1. Which statement describes the location of two types of subatomic particles in a helium atom?
   A) Protons and neutrons are located in the nucleus.
   B) Protons and neutrons are located outside the nucleus.
   C) Protons and electrons are located in the nucleus.
   D) Protons and electrons are located outside the nucleus.

2. Which subatomic particles are found in the nucleus of an atom of beryllium?
   A) electrons and protons
   B) electrons and positrons
   C) neutrons and protons
   D) neutrons and electrons

3. An atom of lithium-7 has an equal number of
   A) electrons and neutrons
   B) positrons and neutrons
   C) protons and neutrons
   D) protons and positrons

4. An atom 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

5. Which part of a helium atom is positively charged?
   A) electron
   B) neutron
   C) nucleus
   D) orbital

6. Which statement best describes the nucleus of an aluminum atom?
   A) It has a charge of +13 and is surrounded by a total of 10 electrons.
   B) It has a charge of +13 and is surrounded by a total of 13 electrons.
   C) It has a charge of -13 and is surrounded by a total of 10 electrons.
   D) It has a charge of -13 and is surrounded by a total of 13 electrons.

7. Which statement concerning elements is true?
   A) Different elements must have different numbers of isotopes.
   B) Different elements must have different numbers of neutrons.
   C) All atoms of a given element must have the same mass number.
   D) All atoms of a given element must have the same atomic number.

8. All atoms of a given element must contain the same number of
   A) protons
   B) neutrons
   C) electrons plus neutrons
   D) protons plus neutrons

9. The major portion of an atom's mass consists of
   A) electrons and protons
   B) electrons and neutrons
   C) neutrons and positrons
   D) neutrons and protons

10. 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

11. The gold foil experiment led to the conclusion that each atom in the foil was composed mostly of empty space because most alpha particles directed at the foil
    A) passed through the foil
    B) remained trapped in the foil
    C) were deflected by the nuclei in gold atoms
    D) were deflected by the electrons in gold atoms

12. The notation for the nuclide $^{12}_{6}C$ gives information about
    A) mass number, only
    B) atomic number, only
    C) both mass number and atomic number
    D) neither mass number nor atomic number

13. 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

14. An atom of any element must contain
    A) an equal number of protons and neutrons
    B) an equal number of protons and electrons
    C) more electrons than neutrons
    D) more electrons than protons

15. In an atom of argon-40, the number of protons
    A) equals the number of electrons
    B) equals the number of neutrons
    C) is less than the number of electrons
    D) is greater than the number of electrons

16. What can be determined if only the atomic number of an atom is known?
    A) the total number of neutrons in the atom, only
    B) the total number of protons in the atom, only
    C) the total number of protons and the total number of neutrons in the atom
    D) the total number of protons and the total number of electrons in the atom

17. What is the total number of protons in an atom with the electron configuration 2-8-18-32-18-1?
    A) 69
    B) 79
    C) 118
    D) 197

18. An atom is electrically neutral because the
    A) number of protons equals the number of neutrons
    B) number of protons equals the number of neutrons
    C) ratio of the number of neutrons to the number of electrons is 1:1
    D) ratio of the number of neutrons to the number of protons is 2:1

19. Compared to an atom of phosphorus-31, an atom of sulfur-32 contains
    A) one less neutron
    B) one less proton
    C) one more neutron
    D) one more proton

20. What is the charge of the nucleus in an atom of oxygen-17?
    A) 0
    B) +2
    C) +8
    D) +17

21. What is the nuclear charge of an iron atom (Fe)?
    A) +26
    B) +30
    C) +56
    D) +82

22. Which quantity can vary among atoms of the same element?
    A) mass number
    B) atomic number
    C) number of protons
    D) numbers of electrons

23. 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

24. The total mass of the protons in an atom of gold-198 is approximately
    A) 79 atomic mass units
    B) 119 atomic mass units
    C) 198 atomic mass units
    D) 277 atomic mass units

25. What is the total number of neutrons in the nucleus of a neutral atom that has 19 electrons and a mass number of 39?
    A) 19
    B) 20
    C) 39
    D) 58

26. Which atom has a mass of approximately two atomic mass units?
    A) $^{1}_{1}$H
    B) $^{2}_{1}$H
    C) $^{3}_{1}$H
    D) $^{4}_{1}$H
27. The table below gives information about the nucleus of each of four atoms.

<table>
<thead>
<tr>
<th>Atom</th>
<th>Number of Protons</th>
<th>Number of Neutrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>D</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>E</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>G</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

How many different elements are represented by the nuclei in the table?

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

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

A) \(^{12}\text{C}\) and \(^{13}\text{C}\)  B) \(^{34}\text{Cl}\) and \(^{36}\text{Cl}\)  C) \(^{14}\text{N}\) and \(^{14}\text{C}\)  D) \(^{32}\text{S}\) and \(^{33}\text{S}\)

29. Which diagram represents the nucleus of an atom of \(^{27}\text{Al}\)?

A)  
B)  
C)  
D)  

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

<table>
<thead>
<tr>
<th>Isotope</th>
<th>Atomic Mass (u)</th>
<th>Natural Abundance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li-6</td>
<td>6.02</td>
<td>7.5</td>
</tr>
<tr>
<td>Li-7</td>
<td>7.02</td>
<td>92.5</td>
</tr>
</tbody>
</table>

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

A) \((0.075)(6.02\text{ u}) + (0.925)(7.02\text{ u})\)  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) \((92.5)(6.02\text{ u}) + (7.5)(7.02\text{ u})\)

31. The average isotopic mass of chlorine is 35.5. Which mixture of isotopes (shown as percents) produces this average mass?

A) 50% \(^{35}\text{Cl}\) and 50% \(^{37}\text{Cl}\)  B) 50% \(^{35}\text{Cl}\) and 50% \(^{37}\text{Cl}\)  C) 75% \(^{35}\text{Cl}\) and 25% \(^{37}\text{Cl}\)  D) 75% \(^{35}\text{Cl}\) and 25% \(^{37}\text{Cl}\)

32. All the isotopes of a given atom have

A) the same mass number and the same atomic number  B) the same mass number but different atomic numbers  C) different mass numbers but the same atomic number  D) different mass numbers and different atomic numbers
1. A
2. C
3. B
4. D
5. C
6. B
7. D
8. A
9. D
10. B
11. A
12. C
13. A
14. B
15. A
16. D
17. B
18. A
19. D
20. C
21. A
22. A
23. C
24. A
25. B
26. B
27. B
28. A
29. B
30. A
31. C
32. C