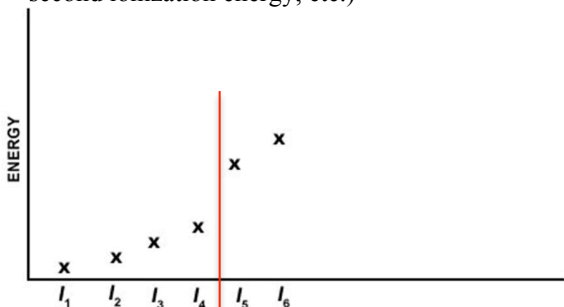


## Chem 2 Chapter 8 Multiple Choice Review—Key

- How many *valence electrons* does a carbon atom have?  
A. 1    B. 2    C. 3    **D. 4**    E. 6
- Which of these atoms has the largest radius?  
A. B    **B. Ga**    C. Br    D. Si    E. Cl  
**Increases left & down**
- If the radius of atom X is greater than the radius of atom Y, then it is also likely that  
A. X has a larger electron affinity than Y does.  
B. X has a larger effective nuclear charge than Y does.  
**C. X has greater metallic character than Y does.**  
D. X has a larger first ionization energy than Y does.  
E. X is a poorer conductor of electricity than Y when in the solid state.  
**All other trends indicate smaller, less metallic atom**
- The elements in Group 7A are known by what name?  
A. transition metals    D. alkaline earth metals  
**B. halogens**    E. noble gases  
C. alkali metals
- The nineteenth century chemists arranged elements in the periodic table according to increasing  
A. atomic number.  
B. number of electrons.  
**C. atomic mass. [Had yet to discover protons]**  
D. number of neutrons.  
E. nuclear binding energy.
- Which of these compounds is a *basic oxide*?  
A. NO<sub>2</sub>    B. H<sub>2</sub>O    **C. Na<sub>2</sub>O**    D. SnO    E. SO<sub>2</sub>  
**Strongest metal (increases left & down)**
- Which of these elements has the smallest first ionization energy?  
A. Li    B. Na    C. Be    D. K    **E. Rb**  
**Increases up & right**
- Which of these atoms has the smallest radius?  
A. Al    **B. P**    C. As    D. Te    E. Na  
**Increases left & down**
- The sulfide ion, S<sup>2-</sup>, is isoelectronic with which one of the following? [Ar]  
A. O<sup>2-</sup>    B. F<sup>-</sup>    C. Na<sup>+</sup>    D. Al<sup>3+</sup>    **E. K<sup>+</sup>**  
[Ne]    [Ne]    [Ne]    [Ne]    [Ar]
- Which of these elements exhibits chemical behavior similar to that of potassium?  
A. magnesium    D. chlorine  
**B. sodium**    E. iron  
C. beryllium
- Which one of these ions has the largest radius?  
A. Cl<sup>-</sup>    B. K<sup>+</sup>    **C. S<sup>2-</sup>**    D. Na<sup>+</sup>    E. O<sup>2-</sup>  
[Ar]    [Ar]    [Ar]    [Ne]    [Ne]
- Which of these ground-state ions has unpaired electrons?  
A. P<sup>3-</sup>    B. V<sup>5+</sup>    C. Mg<sup>2+</sup>    **D. Sc<sup>2+</sup>**    E. S<sup>2-</sup>  
**Must be transition metal; all other ions have full shell. V<sup>5+</sup> is [Ar]; Sc<sup>2+</sup> is [Ar]3d<sup>1</sup>**
- The representative elements are those with unfilled energy levels in which the "last electron" was added to  
A. an s orbital.    D. a p or d orbital.  
**B. an s or p orbital.**    E. an f orbital.  
C. a d orbital.  
**Representative elements are s & p block (IA-VIIIA)**
- The second ionization energy of Mg is \_\_\_\_\_ than its first ionization energy, and is \_\_\_\_\_ than the second ionization energy of Na.  
A. higher, higher    **C. higher, lower**  
B. lower, higher    D. lower, lower  
**2<sup>nd</sup> IE is always greater than 1<sup>st</sup>; 2<sup>nd</sup> IE for Mg lower than Na since not removing core electron.**
- What is the charge on the monatomic ion of nitrogen, the nitride ion?  
A. +2    B. +1    C. -1    D. -2    **E. -3**
- The general electron configuration for atoms of the halogen group is  
A. ns<sup>2</sup>np<sup>6</sup>.    D. ns<sup>1</sup>.  
**B. ns<sup>2</sup>np<sup>5</sup>.**    E. ns<sup>2</sup>np<sup>7</sup>.  
C. ns<sup>2</sup>np<sup>6</sup>(n-1)d<sup>7</sup>.
- Which of these elements has the greatest metallic character?  
