

- What is the overall charge of an ion that has 12 protons, 10 electrons, and 14 neutrons?
A) 2- **B) 2+** C) 4- D) 4+
- Which particles have approximately the same mass?
A) an electron and an alpha particle
B) an electron and a proton
C) a neutron and an alpha particle
D) a neutron and a proton
- An atom of lithium-7 has an equal number of
A) electrons and neutrons
B) electrons and protons
C) positrons and neutrons
D) positrons and protons
- Which phrase describes an atom?
A) a negatively charged nucleus surrounded by positively charged protons
B) a negatively charged nucleus surrounded by positively charged electrons
C) a positively charged nucleus surrounded by negatively charged protons
D) a positively charged nucleus surrounded by negatively charged electrons
- An atom in the ground state has two electrons in its first shell and six electrons in its second shell. What is the total number of protons in the nucleus of this atom?
A) 5 B) 2 C) 7 **D) 8**
- An electron has a charge of
A) -1 and the same mass as a proton
B) +1 and the same mass as a proton
C) -1 and a smaller mass than a proton
D) +1 and a smaller mass than a proton
- As a result of the gold foil experiment, it was concluded that an atom
A) contains protons, neutrons, and electrons
B) contains a small, dense nucleus
C) has positrons and orbitals
D) is a hard, indivisible sphere
- Which sequence represents a correct order of historical developments leading to the modern model of the atom?
A) the atom is a hard sphere → most of the atom is empty space → electrons exist in orbitals outside the nucleus
B) the atom is a hard sphere → electrons exist in orbitals outside the nucleus → most of the atom is empty space
C) most of the atom is empty space → electrons exist in orbitals outside the nucleus → the atom is a hard sphere
D) most of the atom is empty space → the atom is a hard sphere → electrons exist in orbitals outside the nucleus
- Which statement about one atom of an element identifies the element?
A) The atom has 1 proton.
B) The atom has 2 neutrons.
C) The sum of the number of protons and neutrons in the atom is 3.
D) The difference between the number of neutrons and protons in the atom is 1.
- A sample of matter must be copper if
A) each atom in the sample has 29 protons
B) atoms in the sample react with oxygen
C) the sample melts at 1768 K
D) the sample can conduct electricity
- What is the mass number of a carbon atom that contains six protons, eight neutrons, and six electrons?
A) 6 B) 8 **C) 14** D) 20
- The number of neutrons in the nucleus of an atom can be determined by
A) adding the atomic number to the mass number
B) subtracting the atomic number from the mass number
C) adding the mass number to the atomic mass
D) subtracting the mass number from the atomic number

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13. The greatest composition by mass in an atom of $^{17}_8\text{O}$ is due to the total mass of its

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

14. The table below shows the number of subatomic particles in atom X and in atom Z .

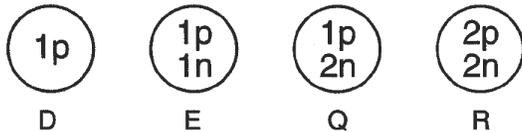
Subatomic Particles in Two Atoms

Atom	Number of Protons	Number of Neutrons	Number of Electrons
X	6	6	6
Z	6	7	6

Atom X and atom Z are isotopes of the element

- A) aluminum **B) carbon** C) magnesium D) nitrogen

15. Each diagram below represents the nucleus of a different atom.



Which diagrams represent nuclei of the same element?

- A) D and E , only **B) D , E , and Q**
C) Q and R , only D) Q , R , and E

16. Chlorine-37 can be represented as

- A) $^{17}_{35}\text{Cl}$ B) $^{20}_{37}\text{Cl}$
C) $^{35}_{20}\text{Cl}$ **D) $^{37}_{17}\text{Cl}$**

17. Which two notations represent different isotopes of the same element?

- A) ^6_4Be and ^9_4Be** B) ^7_3Li and ^7_3Li C) $^{14}_7\text{N}$ and $^{14}_6\text{C}$ D) $^{32}_{15}\text{P}$ and $^{32}_{16}\text{S}$

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18. The atomic masses and the natural abundances of the two naturally occurring isotopes of lithium are shown in the table below.

Lithium Isotopes

Isotope	Atomic Mass (u)	Natural Abundance (%)
Li-6	6.02	7.5
Li-7	7.02	92.5

Which numerical setup can be used to determine the atomic mass of lithium?

