1. A particle with 15 protons and 18 electrons would be symbolized as:

A. \(?\) p\(^{3+}\)
B. \(?\) p\(^{-}\)
C. \(?\) Ar
D. \(?\) Ar\(^{3+}\)
E. \(?\) Ar\(^{-}\)

2. Ions are formed in chemical reactions by:

1. Gaining electrons
2. Losing electrons
3. Gaining protons
4. Losing protons
5. All of these

A. \(?\) 1 and 2 are correct
B. \(?\) 5 is correct
C. \(?\) 1 and 3 are correct
D. \(?\) 2 and 4 are correct
E. \(?\) 3 and 4 are correct
3. The name for the compound NaHSO₄ is:
   A. sodium hydrogen sulfate
   B. two of these are correct
   C. sodium bisulfate
   D. sodium persulfate
   E. none of these is correct

4. Which of following is not true of the carbon-14 atom?
   A. It has six protons
   B. It has six electrons
   C. It has eight neutrons
   D. It has an average mass of 12.011 amu.
   E. It is the less common than carbon-12

5. The average mass of a magnesium atom is 24.31. If you were able to select and measure a single atom of magnesium, the chance that you would select an atom of mass 24.31 is about:
   A. 100%
   B. 0.31%
   C. greater than 50%
   D. 24.31%
   E. 0%

6. Which of the above have equal numbers of neutrons?
### 7. Which of the following is named incorrectly?

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>?</td>
<td>$\text{H}_2\text{PO}_3$ : phosphorous acid</td>
</tr>
<tr>
<td>B.</td>
<td>?</td>
<td>$\text{H}_2\text{SO}_4$ : sulfuric acid</td>
</tr>
<tr>
<td>C.</td>
<td>?</td>
<td>$\text{HClO}_2$ : chlorous acid</td>
</tr>
<tr>
<td>D.</td>
<td>?</td>
<td>$\text{H}_2\text{CO}_2$ : carbonous acid</td>
</tr>
<tr>
<td>E.</td>
<td>?</td>
<td>$\text{HClO}$ : hydrochlorous acid</td>
</tr>
</tbody>
</table>

- Crossed out: *only need strong acid names*

### 8. Of the following elements, the one that forms cations with varying positive charges is:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>?</td>
<td>iron, Fe</td>
</tr>
<tr>
<td>B.</td>
<td>?</td>
<td>nitrogen, N</td>
</tr>
<tr>
<td>C.</td>
<td>?</td>
<td>aluminum, Al</td>
</tr>
<tr>
<td>D.</td>
<td>?</td>
<td>sodium, Na</td>
</tr>
<tr>
<td>E.</td>
<td>?</td>
<td>strontium, Sr</td>
</tr>
</tbody>
</table>

### 9. Which of the following arrangements represent ions?

- 1) 12 protons, 12 neutrons, 11 electrons $\checkmark$ — *electrons $\neq$ protons*
- 2) 12 protons, 11 neutrons, 12 electrons $\times$
- 3) 11 protons, 12 neutrons, 12 electrons $\checkmark$
- 4) 11 protons, 12 neutrons, 11 electrons $\times$
- 5) 12 protons, 12 neutrons, 12 electrons $\times$
10. Which of the following statements is incorrect?

A. [ ] Metalloids are metals with some nonmetallic characteristics  
B. [ ] Nonmetals are generally brittle  
C. [ ] Nonmetals are generally poor conductors of electricity  
D. [ ] Metals are malleable  
E. [ ] Metals generally form cations

11. Which of the following arrangements represent different isotopes of the same element?

1) 12 protons, 11 neutrons, 12 electrons  
2) 11 protons, 12 neutrons, 11 electrons  
3) 10 protons, 12 neutrons, 12 electrons  
4) 11 protons, 12 neutrons, 10 electrons  
5) 12 protons, 12 neutrons, 12 electrons

A. [ ] 2, 3, 4 and 5  
B. [ ] All of these qualify  
C. [ ] 1 and 5  
D. [ ] 2 and 4  
E. [ ] None of these qualify

12. Which of these is the correct number of particles in the nuclide above?
13. J.J. Thomson’s model of the atom can be summarized with the visual image of:

A. none of the above
B. plum pudding
C. planets orbiting the sun
D. bees around a hive
E. a small central nucleus and an electron cloud

14. The apparatus pictured here helped to determine:

A. that energy travels at the speed of light
B. that mass and energy are related by $E=mc^2$
C. that electrons have mass
D. that atoms are mostly empty space
E. the existence of electrons
15. The number of errors contained in the table below is:

<table>
<thead>
<tr>
<th>Nuclide</th>
<th>protons</th>
<th>neutrons</th>
<th>electrons</th>
<th>mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>sodium-23</td>
<td>11</td>
<td>12</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>Cobalt-59</td>
<td>27</td>
<td>32</td>
<td>27</td>
<td>59</td>
</tr>
<tr>
<td>Tungsten-184</td>
<td>74</td>
<td>110</td>
<td>184</td>
<td>184</td>
</tr>
<tr>
<td>fluorine-19</td>
<td>109</td>
<td>810</td>
<td>109</td>
<td>19</td>
</tr>
</tbody>
</table>

A. ? one 
B. ? four 
C. ? three 
D. ? two 
E. ? five 

16. A particle X contains 10 electrons, seven neutrons and has a net charge of 3-. The particle is:

A. ? an oxide ion 
B. ? obviously polyatomic 
C. ? a neon ion 
D. ? none of these are correct 
E. ? a nitride ion 

17. The element hafnium (Hf) has five stable isotopes. The correct number of nuclear particles in an atom of hafnium-178 is:
A. ? 72 protons, 106 neutrons
B. 72 protons, 106 neutrons, 72 electrons
C. ? 106 protons, 72 neutrons
D. ? 72 protons, 72 electrons
E. ? 72 protons, 178 neutrons

18. How many oxygen atoms are there in one formula unit of Al₂(SO₄)₃?

A. ? 24
B. ? 4
C. ? 3
D. ? 12
E. ? 7

19. By knowing the number of electrons in a neutral atom, you should also be able to determine

A. ? the number of protons in the neutral atom
B. ? the mass of the neutral atom
C. ? the number of neutrons in the neutral atom
D. ? two of these
E. ? the atomic number of the neutral atom

20. The correct name for MgO₂ is:

A. ? magnesium oxide
B. magnesium peroxide
C. ? magnesium(II) oxide
D. ? magnesium(IV) peroxide
E. ? magnesium(IV) oxide

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