A. Br    B. F    C. Ge    D. Mn    **E. Sc**  
**Increases down & left**
- Which of these elements has the highest first ionization energy?  
A. Cs    B. Ga    C. K    D. Bi    **E. As**  
**Increases up & right**
- How many 3d electrons does the copper(I) ion, Cu<sup>+</sup>, have? **4s<sup>1</sup>3d<sup>10</sup> → 3d<sup>10</sup>**  
**A. 10**    B. 9    C. 8    D. 7    E. 6
- An element with the general electron configuration for its outermost electrons of ns<sup>2</sup>np<sup>1</sup> would be in which element group?  
A. 2A    **B. 3A**    C. 4A    D. 5A    E. 8A
- Which one of these ions does *not* have [Kr] as its electronic configuration?  
A. Se<sup>2-</sup>    B. Br<sup>-</sup>    C. Rb<sup>+</sup>    D. Y<sup>3+</sup>    **E. Zn<sup>2+</sup>**  
[Kr]    [Kr]    [Kr]    [Kr]    [Ar]3d<sup>10</sup>
- Which of these elements has the greatest electron affinity (largest positive value)?  
A. Mg    B. Al    C. Si    D. P    **E. S**  
**Increases up & right**
- Since zirconium is a metal, ZrO<sub>2</sub> is expected to be a/an \_\_\_\_\_ oxide.  
A. acidic    D. neutral  
B. ionic    **E. basic**  
C. amphoteric
- The general electron configuration for noble gas atoms is  
**A. ns<sup>2</sup>np<sup>6</sup>.**    D. ns<sup>2</sup>np<sup>3</sup>.  
B. ns<sup>2</sup>np<sup>5</sup>.    E. ns<sup>2</sup>.  
C. ns<sup>2</sup>np<sup>4</sup>.    **All except He, which is 1s<sup>2</sup>**
- For phosphorus atoms, which ionization energy will show an exceptionally large increase over the previous ionization energy?  
A. 2nd    B. 3rd    C. 4th    D. 5th    **E. 6th**  
**P has 5 valence electrons**

26. The electron configuration of a cobalt(III) ion is  
 A.  $[\text{Ar}]3d^5$  D.  $[\text{Ar}]3d^6$   
 B.  $[\text{Ar}]4s^13d^5$  E.  $[\text{Ar}]4s^23d^9$   
 C.  $[\text{Ar}]4s^23d^4$   $[\text{Ar}]4s^23d^7 \rightarrow [\text{Ar}]3d^6$
27. The successive ionization energies of a certain element are  $I_1 = 577.9 \text{ kJ/mol}$ ,  $I_2 = 1820 \text{ kJ/mol}$ ,  $I_3 = 2750 \text{ kJ/mol}$ ,  $I_4 = 11,600 \text{ kJ/mol}$ , and  $I_5 = 14,800 \text{ kJ/mol}$ . This pattern of ionization energies suggests that the unknown element is  
 A. K. B. Al. C. Cl. D. Se. E. Kr.  
**Large jump after 3<sup>rd</sup> electron, Al has 3 valence electrons**
28. Which two electron configurations represent elements that would have similar chemical properties?  
 (1)  $1s^22s^22p^4$   
 (2)  $1s^22s^22p^5$   
 (3)  $[\text{Ar}]4s^23d^{10}4p^3$   
 (4)  $[\text{Ar}]4s^23d^{10}4p^4$   
 A. (1) and (2) D. (2) and (4)  
 B. (1) and (3) E. (2) and (3)  
 C. (1) and (4) **Look for the same  $ns^x np^y$  configuration**
29. Which of these species make an *isoelectronic pair*:  $\text{Cl}^-$ ,  $\text{O}^{2-}$ , F,  $\text{Ca}^{2+}$ ,  $\text{Fe}^{3+}$   $[\text{Ar}]$ ,  $[\text{Ne}]$ ,  $[\text{Ar}]$ ,  $[\text{Ar}]3d^5$   
