Section 4.3 How Atoms Differ

In your textbook, read about atomic number.

For each statement below, write true or false.

1. The number of neutrons in an atom is referred to as its atomic number. 
2. The periodic table is arranged by increasing atomic number.
3. Atomic number is equal to the number of electrons in an atom.
4. The number of protons in an atom identifies it as an atom of a particular element.
5. Most atoms have either a positive or a negative charge.

Answer the following questions.

6. Lead has an atomic number of 82. How many protons and electrons does lead have?

7. Oxygen has 8 electrons. How many protons does oxygen have?
8. Zinc has 30 protons. What is its atomic number?
9. Astatine has 85 protons. What is its atomic number?
10. Rutherfordium has an atomic number of 104. How many protons and electrons does it have?
11. Polonium has an atomic number of 84. How many protons and electrons does it have?
12. Nobelium has an atomic number of 102. How many protons and electrons does it have?

In your textbook, read about isotopes and mass number.

Determine the number of protons, electrons, and neutrons for each isotope described below.

13. An isotope has atomic number 19 and mass number 39.
14. An isotope has 14 electrons and a mass number of 28.
15. An isotope has 21 neutrons and a mass number of 40.
16. An isotope has an atomic number 51 and a mass number 123.

Answer the following question.

17. Which of the isotopes in problems 13–16 are isotopes of the same element? Identify the element.

Write each isotope below in symbolic notation. Use the periodic table to determine the atomic number of each isotope.

18. neon-22

19. helium

20. cesium-133

21. uranium-234

Label the mass number and the atomic number on the following isotope notation.

22. $\overset{24}{12}\text{Mg}$

23. $\overset{\text{24}}{\text{12}}\text{Mg}$

In your textbook, read about mass of individual atoms.

Circle the letter of the choice that best completes the statement.

24. The mass of an electron is
   a. smaller than the mass of a proton.
   b. smaller than the mass of a neutron.
   c. a tiny fraction of the mass of an atom.
   d. all of the above.

25. One atomic mass unit is
   a. 1/12 the mass of a carbon-12 atom.
   b. 1/16 the mass of an oxygen-16 atom.
   c. exactly the mass of one proton.
   d. approximately the mass of one proton plus one neutron.

26. The atomic mass of an atom is usually not a whole number because it accounts for
   a. only the relative abundance of the atom’s isotopes.
   b. only the mass of each of the atom’s isotopes.
   c. the mass of the atom’s electrons.
   d. both the relative abundance and the mass of each of the atom’s isotopes.
Use the figures to answer the following questions.

27. What is the atomic number of osmium? ________________

28. What is the chemical symbol for niobium? ________________

29. What is the atomic mass of osmium? ________________

30. What units is the atomic mass reported in? ________________

31. How many protons and electrons does an osmium atom have? A niobium atom?

Calculate the atomic mass of each element described below. Then use the periodic table to identify each element.

32. Isotope  | Mass (amu) | Percent Abundance
------------|------------|------------------
$^{63}X$    | 62.930     | 69.17            
$^{65}X$    | 64.928     | 30.83            

33. Isotope  | Mass (amu) | Percent Abundance
------------|------------|------------------
$^{35}X$    | 34.969     | 75.77            
$^{37}X$    | 36.966     | 24.23            

Section 4.3 continued
Section 4.4 Unstable Nuclei and Radioactive Decay

In your textbook, read about radioactivity.

For each item in Column A, write the letter of the matching item in Column B.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The rays and particles that are emitted by a radioactive material</td>
<td>a. nuclear reaction</td>
</tr>
<tr>
<td>2. A reaction that involves a change in an atom’s nucleus</td>
<td>b. beta radiation</td>
</tr>
<tr>
<td>3. The process in which an unstable nucleus loses energy spontaneously</td>
<td>c. radiation</td>
</tr>
<tr>
<td>4. Fast-moving electrons</td>
<td>d. radioactive decay</td>
</tr>
</tbody>
</table>

In your textbook, read about types of radiation.

Use the diagram to answer the questions.

5. Which plate do the beta particles bend toward? Explain.

6. Explain why the gamma rays do not bend.

7. Explain why the path of the beta particles bends more than the path of the alpha particles.

Complete the following table of the characteristics of alpha, beta, and gamma radiation.

<table>
<thead>
<tr>
<th>Radiation Type</th>
<th>Composition</th>
<th>Symbol</th>
<th>Mass (amu)</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Alpha</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td></td>
<td>1/1840</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>High-energy electromagnetic radiation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>