which represents the ^{235}U atom?

	Protons	Electrons	Neutrons
(A)	46	46	143
(B)	92	92	92
(C)	92	92	143
(D)	92	92	146

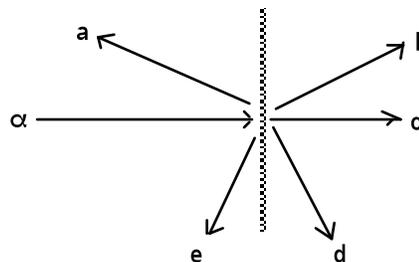
10. In a Millikan oil drop type experiment, the charge on four oil drops (in Coulombs) was found to be:

3.33	Coulombs
8.88	Coulombs
6.66	Coulombs
11.10	Coulombs

What is the charge on the electron according to this experiment?

- a) 1.11 Coulomb c) 4.44 Coulomb
- b) 2.22 Coulomb d) 11.10 Coulomb

11. Pictured below is a schematic of the Rutherford experiment. Which scattered α -particle gives the best evidence for the nuclear atom?



- a) a b) b c) c d) d e) e

12. Which of the following is an isotope of the element with 20 protons ($p=20$) and 22 neutrons ($n=22$)?

- a) titanium-22 c) calcium-40
- b) zirconium-40 d) titanium-48

13. The imaginary element X has the following natural abundances and isotopic masses. What is the atomic weight of X?

$^{24}_{12}\text{X}$	24.02 amu	40.0%
$^{26}_{12}\text{X}$	26.10 amu	60.0%

Show your work:

For questions 14 - 17, use the following key:
(each answer may be used once, more than once,
or not at all.)

- a) John Dalton
- b) Ernest Rutherford
- c) J.J. Thomson
- d) Democritus

14. His model of the atom has been called the “billiard ball” model.

15. He studied matter in cathode ray tubes.

16. His philosophical idea included the term “atomos”.

17. He added to the atomic theory the idea that atoms had positive and negative parts.

18. Which statement about the mass of an electron is correct?

- (a) The mass of an electron is equal to the mass of a proton.
- (b) The mass of an electron is less than the mass of a proton.
- (c) The mass of an electron is equal to the mass of a neutron.
- (d) The mass of an electron is greater than the mass of a neutron.

19. Which particles are isotopes of each other?

- (1) ${}^1_1\text{X}$ and ${}^3_1\text{X}$
- (2) ${}^2_1\text{X}$ and ${}^3_2\text{X}$
- (3) ${}^2_1\text{X}$ and ${}^4_2\text{X}$
- (4) ${}^3_1\text{X}$ and ${}^3_2\text{X}$

20. What are the characteristics of a neutron?

- (1) It has no charge and no mass.
- (2) It has no charge and a mass of 1 amu.
- (3) It has a charge of +1 and no mass.
- (4) It has a charge of +1 and a mass of 1 amu.

21. Consider the following notation: ${}^{220}_{86}\text{Rn}$

Which statement below is correct?

- a) This particle contains 86 protons
- b) This particle has a mass number of 86
- c) This particle has an atomic number of 220
- d) This particle contains 220 neutrons

22. Isotopes of an element have the same number of

- A. protons and electrons.
- B. protons and neutrons.
- C. neutrons and electrons.
- D. protons, neutrons and electrons.

Just For Fun:

Element names finish these sentences.

- A ridiculous inmate is a _____.
- I bumped my _____ the car door.
- I am sad when all the flowers _____.
- What the police officer does to the crook. _____
- What the doctor does to the patient. _____
- What the undertaker does if the doctor doesn't succeed. _____
- If your cattle get away, _____.
- A famous London theatre is the _____.
- Demonstrations help keep the lectures from getting _____.
- Linoleum, tile, and hardwood are three types of _____.