Chem 2 AP Chapter 7 MC Review Key

1. Is it possible for a fluorescent material to emit radiation in the ultraviolet region after absorbing visible light? Explain your answer.

\[ E = \frac{hc}{\lambda} \]

A) No, ultraviolet light has higher energy than visible light.
B) No, fluorescent materials only emit purple and green visible light.
C) Yes, fluorescent materials emit a broad spectrum of light.
D) Yes, after storing enough visible light energy, the fluorescent material can emit ultraviolet light.

2. The ground-state electron configuration listed is incorrect: F: 1s²2s²2p⁶. Write the correct electron configuration.

A) F: 1s²2s²2p⁴  
B) F: 1s²2s²2p⁵  
C) F: 1s²2s²2p⁶  
D) F: 1s²2s²2p⁷

3. Indicate the number of unpaired electrons present in each of the following atoms: Kr, Fe, Cd, I, Pb.

A) Kr(0); Fe(4); Cd(0); I(1); Pb(1)  
B) Kr(0); Fe(4); Cd(1); I(1); Pb(2)  
C) Kr(0); Fe(3); Cd(0); I(1); Pb(2)  
D) Kr(0); Fe(4); Cd(0); I(1); Pb(2) (p⁶, d⁶, d⁷, p³, p⁵)

4. The electron configuration of a neutral atom is 1s²2s²2p⁶3s². Name the element.

A) Si  
B) Na  
C) Mg  
D) Al

5. Use the Aufbau principle to obtain the ground-state electron configuration of technetium.

A) Tc: [Kr] 4d⁶  
B) Tc: [Kr] 4d³  
C) Tc: [Kr] 5s⁴4d⁶  
D) Tc: [Kr] 5s⁴4d⁷

6. A photoelectric experiment was performed by separately shining a laser at 450 nm (blue) and a laser at 560 nm (yellow) on a clean metal surface and measuring the KE of the ejected electrons. Which light would generate higher energy e⁻? Assume that the frequencies of the lasers exceed the threshold frequency.

A) The yellow light would generate higher energy e⁻.  
B) The blue light would generate higher energy e⁻.  
C) The blue and yellow lights would generate electrons of equal energy.  
D) The blue electrons would have higher KE.

7. An electron in a hydrogen atom is excited from the ground state to the n = 4 state. Decide whether the following statement is true or false. Statement: The wavelength of light emitted when the electron drops from n = 4 to n = 1 is longer than the wavelength of light emitted when the electron drops from n = 4 to n = 2.

A) True  
B) False

8. Which electron configuration corresponds to that of a noble gas?

A) 1s²2s²2p⁶3s²3p⁴  
B) 1s²2s²2p⁶3s²3p³  
C) 1s²2s²2p⁶3s²3p⁴

9. Which electronic transition requires the addition of the most energy? [The only one where n < n]

A) n=1 to n=3  
B) n=4 to n=1  
C) n=5 to n=2  
D) n=5 to n=1  
E) n=5 to n=3

10. An orbital that could never exist according to quantum mechanics is

A) 3d  
B) 8s  
C) 6d  
D) 3f

11. N₂ molecules absorb ultraviolet light but not visible light. I₂ molecules absorb both visible and ultraviolet light. Which of the following statements explains the observations?

A) More energy is required to make N₂ molecules vibrate than is required to make I₂ molecules vibrate.
B) More energy is required to remove an electron from an I₂ molecule than is required to remove an electron from a N₂ molecule.
C) Visible light does not produce transitions between electronic energy levels in the N₂ molecule but does produce transitions in the I₂ molecule.
D) The molecular mass of I₂ is greater than the molecular mass of N₂.

Chem 2 Chapter 8 MC Review Key

1. How many valence electrons does a carbon atom have?

A) 1  
B) 2  
C) 3  
D) 4  
E) 6

2. Which of these atoms has the largest radius?

A) B  
B) Ga  
C) Br  
D) Si  
E) Cl

3. 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

4. Which of these elements has the smallest first ionization energy?

A) Li  
B) Na  
C) Be  
D) K  
E) Rb

5. Which of these atoms has the smallest radius?

A) Al  
B) P  
C) As  
D) Te  
E) Na

6. The sulfide ion, S²⁻, is isoelectronic with which one of the following? [Ar]

A) O²⁻  
B) F⁻  
C) Na⁺  
D) Al³⁺  
E) K⁻  
F) [Ne]  
G) [Ne]  
H) [Ne]  
I) [Ar]

7. Which of these elements exhibits chemical behavior similar to that of potassium?

A) magnesium  
B) chlorine  
C) beryllium  
D) sodium  
E) iron
8. Which one of these ions has the largest radius?
   A. Cl⁻  B. K⁺  C. S²⁻  D. Na⁺  E. O²⁻
   [Ar]  [Ar]  [Ar]  [Ne]  [Ne]

9. Which of these ground-state ions has unpaired electrons?
   A. P₃⁻  B. V⁵⁺  C. Mg⁵⁺  D. Sc⁷⁺  E. S²⁻
   Must be transition metal; all other ions have full shell. V⁵⁺ is [Ar]; Sc⁷⁺ is [Ar]3d⁴

10. 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
    2nd IE is always greater than 1st; 2nd IE for Mg lower than Na since not removing core electron.

