

### CH301 Worksheet 5: Practice Exam

*It is recommended that you use this worksheet as practice for the exam, not for studying. Try to complete the worksheet without using any reference material and within 90 minutes.*

1. What would you expect to happen if you hit a molecule with a gamma ray?
  1. It would start to vibrate.
  2. It would start to rotate.
  3. An electron would be promoted to a higher energy level.
  4. **It would break apart into constituent atoms.**
2. The photoelectric effect gave evidence against classical mechanics for which reason?
  1. The energy with which electrons were ejected depended sensitively on the intensity of the light used.
  2. There was a threshold intensity below which no electrons were emitted.
  3. **There was a threshold frequency below which no electrons were emitted.**
  4. Classical mechanics predicted that no electrons should be emitted from the metal, no matter what kind of light it was hit with.
3. What is the wavelength of light emitted in the  $n = 5$  to  $n = 3$  transition for hydrogen?

1280 nm
4. Which of the following is not a valid wavelength for a particle in a box of length 10 nm?
  1. 3.33 nm
  2. 5 nm
  3. 10 nm
  4. **15 nm**
  5. 20 nm

5. You know the velocity of a proton ( $m = 1.67 \times 10^{-27}$  kg) with an uncertainty of 1.00 km/s. What is the minimum uncertainty in the position of the proton?

31.6 pm

6. The peak emission wavelength from a blackbody radiator is 550 nm. What is the temperature of the radiator?

5240 K

7. What is the physical meaning of the wave function found by solving the Schrödinger equation?

1. It gives the probability of finding the particle at each location in space.
2. Its square root gives the probability of finding the particle at each location in space.
3. Its square gives the probability of finding the particle at each location in space.

8. Which group is known as the halogens?

1. 1
2. 2
3. II
4. VII
5. 18

9. For  $n = 3$ ,  $l = 2$ , which of these is not an allowed value of  $m_l$ ?

1. -2
2. 0
3. 3
4. 2

10. Which of the following is a valid quantum number assignment?

1.  $n = 1, l = 1, m_l = 0, m_s = 0$
2.  $n = 3, l = 2, m_l = 2, m_s = 1/2$
3.  $n = 5, l = 0, m_l = 1, m_s = -1/2$
4.  $n = 2, l = 2, m_l = 1, m_s = 1/2$
5.  $n = 3, l = 2, m_l = -1, m_s = -1$

11. Coulombic electron-electron repulsion is the reasoning behind which of the following rules?

1. the Aufbau Principle
2. Hund's Rule
3. the octet rule
4. the Pauli Exclusion Principle

12. Which of the following is the correct electronic configuration for V?

1.  $[\text{Ar}]3d^34s^2$
2.  $[\text{Ar}]4s^24p^2$
3.  $[\text{Ar}]3d^5$
4.  $[\text{Ar}]3d^34p^2$

13. Which of the following is the correct electronic configuration for  $\text{Sb}^+$ ?

1.  $[\text{Kr}]3d^{10}4s^14p^3$
2.  $[\text{Kr}]3d^{10}4s^24p^2$
3.  $[\text{Kr}]4s^24p^24d^{10}$
4.  $[\text{Kr}]3d^84p^6$
5.  $[\text{Kr}]3d^94s^24p^3$

14. Which of the following is an **INCORRECT** valence shell electron configuration?

1.  $s^2p^2$
2.  $s^2d^4$
3.  $s^2d^8$
4.  $s^1d^{10}$
5.  $s^2p^5$

15. Stable filled and half-filled shells and subshells explain which of the following?

1. The atomic radius of sulfur is smaller than that of phosphorous.
2. The electronegativity of fluorine is higher than that of oxygen.
3. The electron affinity of carbon is higher than that of nitrogen.
4. Tin has more metallic character than arsenic.

