

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Instructions: Answer the following questions. Show ALL work for problems to receive full credit. Make sure to include proper units and significant figures for all answers.**

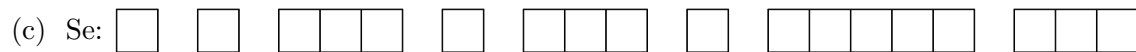
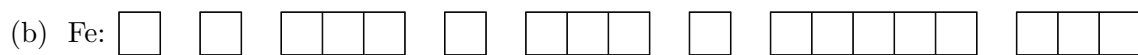
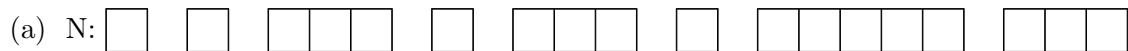
- [10 pt] 1. Name the scientist associated with each of the following discoveries, experiments or statements. Choices are: Albert Einstein, Christiaan Hugen, Ernest Rutherford, Erwin Schrodinger, James Clerk Maxwell, Louis De Broglie, Max Planck, Niels Bohr, Sir Isaac Newton, Werner Heisenberg, Wolfgang Pauli, and Thomas Young.
- (a) Protons are in the middle and the electrons are in a cloud around the nucleus 1(a) \_\_\_\_\_
  - (b) Created a mathematical model that described electrons as wave functions, and described their location in terms of probabilities. 1(b) \_\_\_\_\_
  - (c) You can't really know where an electron is (or a car). 1(c) \_\_\_\_\_
  - (d) Photoelectric effect, and light can be quantized. 1(d) \_\_\_\_\_
  - (e) Double Slit experiment, proved light is a wave 1(e) \_\_\_\_\_
  - (f) First scientist to propose light is a wave. 1(f) \_\_\_\_\_
  - (g) First scientist to propose light is a particle. 1(g) \_\_\_\_\_
  - (h) Scientist who proposed that since light can be both a wave and a particle, then an electron can be both a particle and a wave. 1(h) \_\_\_\_\_
  - (i) His model explained Line Spectra. 1(i) \_\_\_\_\_
  - (j) Proposed electrons are located in orbitals around the nucleus like planets around the sun 1(j) \_\_\_\_\_
- [3 pt] 2. Describe the location of electrons in an atom **AND** sketch a picture of the atom according to Rutherford.
- [3 pt] 3. Describe the location of electrons in an atom **AND** sketch a picture of the atom according to Bohr. What modification to Rutherford's model did Bohr make.

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- [3 pt] 4. Describe the location of electrons in an atom **AND** sketch a picture of the atom according to De Broglie. What modification to Bohr's model did De Broglie make.
- [3 pt] 5. Sketch **AND** label an S, P, and D orbital.
- [4 pt] 6. Schrodinger used 4 Quantum Numbers to describe the atom. Give the associated symbol and what about an electron each Quantum Number describes:
- 6(a) Principal quantum number:
- 6(b) Angular-momentum quantum number:
- 6(c) The Magnetic quantum number:
- 6(d) Electron spin quantum number:
- [3 pt] 7. Describe what type of orbital is defined by the following 4 quantum numbers,  $(3,1,1,\frac{1}{2})$  **AND** draw a picture of the orbital.
- [4 pt] 8. Give the electron configuration (1s 2s etc.) for the following elements:
- (a) Ca
- (b) Mn
- (c) Se

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[4 pt] 9. Draw orbital diagrams for the following elements. Ignore any extra boxes provided.



[5 pt] 10. Is energy directly proportional to or inversely proportional to wavelength. Show evidence (an equation with properly labeled values and typical units) to support your answer.

[3 pt] 11. What is the wavelength in meters of a medical xray with a frequency of  $9.55 \times 10^{17}\text{Hz}$

[6 pt] 12. How does Quantum Mechanics lead to the shape of the periodic table?

(a) What is different about the 4 major regions of the periodic table (ie why are they 2, 6, 10 and 14 elements wide)?

(b) What is the same about each row?

(c) What is the same about each column?

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[6 pt] 13. Complete each statement **AND** explain the trend observed.

(a) Atoms get \_\_\_\_\_ as you go down a column, for example K is \_\_\_\_\_ than Li.

(b) Atoms get \_\_\_\_\_ as you go across a row, for example F is \_\_\_\_\_ than Na.

[4 pt] 14. Complete the following statements about Coulombs Law.

(a) Like charges \_\_\_\_\_ and have a \_\_\_\_\_ energy.