 A.  $\text{Ca}^{2+}$  and  $\text{Fe}^{3+}$  D.  $\text{Cl}^-$  and  $\text{Ca}^{2+}$   
 B.  $\text{O}^{2-}$  and F E. none of these  
 C. F and  $\text{Cl}^-$
30. Which of these compounds is an *amphoteric oxide*?  
 A.  $\text{Na}_2\text{O}$  D.  $\text{SO}_2$   
 B.  $\text{MgO}$  E.  $\text{Cl}_2\text{O}_7$   
 C.  $\text{Al}_2\text{O}_3$   **$\text{Al}_2\text{O}_3$  is nearest to metalloids**
31. Which of these compounds is an *acidic oxide*?  
 A.  $\text{P}_4\text{O}_{10}$  D.  $\text{K}_2\text{O}$   
 B.  $\text{MgO}$  E.  $\text{Cr}_2\text{O}_3$   
 C.  $\text{Fe}_2\text{O}_3$   **$\text{P}_4\text{O}_{10}$  is the only nonmetal**
32. Which ion is *isoelectronic* with Ar?  
 A.  $\text{Fe}^{2+}$  B.  $\text{F}^-$  C.  $\text{Br}^-$  D.  $\text{Ga}^{3+}$  E.  $\text{Ca}^{2+}$
33. Which of these ground-state ions has the largest number of unpaired electrons?  
 A.  $\text{Cr}^{2+}$  B.  $\text{Mn}^{2+}$  C.  $\text{Ni}^{2+}$  D.  $\text{Cu}^+$  E.  $\text{Co}^{2+}$   
 $d^4$   $d^5$   $d^8$   $d^{10}$   $d^7$
34. Consider the following reaction:  $3\text{Li} + \text{Z} \rightarrow \text{Li}_3\text{Z}$ . What is the formula for the compound if we substitute magnesium for lithium?  
 A.  $\text{MgZ}$  D.  $\text{Mg}_3\text{Z}$   
 B.  $\text{Mg}_2\text{Z}$  E.  $\text{Mg}_3\text{Z}_2$   
 C.  $\text{MgZ}_2$  **Z forms 3- ion**
35. For which of these reactions is the enthalpy change equal to the second ionization energy of nitrogen?  
 A.  $\text{N}^{2+}(\text{g}) \rightarrow \text{N}^{3+}(\text{g}) + \text{e}^-$   
 B.  $\text{N}^{2+}(\text{g}) + \text{e}^- \rightarrow \text{N}^+(\text{g})$   
 C.  $\text{N}(\text{g}) \rightarrow \text{N}^{2+}(\text{g}) + 2\text{e}^-$   
 D.  $\text{N}^-(\text{g}) + \text{e}^- \rightarrow \text{N}^{2-}(\text{g})$   
 E.  $\text{N}^+(\text{g}) \rightarrow \text{N}^{2+}(\text{g}) + \text{e}^-$  **Reaction must start with  $\text{N}^+(\text{g})$**
36. How many 3d electrons does an  $\text{Fe}^{3+}$  ion have?  
 A. 9 B. 6 C. 5 D. 4 E. 3  
 $4s^23d^6 - 3\text{e}^- \rightarrow 3d^5$
37. Which of these elements has the following pattern for its first six ionization energies? ( $I_1$  = first ionization energy,  $I_2$  = second ionization energy, etc.)
- 
- A. Ca B. Si C. Al D. Se E. P  
**Si has 4 valence electrons**
38. For silicon atoms, which ionization energy will show an exceptionally large increase over the preceding ionization energy? **Si has 4 valence electrons**  
 A. 2nd B. 3rd C. 4th D. 5th E. 6th
39. Consider the following reaction  $2\text{A} + 3\text{F}_2 \rightarrow 2\text{AF}_3$ . What is the formula for the reaction product if we substitute sulfur for fluorine? **A forms 3+ ion**  
 A.  $\text{A}_2\text{S}_3$  B.  $\text{A}_3\text{S}_2$  C.  $\text{AS}_3$  D.  $\text{A}_3\text{S}$  E.  $\text{AS}$
40. Arrange these ions in order of increasing ionic radius:  $\text{K}^+$ ,  $\text{P}^{3-}$ ,  $\text{S}^{2-}$ ,  $\text{Cl}^-$ .
- Increasing radius  $\rightarrow$   
 A.  $\text{K}^+ < \text{Cl}^- < \text{S}^{2-} < \text{P}^{3-}$   
 B.  $\text{K}^+ < \text{P}^{3-} < \text{S}^{2-} < \text{Cl}^-$   
 C.  $\text{P}^{3-} < \text{S}^{2-} < \text{Cl}^- < \text{K}^+$   
 D.  $\text{Cl}^- < \text{S}^{2-} < \text{P}^{3-} < \text{K}^+$   
 E.  $\text{Cl}^- < \text{S}^{2-} < \text{K}^+ < \text{P}^{3-}$   
**All isoelectronic with Ar, highest  $Z_{\text{eff}}$  is smallest**