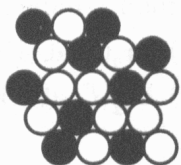
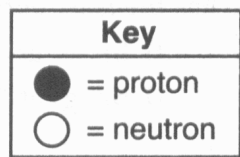


- 1) The diagram below represents the nucleus of an atom.



What are the atomic number and mass number of this atom?

- A) The atomic number is 9 and the mass number is 19.
- B) The atomic number is 9 and the mass number is 20.
- C) The atomic number is 11 and the mass number is 19.
- D) The atomic number is 11 and the mass number is 20.

- 2) Which subatomic particles are located in the nucleus of a neon atom?

- A) electrons and neutrons
- B) electrons and positrons
- C) protons and electrons
- D) protons and neutrons

- 3) Which statement best describes the nucleus of an aluminum atom?

- A) It has a charge of -13 and is surrounded by a total of 13 electrons.
- B) It has a charge of +13 and is surrounded by a total of 10 electrons.
- C) It has a charge of +13 and is surrounded by a total of 13 electrons.
- D) It has a charge of -13 and is surrounded by a total of 10 electrons.

- 4) Which statement best describes electrons?

- A) They are negative subatomic particles and are found surrounding the nucleus.
- B) They are positive subatomic particles and are found in the nucleus.
- C) They are negative subatomic particles and are found in the nucleus.
- D) They are positive subatomic particles and are found surrounding the nucleus.

- 5) What is the atomic number of an element that has six protons and eight neutrons?

- A) 6 B) 2 C) 8 D) 14

- 6) All atoms of a given element *must* contain the same number of

- A) neutrons
- B) protons
- C) electrons plus neutrons
- D) protons plus neutrons

- 7) Experimental evidence indicates that the nucleus of an atom

- A) contains a small percentage of the mass of the atom
- B) has a negative charge
- C) contains most of the mass of the atom
- D) has no charge

- 8) In Rutherford's gold foil experiments, some alpha particles were deflected from their original paths but most passed through the foil with no deflection. Which statement about gold atoms is supported by these experimental observations?

- A) Alpha particles are more dense than gold atoms.
- B) Alpha particles and gold nuclei have opposite charges.
- C) Gold atoms are similar to alpha particles.
- D) Gold atoms consist mostly of empty space.

- 9) Compared to the entire atom, the nucleus of the atom is

- A) larger and contains most of the atom's mass
- B) larger and contains little of the atom's mass
- C) smaller and contains most of the atom's mass
- D) smaller and contains little of the atom's mass

- 10) An atom is electrically neutral because the

- A) number of protons equals the number of electrons
- B) ratio of the number of neutrons to the number of electrons is 1:1
- C) number of protons equals the number of neutrons
- D) ratio of the number of neutrons to the number of protons is 2:1

- 11) What is the nuclear charge of an atom with a mass of 23 and an atomic number of 11?

- A) 11+ B) 12+ C) 23+ D) 34+

- 12) What is the mass number of an atom that contains 19 protons, 19 electrons, and 20 neutrons?

- A) 19 B) 20 C) 39 D) 58

13) Atoms of ^{16}O , ^{17}O , and ^{18}O have the same number of

- A) electrons, but a different number of protons
- B) neutrons, but a different number of protons
- C) protons, but a different number of electrons
- D) protons, but a different number of neutrons

14) Which pair of atoms are isotopes?

- A) $^{40}_{19}\text{K}$ and $^{40}_{18}\text{Ar}$
- B) $^{222}_{88}\text{Ra}$ and $^{222}_{86}\text{Rn}$
- C) $^{14}_6\text{C}$ and $^{14}_7\text{N}$
- D) $^{40}_{19}\text{K}$ and $^{42}_{19}\text{K}$

15) The electron configuration of an atom in the ground state is 2-4. The total number of occupied principal energy levels in this atom is

- A) 1 B) 2 C) 3 D) 4

16) Which electron configuration represents an atom of an element having a completed third principal energy level?

- A) 2-8-10-2 B) 2-8-2
- C) 2-8-6-2 D) 2-8-18-2

17) Which principal energy level of an atom contains an electron with the lowest energy?

- A) $n = 1$ B) $n = 2$
- C) $n = 3$ D) $n = 4$

18) Compared to an atom of hydrogen in the ground state, an atom of hydrogen in the excited state has

- A) absorbed energy
- B) released energy
- C) neither released nor absorbed energy

19) Which electron configuration represents an atom of lithium in an excited state?