- A) **(0.075)(6.02 u) + (0.925)(7.02 u)**
B) $(0.925)(6.02 \text{ u}) + (0.075)(7.02 \text{ u})$
C) $(7.5)(6.02 \text{ u}) + (92.5)(7.02 \text{ u})$
D) $(92.5)(6.02 \text{ u}) + (7.5)(7.02 \text{ u})$
19. The atomic mass of titanium is 47.88 atomic mass units. This atomic mass represents the
- A) total mass of all the protons and neutrons in an atom of Ti
B) total mass of all the protons, neutrons, and electrons in an atom of Ti
C) weighted average mass of the most abundant isotope of Ti
D) weighted average mass of all the naturally occurring isotopes of Ti
20. An orbital is defined as a region of the most probable location of
- A) **an electron** B) a neutron
C) a nucleus D) a proton

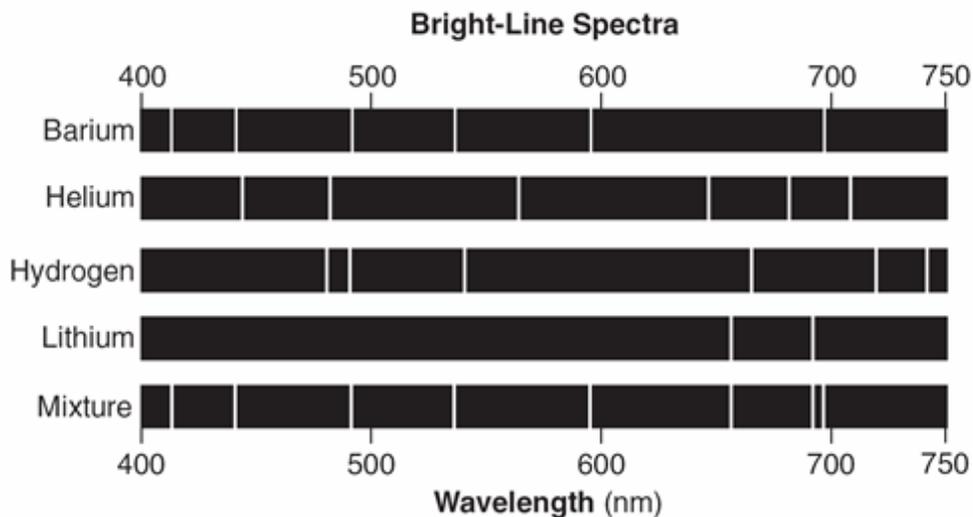
21. Which statement describes the relative energy of the electrons in the shells of a calcium atom?
- A) An electron in the first shell has more energy than an electron in the second shell.
B) An electron in the first shell has the same amount of energy as an electron in the second shell.
C) An electron in the third shell has more energy than an electron in the second shell.
D) An electron in the third shell has less energy than an electron in the second shell.
22. Which electron configuration represents the electrons of an atom in an excited state?
- A) 2-1 **B) 2-7-4** C) 2-8-7 D) 2-4
23. Which statement describes how an atom in the ground state becomes excited?
- A) The atom absorbs energy, and one or more electrons move to a higher electron shell.**
B) The atom absorbs energy, and one or more electrons move to a lower electron shell.
C) The atom releases energy, and one or more electrons move to a higher electron shell.
D) The atom releases energy, and one or more electrons move to a lower electron shell.
24. Which Group 18 element in the ground state has a maximum of 2 completely filled energy shells?
- A) Kr B) Xe C) He **D) Ne**
25. As an electron in a hydrogen atom moves from the second principal energy level to the first principal energy level, the energy of the atom
- A) decreases** B) increases
C) remains the same
26. During a flame test, a lithium salt produces a characteristic red flame. This red color is produced when electrons in excited lithium atoms
- A) are lost by the atoms
B) are gained by the atoms
C) return to lower energy states within the atoms
D) move to higher energy states within the atoms

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27. What must occur when an electron in an atom returns from a higher energy state to a lower energy state?

- A) **A specific amount of energy is released.**
- B) A random amount of energy is released.
- C) The atom undergoes transmutation.
- D) The atom spontaneously decays.

28. The diagram below represents the bright-line spectra of four elements and a bright-line spectrum produced by a mixture of two of these elements.



Which two elements are in this mixture?

- A) barium and hydrogen
- B) **barium and lithium**
- C) helium and hydrogen
- D) helium and lithium

29. In the electron cloud model of the atom, an orbital is defined as the most probable

- A) charge of an electron
- B) conductivity of an electron
- C) **location of an electron**
- D) mass of an electron

30. Which atom in the ground state has the same electron configuration as a calcium ion, Ca^{2+} , in the ground state?

- A) **Ar**
- B) K
- C) Mg
- D) Ne

Answer Key
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1. **B**
 2. **D**
 3. **B**
 4. **D**
 5. **D**
 6. **C**
 7. **B**
 8. **A**
 9. **A**
 10. **A**
 11. **C**
 12. **B**
 13. **B**
 14. **B**
 15. **B**
 16. **D**
 17. **A**
 18. **A**
 19. **D**
 20. **A**
 21. **C**
 22. **B**
 23. **A**
 24. **D**
 25. **A**
 26. **C**
 27. **A**
 28. **B**
 29. **C**
 30. **A**
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