11. What is the charge on the monatomic ion of nitrogen, the nitride ion?
    A. +2  B. +1  C. −1  D. −2  E. −3

12. The general electron configuration for atoms in group 17/VIIA is:
    A. ns²np⁵  B. ns²np⁶  C. ns²np⁷  D. ns¹  E. ns¹np⁷

13. Which of these elements has the greatest metallic character? Increases down & left
    A. Br  B. F  C. Ge  D. Mn  E. Se

14. Which of these elements has the highest first ionization energy?
    A. Cs  B. Ga  C. K  D. Bi  E. As
    Increases up & right

15. An element with the general electron configuration for its outermost electrons of ns²np¹ would be in which element group?
    A. 2A  B. 3A  C. 4A  D. 5A  E. 8A

16. Which one of these ions does not have [Kr] as its electronic configuration?
    A. Se²⁻  B. Br⁻  C. Rb⁺  D. Y³⁺  E. Zn³⁺
    [Kr]  [Kr]  [Kr]  [Kr]  [Ar]3d¹⁰

17. 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

18. 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

19. Which two electron configurations represent elements that would have similar chemical properties?
    (1) 1s²2s²2p⁴  (2) 1s²2s²2p⁵  (3) [Ar]4s²3d⁰4p³  (4) [Ar]4s²3d⁰4p⁴
    A. (1) and (2)  D. (2) and (4)
    B. (1) and (3)  E. (2) and (3)
    C. (1) and (4)

20. The electron configuration of a cobalt(III) ion is:
    A. [Ar]3d⁷  B. [Ar]4s²3d⁷  C. [Ar]4s²3d⁰
    D. [Ar]3d⁷  E. [Ar]4s⁴3d⁰

21. Which of these species make an isoelectronic pair: Cl⁻, O²⁻, F, Ca²⁺, Fe³⁺, [Ar], [Ne], 1s²2s²2p⁴, [Ar], [Ar]3d³
    A. Ca²⁺ and Fe³⁺  B. Cl⁻ and Ca²⁺  C. O²⁻ and F  D. none of these
    E. F and Cl⁻

22. Which ion is isoelectronic with Ar?
    A. Fe²⁺  B. F⁻  C. Br⁻  D. Ga³⁺  E. Ca²⁺

23. Which of these ground-state ions has the largest number of unpaired electrons?
    A. Cr²⁺  B. Mn³⁺  C. Ni²⁺  D. Cu²⁺  E. Co²⁺
    d⁴  d⁵  d⁶  d⁹  d⁷

24. Consider the following reaction: 3Li + Z → LiZ. What is the formula for the compound if we substitute magnesium for lithium?
    A. MgZ  B. Mg₂Z  C. MgZ₂  D. Mg₂Z  E. Z forms 3– ionS

25. For which of these reactions is the enthalpy change equal to the second ionization energy of nitrogen?
    A. N²⁺(g) → N³⁺(g) + e⁻  B. N²⁺(g) + e⁻ → N³⁺(g)
    C. N(g) → N²⁺(g) + 2e⁻  D. N(g) + e⁻ → N³⁺(g)  E. N⁺(g) → N²⁺(g) + e⁻
    Reaction must start with N(g)

26. How many 3d electrons does an Fe³⁺ ion have?
    A. 9  B. 6  C. 5  D. 4  E. 3
    4s²3d⁶ – 3 e⁻ → 3d⁶

27. Which of these elements has the following pattern for its first six ionization energies? (I₁ = first ionization energy, I₂ = second ionization energy, etc.)
    A. Ca  B. Si  C. Al  D. Se  E. P
    Si has 4 valence electrons

28. Arrange these ions in order of increasing ionic radius:
    K⁺, P³⁻, S²⁻, Cl⁻.
    Increasing radius →
    A. K⁺ < Cl⁻ < S²⁻ < P³⁻  All isoelectronic
    B. K⁺ < P³⁻ < S²⁻ < Cl⁻  with Ar, highest
    C. P³⁻ < S²⁻ < Cl⁻ < K⁺  Zeff is smallest
    D. Cl⁻ < S²⁻ < P³⁻ < K⁺
    E. Cl⁻ < S²⁻ < K⁺ < P³⁻