

Name:

UNIT Review
ATOMIC THEORY

- Experimental evidence indicates that the nucleus of an atom
 - contains most of the mass of the atom
 - contains a small percentage of the mass of the atom
 - has no charge
 - has a negative charge
- Which particle has approximately the same mass as a proton?
 - alpha
 - beta
 - electron
 - neutron
- As the number of neutrons in the nucleus of an atom increases, the nuclear charge of the atom
 - decreases
 - increases
 - remains the same
- Which conclusion was a direct result of the gold foil experiment?
 - An atom is mostly empty space with a dense, positively charged nucleus.
 - An atom is composed of at least three types of subatomic particles.
 - An electron has a positive charge and is located inside the nucleus.
 - An electron has properties of both waves and particles.
- Which sequence represents a correct order of historical developments leading to the modern model of the atom?
 - the atom is a hard sphere → most of the atom is empty space → electrons exist in orbitals outside the nucleus
 - the atom is a hard sphere → electrons exist in orbitals outside the nucleus → most of the atom is empty space
 - most of the atom is empty space → electrons exist in orbitals outside the nucleus → the atom is a hard sphere
 - most of the atom is empty space → the atom is a hard sphere → electrons exist in orbitals outside the nucleus
- Which statement about the mass of an electron is correct?
 - The mass of an electron is equal to the mass of a proton.
 - The mass of an electron is less than the mass of a proton.
 - The mass of an electron is equal to the mass of a neutron.
 - The mass of an electron is greater than the mass of a neutron.
- Experiments with gold foil indicated that atoms
 - usually have a uniform distribution of positive charges
 - usually have a uniform distribution of negative charges
 - contain a positively charged, dense center
 - contain a negatively charged, dense center
- What is the total number of protons in an atom with the electron configuration 2-8-18-32-18-1?
 - 69
 - 79
 - 118
 - 197
- What is the total charge of the nucleus of a nitrogen atom?
 - +5
 - +2
 - +7
 - +1
- What is the net charge on an ion that has 9 protons, 11 neutrons, and 10 electrons?
 - 1+
 - 2+
 - 1-
 - 2-
- An atom is electrically neutral because the
 - number of protons equals the number of electrons
 - number of protons equals the number of neutrons
 - ratio of the number of neutrons to the number of electrons is 1:1
 - ratio of the number of neutrons to the number of protons is 2:1
- A sample composed only of atoms having the same atomic number is classified as
 - a compound
 - a solution
 - a element
 - an isomer
- What is the total charge of the nucleus of a carbon atom?
 - 6
 - 0
 - +6
 - +12

14. Compared to an atom of phosphorus-31, an atom of sulfur-32 contains
- one less neutron
 - one less proton
 - one more neutron
 - one more proton
15. Which notation represents an atom of sodium with an atomic number of 11 and a mass number of 24?
- ${}_{11}^{24}\text{Na}$
 - ${}_{11}^{24}\text{Na}$
 - ${}_{11}^{13}\text{Na}$
 - ${}_{11}^{35}\text{Na}$
16. The mass of 12 protons is approximately equal to
- 1 atomic mass unit
 - 12 atomic mass units
 - the mass of 1 electron
 - the mass of 12 electrons
17. The total mass of the protons in an atom of gold-198 is approximately
- 79 atomic mass units
 - 119 atomic mass units
 - 198 atomic mass units
 - 277 atomic mass units
18. What is the mass number of an atom that has six protons, six electrons, and eight neutrons?
- 6
 - 12
 - 14
 - 20
19. What is the total number of neutrons in the nucleus of a neutral atom that has 19 electrons and a mass number of 39?
- 19
 - 20
 - 39
 - 58
20. In which list are the elements arranged in order of increasing atomic mass?
- Cl, K, Ar
 - Fe, Co, Ni
 - Te, I, Xe
 - Ne, F, Na
21. The number of neutrons in the nucleus of an atom can be determined by
- adding the atomic number to the mass number
 - subtracting the atomic number from the mass number
 - adding the mass number to the atomic mass
 - subtracting the mass number from the atomic number
22. What is the total number of neutrons in an atom of ${}_{3}^{7}\text{Li}$?
- 7
 - 10
 - 3
 - 4
23. The mass of an electron is approximately equal to $\frac{1}{1836}$ of the mass of
- a positron
 - a proton
 - an alpha particle
 - a beta particle
24. Atoms of different isotopes of the same element differ in their total number of
- electrons
 - neutrons
 - protons
 - valence electrons
25. The nucleus of an atom of cobalt-58 contains
- 27 protons and 31 neutrons
 - 27 protons and 32 neutrons
 - 59 protons and 60 neutrons
 - 60 protons and 60 neutrons
26. All the isotopes of a given atom have
- the same mass number and the same atomic number
 - the same mass number but different atomic numbers
 - different mass numbers but the same atomic number
 - different mass numbers and different atomic numbers
27. Chlorine-37 can be represented as
- ${}_{17}^{35}\text{Cl}$
 - ${}_{17}^{37}\text{Cl}$
 - ${}_{20}^{35}\text{Cl}$
 - ${}_{17}^{37}\text{Cl}$
28. Which two notations represent different isotopes of the same element?
- ${}_{4}^{6}\text{Be}$ and ${}_{4}^{9}\text{Be}$
 - ${}_{3}^{7}\text{Li}$ and ${}_{3}^{7}\text{Li}$
 - ${}_{7}^{14}\text{N}$ and ${}_{6}^{14}\text{C}$
 - ${}_{15}^{32}\text{P}$ and ${}_{16}^{32}\text{S}$
29. What is the total number of neutrons in an atom of ${}_{26}^{57}\text{Fe}$?
- 26
 - 31
 - 57
 - 83

