

CHEM 1A Exam 1 Topics

• Chapter 1

1. Basic use of periodic table
2. Chemical and Physical Changes
3. Density
4. Temperature Conversion
5. Metric Conversion
6. Dimensional Analysis
7. Accuracy vs. Precision

• Chapter 2

1. Historical development of atomic theory
2. Protons, Neutrons, and Electrons
3. Isotopes
4. Atomic weight calculations

• Chapter 7

- Electromagnetic Spectrum
- $c = \lambda \cdot \nu$ ($c = 3.0 \times 10^8$ m/s)
- $E = h \cdot \nu$ ($h = 6.626 \times 10^{-34}$ J·sec)
- Bohr model
 - The problems
 - How it works with hydrogen
- $E = -\frac{Rhc}{n^2}$
- $\Delta E = -Rhc \left[\frac{1}{n_{final}^2} - \frac{1}{n_{initial}^2} \right]$
- Relationship between energy, frequency and wavelength
- Wave model of the atom (Quantum Chemistry)
- Shapes of orbitals
- Quantum numbers (n, ℓ, m_ℓ)

- Quantum number (m_s)
- Pauli exclusion principle
- Hund's rule
- Electron configurations of atoms
- Orbital box diagrams
- Periodic trends
 - Atomic size
 - Effective nuclear charge
 - Ionic radius
 - Ionization energy
 - Electron affinity
 - Electronegativity

Example Problems for Exam 1

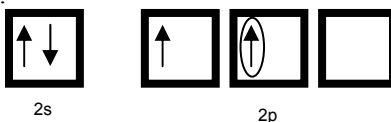
(These are just problems that get you to think.)

(You may or may not see these on the exam or they could even be different.)

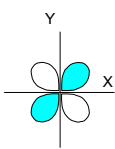
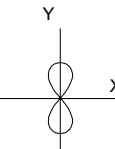
- Name an element in the noble gases family. What are the rows in the periodic table called?
- A phase change is an example of a physical or chemical change?
- Your object has a density of 0.83564 kg/ μ L, what would the mass of your object be if you know it has a volume of 54.87 mm³?
- What temperature is 98.6 °F in Kelvin? (I would give you the formula for the conversion from °F to °C.)
- You are measuring the mass of a pencil. You get the following values. The pencil really weighs 3.45 g, are your data accurate or precise?

Mass of Pencil
3.45g
4.53g
3.46g
3.65g

- What are the numbers of electrons, protons, and neutrons in ⁴⁵Sc⁺³?
- Make up an atomic weight calculation from www.webelements.com.
- Calculate the wavelength (nm) and frequency (MHz) when an electron in an excited hydrogen atom relaxes from n=5 to n=2.
- Energy and wavelength have what type of relationship (direct or indirect).
- Why do we use the quantum chemical model of an atom as opposed to Bohr's model?
- What did Mulliken's oil drop experiment prove?
- What does the Heisenberg Uncertainty Principle state?
- Using the orbital box diagrams, Hund's Rule, and Pauli Exclusion Principle explain why silver's common oxidation state (charge) is +1 and not +2.
- For the following orbital box diagram give me a set of the four quantum number for the circled electron and also tell me what the element is that is described by the orbital box.



- Which ion is smallest, N³⁻, F⁻, or Mg²⁺?
- Which atom would have the larger second ionization Na or Mg?
- Fill in the following chart by drawing the orbital that is described by the 3 quantum numbers. If it is not possible, write, "not possible".

n	ℓ	m _ℓ	Orbital Drawing
5	2	-1	
4			
9	0	0	
3			
2	2	0	

Orbital	m _ℓ	orbital & direction
S	0	s orbital
P	-1	p _y orbital
	0	p _z orbital
	+1	p _x orbital
D	-2	d _{xy} orbital
	-1	d _{yz} orbital
	0	d _{z²} orbital
	+1	d _{xz} orbital
	+2	d _{x²-y²} orbital

- Remember that the homework that I put up on the first slide is just a minimum. You can always do more than just the minimum and I might even take some of the problems from the book. I would look at some of the challenge problems too.