(b) Opposite charges \_\_\_\_\_ and have a \_\_\_\_\_ energy.

(c) The magnitude of the interaction is \_\_\_\_\_ to the distance between the charges.

(d) The magnitude of the interaction is \_\_\_\_\_ to the magnitude of the charges.

[3 pt] 15. Define Compound. What is the driving force behind the formation of compounds?

[3 pt] 16. What are the differences between Ionic compounds and Covalent/Molecular compounds?

Property	Ionic	Covalent/Molecular
1. Formed by		
2. Between		
3. Bond Strength		

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- [5 pt] 17. Label the following on the periodic table below:  
 (a) Alkali metals (b) Alkaline Earth metals (c) Transition metals (d) Halogens (e) Noble Gases (f) Actinides (h) Lanthinides

The image shows a blank periodic table grid. It consists of a main body with 7 rows and 18 columns. The first two columns are on the left, and the last two columns are on the right. There is a gap between the 10th and 11th columns in the first three rows. Below the main body, there are two rows of 14 cells each, representing the lanthanide and actinide series.

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- [8 pt] 18. Answer the following questions about Ionization Energy (IE):
- Write a reaction showing what is meant by IE using a Sodium atom. Be sure to include energy in the equation.
  - In general the first ionization energy (increases, decreases or remains the same down a column? Explain your answer.
  - In general the first ionization energy (increases, decreases, or remains the same across a row? Explain your answer.
  - Explain why removing the 3rd electron from Be requires 10 times the amount of energy required to remove the 2nd electron.

- [10 pt] 19. Complete the following table:

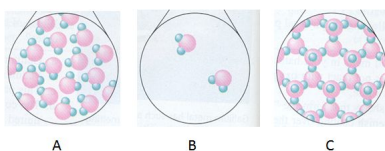
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Shape and Volume Columns: (D)efinite or (I)ndefinite.

Compressibility: (H)igh, (L)ow, and (N)one.

Density: (H)igh or (L)ow

Picture: Which picture below best represents each state.



Particles: Provide a general description of how particles are arranged **AND** the motion allowed.

IMF: Include how the attractive (Intermolecular Forces) between the molecules relates to the Kinetic Energy (Temperature) available (greater, equal, less than).

State	Shape	Volume	Compressibility	Density	Picture	Particles	IMF vs KE
Solid							
Liquid							
Gas							

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[5 pt] 20. Are the following statements true or false. For the false statements explain why they are false or change them to be a true statement in the space provided.

(a) Mixtures are physically separable. 20(a) \_\_\_\_\_

(b) Compounds are physically and chemically separable. 20(b) \_\_\_\_\_

(c) Mixtures can be homogeneous or heterogeneous. 20(c) \_\_\_\_\_

(d) Mixtures have a fixed composition 20(d) \_\_\_\_\_

(e) A heterogeneous mixture has the same physical and chemical properties throughout the substance. 20(e) \_\_\_\_\_

[5 pt] 21. Are the following statements true or false. For the false statements change them to be a true statement in the space provided.

(a) All atoms of an element have the same size and mass. 21(a) \_\_\_\_\_

(b) Elements in a compound can have more than one ratio. 21(b) \_\_\_\_\_

(c) Opposites attract and Likes repel 21(c) \_\_\_\_\_

(d) Cations form when an atom gains a proton. 21(d) \_\_\_\_\_

(e) An isotope is formed when an atom gains an electron. 21(e) \_\_\_\_\_

[5 pt] 22. Do the following statements best describe (p)rotons, (n)eutrons or (e)lectrons. There may be more than one correct answer for each question.

(a) Has a negative charge. 22(a) \_\_\_\_\_

(b) Responsible for Isotopes. 22(b) \_\_\_\_\_

(c) Forms bonds between atoms to form molecules. 22(c) \_\_\_\_\_

(d) Has the largest mass. 22(d) \_\_\_\_\_

(e) Is contained in the nucleus of the atom. 22(e) \_\_\_\_\_

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[5 pt] 23. Answer the following questions about the following isotope:  ${}_{48}^{98}\text{X}^{+2}$ .

- |   |             |
|---|-------------|
| (a) How many protons are there?         | 23(a) _____ |
| (b) How many electrons are there?       | 23(b) _____ |
| (c) How many neutrons are there?        | 23(c) _____ |
| (d) What element is this an isotope of? | 23(d) _____ |
| (e) Is this a cation or anion?          | 23(e) _____ |