- A) 1-2 B) 2-1 C) 2-2 D) 1-1

20) The characteristic bright-line spectrum of an element occurs when electrons

- A) move from higher to lower energy levels
- B) move from lower to higher energy levels
- C) are lost by a neutral atom
- D) are gained by a neutral atom

21) When electrons in an atom in an excited state fall to lower energy levels, energy is

- A) absorbed, only
- B) released, only
- C) neither released nor absorbed
- D) both released and absorbed

22) Which of these phrases best describes an atom?

- A) a hard sphere with positive particles uniformly embedded
- B) a hard sphere with negative particles uniformly embedded
- C) a positive nucleus surrounded by a hard negative shell
- D) a positive nucleus surrounded by a cloud of negative charges

23) Which of these phrases best describes an atom for the Wave-Mechanical Model?

- A) a hard sphere with negative particles uniformly embedded
- B) a hard sphere with positive particles uniformly embedded
- C) a positive nucleus surrounded by a cloud of negative charges
- D) a positive nucleus surrounded by a hard negative shell

24) Draw a Lewis electron-dot diagram for a sulfur atom in the ground state.

25) Draw a Bohr Diagram for Magnesium. State how many valence electrons Magnesium has.

26) Naturally occurring boron is composed of two isotopes. The percent abundance and the mass of each isotope are listed below.

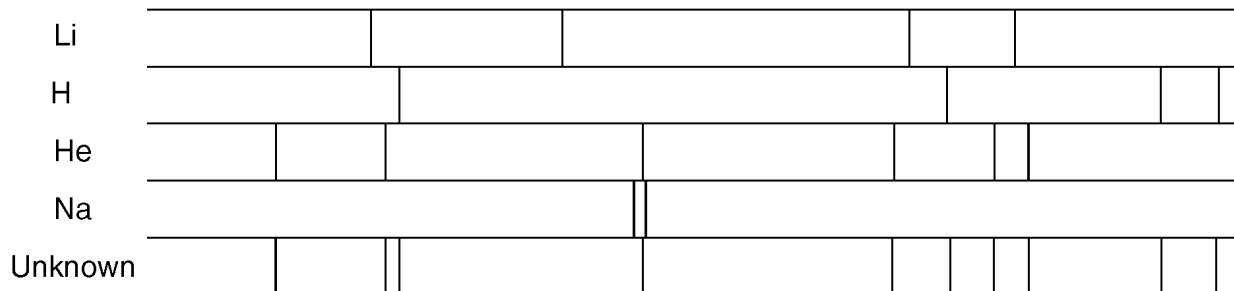
- 19.9% of the boron atoms have a mass of 10.013 atomic mass units.
- 80.1% of the boron atoms have a mass of 11.009 atomic mass units.

Calculate the atomic mass of boron. Your response must include *both* a correct numerical setup and the calculated result.

_____ atomic mass units

Base your answer to questions 27 and 28 on the diagram below, which shows bright-line spectra of selected elements.

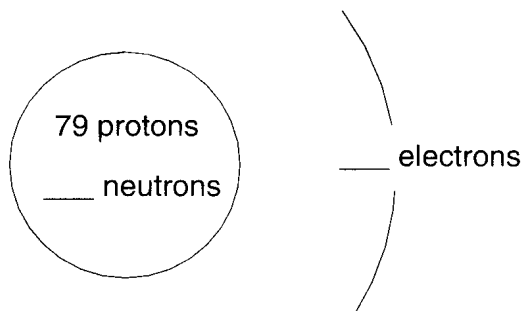
Bright-Line Spectra



27) Identify the *two* elements in the unknown spectrum.

28) Explain how a bright-line spectrum is produced, in terms of *excited state*, *energy transitions*, and *ground state*.

29) In the early 1900s, evidence was discovered that atoms were not “hard spheres.” It was shown that atoms themselves had an internal structure. One experiment involved gold metal foil.



a Complete the simple model for an atom of gold-197 by placing the correct numbers in the two blanks.

b In the gold-foil experiment, alpha particles were directed toward the foil. Most of the alpha particles passed directly through the foil with no effect. This result did not agree with the “hard spheres model” for the atom. What conclusion about the internal structure of the atom did this evidence show?

c In the same experiment, some of the alpha particles returned toward the source. What does this evidence indicate about the charge of the atom’s nucleus?

30) Base your answer to the following question on the electron configuration table shown below.

Element	Electron Configuration
X	2-8-8-2
Y	2-8-7-3
Z	2-8-8

Which electron configuration represents the excited state of a calcium atom?
