Multiple choice. (2 points each) Circle the letter corresponding to the best answer for each of the following questions.

1. Which of the following statements is correct?
   a. the number of neutrons in a nucleus determines the identity of an element
   b. the number of protons in a nucleus determines the identity of an element
   c. the number of electrons in an atom determines the identity of an element
   d. the mass number determines the identity of an element
   e. two atoms of the same element must have the same mass number

2. A species with the symbol $^{37}_{17}\text{Cl}^-$ has:
   a. 17 protons, 20 neutrons, and 17 electrons
   b. 17 protons, 20 neutrons, and 18 electrons
   c. 17 protons, 20 neutrons, and 16 electrons
   d. 17 protons, 37 neutrons, and 16 electrons
   e. 17 protons, 37 neutrons, and 18 electrons

3. According to Bohr, the lines we see in the emission spectra of gas discharge tubes (demo in class with diffraction gratings) are due to
   a. protons moving from one nucleus to another
   b. neutrons moving from one nucleus to another
   c. electrons absorbing energy to go from a lower energy level to a higher energy level
   d. electrons releasing energy when they go from a higher energy level to a lower energy level.
   e. protons being converted to neutrons

4. The elements in Group 2 all end their electron configuration with:
   a. $s^2$           b. $p^2$           c. $s^1$           d. $p^1$           e. $d^2$

5. How many valence electrons are in elements that are members of the halogens?
   a. 1           b. 2           c. 6           d. 7           e. 8

6. Which of the following is a member of the alkaline earth metals?
7. Which of the following is a member of the noble gases?

8. Which neutral atom would have the electron configuration 1s²2s²2p⁶3s²3p³?

9. Which of the elements below does not follow the octet rule in a compound?

10. When naming the compound formed between a metal and a nonmetal, the naming convention is that:
    a. the metal retains its name and the nonmetal name is changed to end in –ide.
    b. the nonmetal retains its name and the metal name is changed to end in –ide.
    c. both element names are changed to end in –ide.
    d. the number of atoms of each kind is given by including prefixes prior to the name of each element.
    e. both elements retain their name – there is no change in ending.

11. When naming a compound that involves a polyatomic ion, the naming convention is that:
    a. the polyatomic name is changed to end in –ide.
    b. the polyatomic ion name is unchanged.
    c. prefixes are used to indicate the number of atoms of each element in the polyatomic ion.
    d. the name of any metal in the compound is changed to –ide
    e. prefixes are used to indicate the number of metal atoms in the compound

You had five polyatomic ions to know for this. Let’s see how you did.

12. Which of the following is the nitrate ion?
    a. NH₄⁺  b. SO₄²⁻  c. NO₃⁻  d. OH⁻  e. PO₄³⁻

13. Which of the following is the sulfate ion?
    a. NH₄⁺  b. SO₄²⁻  c. NO₃⁻  d. OH⁻  e. SO₃²⁻

14. Which of the following is the ammonium ion?
    a. NH₄⁺  b. SO₄²⁻  c. NO₃⁻  d. OH⁻  e. PO₄³⁻
15. The OH⁻ ion is called the:

   a. hydroxide
   b. phosphate
   c. sulfate
   d. ammonium
   e. nitrate

16. In naming polyatomic ions, one of the interesting patterns is that the name for a polyatomic ion containing oxygen will have a naming pattern based on the number of oxygens. One of the base ions will have an –ate ending, the one with one less oxygen will end in –ite. For example, ClO₃⁻ is the chlorate ion, ClO₂⁻ is the chlorite ion. What do you suppose the name is for the ion PO₃³⁻?

   a. phosphide
   b. phosphite
   c. phosphate
   d. phosphorous trioxide
   e. hypophosphorate

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Short answer problems. The following question require some sort of short responses. Point totals are indicated in parentheses to the right of the problem number.

17. (10 points) Complete the following table. Pay attention to spelling.

<table>
<thead>
<tr>
<th>Formula</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Ba and S</td>
<td>____________</td>
</tr>
<tr>
<td>b. Pb²⁺ and NO₃⁻</td>
<td>____________</td>
</tr>
<tr>
<td>c. NH₄⁺ and N</td>
<td>____________</td>
</tr>
<tr>
<td>d. Al and O</td>
<td>____________</td>
</tr>
<tr>
<td>e. Mn⁴⁺ and Br</td>
<td>____________</td>
</tr>
</tbody>
</table>
18. (5 points) Name the following compounds.

Name

a. BF$_3$  ___________________________________

b. N$_2$O$_4$  __________________________________

c. SrCl$_2$  __________________________________

d. PBr$_5$  __________________________________

e. CO$_2$  ___________________________________

19. (10 points) For the following species:
   a. Draw the Lewis structure.
   b. State the molecular shape.
   c. State whether the molecule is polar or nonpolar.

<table>
<thead>
<tr>
<th>Species</th>
<th>Lewis Structure</th>
<th>Molecular Shape</th>
<th>Polar or Nonpolar?</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF$_3$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O$_3$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The periodic table of elements is shown with atomic numbers, element symbols, and element names. Each element is assigned a unique position based on its atomic number. The table includes columns for different groups and periods, with elements arranged in order of increasing atomic number. The key provides a legend for interpreting the table, including the average atomic mass and notes for elements with parentheses, indicating the atomic mass of the most stable isotope. The table also highlights specific elements, such as those in certain groups or periods, for emphasis or reference.