CH 221 Quantum Chemistry
Self Quiz Name: _____ Lab Section: _____

This is a sample quiz providing quantum chemistry examples. Answers are provided at the end of this handout. *Good luck!*

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1. What wavelength corresponds to a frequency of 8.22×10^{9} Hz?
   a) 0.307 m
   b) 0.0365 m
   c) 0.122 m
   d) 0.110 m
   e) 27.4 m

2. A radio station transmits at 110. MHz ($110. \times 10^{6}$ Hz). What wavelength is this radio wave?
   a) 3.65×10^{-5} m
   b) 3.30 m
   c) 3.81×10^{-5} m
   d) 2.73 m

3. Which one of the following is NOT a proper unit for frequency?
   a) Hz
   b) s^{-1}
   c) $m \cdot s^{-1}$
   d)

4. Calculate the wavelength of the fourth line in the Balmer series (the n=6 to n=2 transition) of the hydrogen spectrum ($R = 1.097 \times 10^{7}\ m^{-1}$, $E_n = -Rhc/n^2$)
   a) 0.1233 m
   b) 24.37 m
   c) 2.735×10^{-7} m
   d) 4.102×10^{-7} m
   e) 36.56 m

5. What is the relationship between the energy of a photon of light and its frequency?
   a) $E = \nu$
   b) E =
   c) $E = h\nu$
   d) E =
   e) E =

6. What is the energy needed to raise an electron in the hydrogen atom from the second energy level to the third energy level? ($R = 1.097 \times 10^{7}\ m^{-1}$, $E_n = -Rhc/n^2$)
   a) 1.52×10^{4} J
   b) 3.63×10^{-19} J
   c) 2.18×10^{-19} J
   d) 4.48×10^{-19} J
   e) 3.03×10^{-19} J

7. What is the de Broglie wavelength of an electron moving at 80.0% the speed of light.
   a) 3.03×10^{-12} m
   b) 2.42×10^{-12} m
   c) 3.30×10^{11} m
   d) 1.59×10^{-25} m

8. How many orbitals make up the **4d** subshell?

a) 0 b) 1 c) 3 d) 5 e) 7

9. The value of ℓ that is related to the following orbital is:

a) 0 b) 1 c) 2 d) 3 e) 4

10. The correct electron configuration for nitrogen is

a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$
b) $1s^2\ 2s^2\ 2p^6\ 2d^4$
c) $1s^2\ 2s^2\ 2p^3$
d) $1s^2\ 2s^2\ 3s^2\ 4s^1$
e) $1s^2\ 1p^5$

11. The electron configuration of the indicated atom in the ground state is correctly written for which atom?

a) Ga [Ar] $3d^{12}\ 4s^2$
b) Ni [Ar] $3d^{10}$
c) Ni [Ar] $3s^2\ 3p^8$
d) Fe [Ar] $3d^6\ 4s^2$

12. Which of the following sets of quantum numbers is possible for a **3d** electron?

a) $n = 3, \ell = 3, m_\ell = -2, m_s = +$
b) $n = 2, \ell = 1, m_\ell = +1, m_s = -$
c) $n = 3, \ell = 1, m_\ell = 0, m_s = -$
d) $n = 3, \ell = 2, m_\ell = -2, m_s = +$
e) $n = 4, \ell = 1, m_\ell = +1, m_s = +$

13. In what section of the periodic table is the **4f** subshell being filled?

a) period 4
b) transition elements Y to Cd
c) noble gases
d) group IA
e) lanthanides

14. Which one of the following elements has 3 electrons in a **p** subshell?

a) Sb b) Na c) Sc d) V e) Nd

15. Which of the following distributions of electrons is correct for three electrons in p-subshell?

a) ↑ ↑ ↑

b) ↑↓ ↑

c) ↑ ↑ ↓

d) ↑ ↑↓

e) ↑↑ ↑

16. Which of the following particles would be most paramagnetic?

a) P b) Ga c) Br d) Cl^- e) Na^+

17. Which of the following correctly represents the ionization of an atom?

a) $Cl(g) + e^- \rightarrow Cl^-(g)$

b) $Na(g) \rightarrow Na^+(g) + e^-$

c) $Na(s) - e^- \rightarrow Na^+(g)$

d) $Cl_2(g) \rightarrow 2\ Cl(g)$

18. Which of the following is likely to have the largest atomic radius?

a) H b) Mn c) Cl d) Rb e) Ag

19. Which one of the following isoelectronic species has the smallest radius?

a) Mg^{2+} b) Na^+ c) Ne d) F^- e) O^{2-}

20. Which of the following has the greatest ionization energy?

a) K b) Ca c) Fe d) Ga e) Br

21. Which of the following has the lowest ionization energy?

a) Li b) Na c) K d) Rb e) Cs

22. The successive ionization energies for one of the period three elements are listed below. Which element is referred to?

E_1	577.4 kJ/mol
E_2	1,816 kJ/mol
E_3	2,744 kJ/mol
E_4	11,580 kJ/mol
E_5	15,030 kJ/mol

a) Na b) Mg c) Al d) Si e) P

Answers:

1.	**B**	12.	**D**
2.	**D**	13.	**E**
3.	**C**	14.	**A**
4.	**D**	15.	**A**
5.	**C**	16.	**A**

6.	**E**	17.	**B**
7.	**A**	18.	**D**
8.	**D**	19.	**A**
9.	**B**	20.	**E**
10.	**C**	21.	**E**
11.	**D**	22.	**C**