30. Which value of an element is calculated using both the mass and the relative abundance of each of the naturally occurring isotopes of this element?
- 1) atomic number
 - 2) atomic mass
 - 3) half-life
 - 4) molar volume
31. A 100.00-gram sample of naturally occurring boron contains 19.78 grams of boron-10 (atomic mass = 10.01 atomic mass units) and 80.22 grams of boron-11 (atomic mass = 11.01 atomic mass units). Which numerical setup can be used to determine the atomic mass of naturally occurring boron?
- 1) $(0.1978)(10.01) + (0.8022)(11.01)$
 - 2) $(0.8022)(10.01) + (0.1978)(11.01)$
 - 3) $(0.1978)(10.01)/(0.8022)(11.01)$
 - 4) $(0.8022)(10.01)/(0.1978)(11.01)$
32. The atomic mass of an element is the weighted average of the
- 1) number of protons in the isotopes of that element
 - 2) number of neutrons in the isotopes of that element
 - 3) atomic numbers of the naturally occurring isotopes of that element
 - 4) atomic masses of the naturally occurring isotopes of that element
33. Given the table below that shows student's examples of proposed models of the atom:

Proposed Models of the Atom

Model	Location of Protons	Location of Electrons
A	in the nucleus	specific shells
B	in the nucleus	regions of most probable location
C	dispersed throughout the atom	specific shells
D	dispersed throughout the atom	regions of most probable location

Which model correctly describes the locations of protons and electrons in the wave-mechanical model of the atom?

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

34. 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
- 1) 1
 - 2) 2
 - 3) 3
 - 4) 4

35. How many electrons are in the outermost principal energy level (shell) of an atom of carbon in the ground state?
- 1) 6
 - 2) 2
 - 3) 3
 - 4) 4
36. What is the maximum number of electrons that can occupy the fourth principal energy level (shell) of an atom?
- 1) 6
 - 2) 8
 - 3) 18
 - 4) 32

37. What is the highest principal energy level for an electron in an atom of sulfur in the ground state?
- 1) 1
 - 2) 2
 - 3) 3
 - 4) 4
38. Which electron configuration represents an atom of an element having a completed third principal energy level?
- 1) 2-8-2
 - 2) 2-8-6-2
 - 3) 2-8-10-2
 - 4) 2-8-18-2
39. Which element has atoms with only one completely filled principal energy level?
- 1) N
 - 2) P
 - 3) As
 - 4) Sb
40. Which electron configuration could represent a strontium atom in an excited state?
- 1) 2-8-18-7-1
 - 2) 2-8-18-7-3
 - 3) 2-8-18-8-1
 - 4) 2-8-18-8-2
41. Which electron configuration represents an atom of aluminum in an excited state?
- 1) 2-7-4
 - 2) 2-7-7
 - 3) 2-8-3
 - 4) 2-8-6
42. Compared to an atom of hydrogen in the ground state, an atom of hydrogen in the excited state has
- 1) absorbed energy
 - 2) released energy
 - 3) neither released nor absorbed energy
43. An atom with the electron configuration 2-8-8-2 has an incomplete
- 1) 2nd principal energy level
 - 2) 2s sublevel
 - 3) 3rd principal energy level
 - 4) 3s sublevel
44. Which electron configuration is possible for a nitrogen atom in the excited state?
- 1) 2-5
 - 2) 2-4-1
 - 3) 2-6
 - 4) 2-4
45. Which electron configuration represents an atom of lithium in an excited state?
- 1) 1-1
 - 2) 1-2
 - 3) 2-1
 - 4) 2-2
46. An atom of oxygen is in an excited state. When an electron in this atom moves from the third shell to the second shell, energy is
- 1) emitted by the nucleus
 - 2) emitted by the electron
 - 3) absorbed by the nucleus
 - 4) absorbed by the electron
47. As an electron in an atom moves from the ground state to the excited state, the electron
- 1) gains energy as it moves to a higher energy level
 - 2) gains energy as it moves to a lower energy level
 - 3) loses energy as it moves to a higher energy level
 - 4) loses energy as it moves to a lower energy level
48. Which electron configuration represents the electrons of an atom in an excited state?
- 1) 2-8-1
 - 2) 2-8-6
 - 3) 2-8-17-6
 - 4) 2-8-18-5
49. Which electron transition represents a gain of energy?
- 1) from 2nd to 3rd shell
 - 2) from 2nd to 1st shell
 - 3) from 3rd to 2nd shell
 - 4) from 3rd to 1st shell
50. When the electrons of an excited atom return to a lower energy state, the energy emitted can result in the production of
- 1) alpha particles
 - 2) isotopes
 - 3) protons
 - 4) spectra
51. During a flame test, ions of a specific metal are heated in the flame of a gas burner. A characteristic color of light is emitted by these ions in the flame when the electrons
- 1) gain energy as they return to lower energy levels
 - 2) gain energy as they move to higher energy levels
 - 3) emit energy as they return to lower energy levels
 - 4) emit energy as they move to higher energy levels
52. Which phrase describes an atom?
- 1) a positively charged electron cloud surrounding a positively charged nucleus
 - 2) a positively charged electron cloud surrounding a negatively charged nucleus
 - 3) a negatively charged electron cloud surrounding a positively charged nucleus
 - 4) a negatively charged electron cloud surrounding a negatively charged nucleus