16. Create an isoelectronic series and rank the following in order of increasing ionic radius:

As, Sr, Y, Br, Rb

1.  $As^{+3} < Br^+ < Rb^- < Sr^{-2} < Y^{-3}$
2.  $Y^{+3} < Sr^{+2} < Rb^+ < Br^- < As^{-3}$
3.  $Rb^+ < Br^- < Sr^{+2} < Y^{+3} < As^{-3}$
4.  $As^{-3} < Br^- < Rb^+ < Sr^{+2} < Y^{+3}$
5.  $Y^{-3} < Sr^{-2} < Rb^- < Br^+ < As^{+3}$

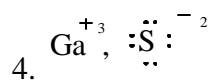
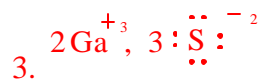
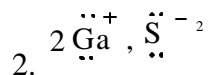
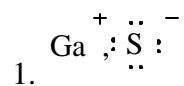
17. Rank the following in order of increasing ionization energy:

Ba, Ge, As, Fe, Mn, Se

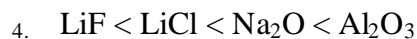
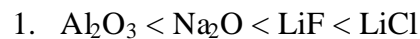
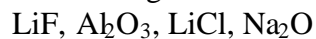
1.  $Ba < Fe < Mn < Ge < Se < As$
2.  $Ba < Mn < Fe < Ge < As < Se$
3.  $As < Se < Ge < Mn < Fe < Ba$



18. Which of the following is the correct Lewis structure for the ionic compound containing Ga and S?



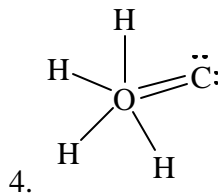
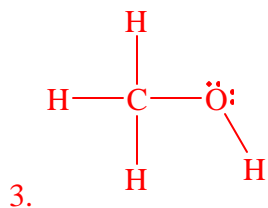
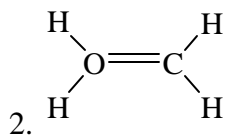
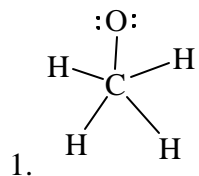
19. Rank the following in order of increasing crystal lattice energy:



20. Which of the following compounds has resonance?



21. Which of the following is the correct structure for CH<sub>4</sub>O?



22. Which of the following can not fulfill the octet/duplet rule for all atoms in the molecule?



23. The octet rule is violated for the aluminum atom in AlH<sub>3</sub>. Why?

1. There are too many valence electrons.

2. There are an odd number of valence electrons.

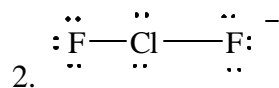
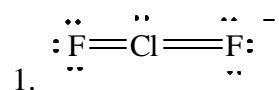
3. There are too few valence electrons.

4. Adding more electrons to the aluminum atom would change its formal charge from 0 to -1.

24. Which of the following molecules contains a triple bond?

1. SeCP<sup>-</sup>
2. HSiP
3. GeS<sub>2</sub>
4. CH<sub>2</sub>O

25. Which of the following is the correct Lewis dot structure for ClF<sub>2</sub><sup>-</sup>?



26. In which of the following molecules does the central atom have more than 8 electrons?

1. CCl<sub>4</sub>
2. SeBr<sub>4</sub>
3. BF<sub>3</sub>
4. SiS<sub>2</sub>

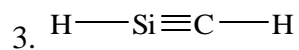
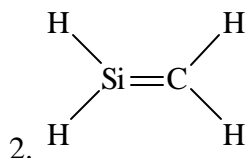
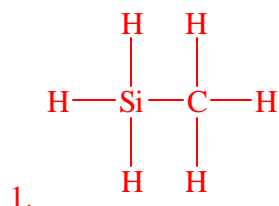
27. What is the formal charge on carbon in CO?

1. -2
2. -1
3. 0
4. 1
5. 2

28. Based on formal charge, which is the central atom in a molecule made up of one Ge, one As, and one I?

1. Ge
2. As
3. I

29. Which of the following has the longest Si-C bond length?



30. What is the EN difference in BeO?

1. 0.5
2. 1.0
3. 1.5
4. 2.0
5. 2.5