53. In the wave-mechanical model of the atom, orbitals are regions of the most probable locations of

- 1) protons
- 2) positrons
- 3) neutrons
- 4) electrons

Base your answers to questions 54 through 57 on the table below.

Naturally Occurring Isotopes of Copper

Isotope Notation	Percent Natural Abundance (%)	Atomic Mass (atomic mass units, u)
Cu-63	69.17	62.930
Cu-65	30.83	64.928

54. Show a correct numerical setup for calculating the atomic mass of copper.

55. The atomic mass of Cu-63 is expressed to what number of significant figures?

56. What is the total number of electrons in an atom of Cu-65?

57. State, in terms of subatomic particles, how an atom of Cu-63 differs from an atom of Cu-65.

58. Write *one* electron configuration for an atom of silicon in an excited state.

59. Write an electron configuration for an atom of aluminum-27 in an excited state.

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

Base your answers to questions 61 through 63 on the information below.

A glass tube is filled with hydrogen gas at low pressure. An electric current is passed through the gas, causing it to emit light. This light is passed through a prism to separate the light into the bright, colored lines of hydrogen's visible spectrum. Each colored line corresponds to a particular wavelength of light. One of hydrogen's spectral lines is red light with a wavelength of 656 nanometers.

Tubes filled with other gases produce different bright-line spectra that are characteristic of each kind of gas. These spectra have been observed and recorded.

61. Explain how the elements present on the surface of a star can be identified using bright-line spectra.

62. Explain, in terms of electron energy states and energy changes, how hydrogen's bright-line spectrum is produced.

63. A student measured the wavelength of a hydrogen's visible red spectral line to be 647 nanometers. Show a correct, numerical setup for calculating the student's percent error.

64. Base your answer to the following question on the information below.

An atom has an atomic number of 9, a mass number of 19, and an electron configuration of 2–6–1.

Explain why the number of electrons in the second and third shells show that this atom is in an excited state.

65. Draw a Lewis electron-dot diagram of a selenium atom in the ground state.

1. 1
2. 4
3. 3
4. 1
5. 1
6. 2
7. 3
8. 2
9. 3
10. 3
11. 1
12. 3
13. 3
14. 4
15. 1
16. 2
17. 1
18. 3
19. 2
20. 1
21. 2
22. 4
23. 2
24. 2
25. 1
26. 3
27. 4
28. 1
29. 2

30. 2
31. 1
32. 4
33. 2
34. 2
35. 4
36. 4
37. 3
38. 4
39. 1
40. 2
41. 1
42. 1
43. 3
44. 2
45. 2
46. 2
47. 1
48. 3
49. 1
50. 4
51. 3
52. 3
53. 4

54. $(0.6917)(62.930 \text{ u}) + (0.3083)(64.928 \text{ u})$

$$\frac{(69.17)(62.930) + (30.83)(64.928)}{10}$$

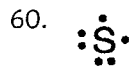
55. Five
56. 29

Atomic Mass Review Packet
Answer Key
[New Exam]

57. *Examples:* – An atom of copper-63 has two fewer neutrons than an atom of copper-65. – An atom of Cu-63 has 34 neutrons and an atom of Cu-65 has 36 neutrons.

58. *Examples:* - 2-7-4-1 ; 2-7-5 ; 2-8-3-1 ; 1-8-5

59. *Examples:* - 2-7-4 - 1-8-4 - 2-6-2-3



61. *Example:* The spectrum from a star is compared to spectra of known elements.

62. *Examples:* – The electron of hydrogen absorbs energy and jumps to a higher energy state. The excited electron returns to a lower energy state, releasing light energy – The e^- absorbs energy and jumps to a higher level. The e^- falls back to a lower level and releases energy related to a particular color.

63. % error = $\frac{647 \text{ nm} - 656 \text{ nm}}{656 \text{ nm}} \times 100$

$$\frac{647 - 656}{656} \times 100$$

64. *Examples:* – The third shell has one electron before the second shell is completely filled – The electron configuration is not 2-7, which is the ground state for an atom with atomic number 9

