CHEMISTRY I HONORS – 1st SEMESTER EXAM REVIEW

STRATEGY: Start by reading through your notes to refresh your memory on these topics. Then, use this review sheet as a starting point to identify the areas on which you need to spend more study time. For those areas, go back to homework assignments, quizzes, and reviews to practice more problems. I would also recommend going through all of your tests since these questions are only samples and do not include specific examples of how vocabulary and other conceptual information might appear in a multiple-choice or other format. Remember you can access notes and reviews on Mrs. J's Chemistry page at: www.nisd.net/comartww/pages/chem/notes.

FORMAT:

- Questions will include multiple-choice and matching.
- A formula bank will be provided in addition to any values that you might need (electronegativity, etc.), but you will NOT be given "formulas" for items listed in the VOCAB sections (average atomic mass, % error, etc.).

Atomic Structure – Ch. 3

1. Identify the scientists who made the following discoveries.
   a. Atoms contain negative particles called electrons.
   b. The mass of an electron is 9.11×10^{-28} g.
   c. Atoms contain neutral particles called neutrons.
   d. Atoms contain a dense, positive nucleus.
   e. Atoms are indivisible and resemble billiard balls.
2. Describe the evolution of the atomic model from the billiard ball model to the electron cloud model.
3. Write the isotope symbol, including atomic number & mass number, for the following isotopes.
   a. carbon-14 c. nickel-63
   b. chromium-53 d. zirconium-92
4. Complete the table for the following isotopes.

Symbol	Zn			
Atomic #		20		
Mass #	65		74	40
# of protons			34	
# of neutrons		21		
# of electrons				18

5. Calculate the average atomic mass of copper if 69.17% of the copper atoms occurring in nature are ^{63}Cu and 30.83% are ^{65}Cu.

VOCAB: isotope average atomic mass
quark

Matter – Ch. 1

6. Classify the following substances as *solid*, *liquid*, *gas, or plasma* based on their properties.
   a. flexible volume, high KE, particles can disperse freely.
   b. flexible volume, very high KE, particles are charged.
   c. fixed volume, very low KE, orderly particles.
   d. fixed volume, low KE, particles can move past each other.
7. Compare and contrast a solution, colloid, and suspension.
8. Classify the following as element, compound, heterogeneous mixture, or solution.
   a. graphite (carbon)
   b. grape juice
   c. table salt (NaCl)
   d. pepper
9. Classify the following as *chemical* or *physical changes*.
   a. cutting wire
   b. ripening tomato
   c. apple slices turning brown
   d. compressing a gas
10. Classify the following properties as *physical* or *chemical*.
    a. melts at 68.0°C
    b. corrosive
    c. reacts violently with water
    d. decomposes in air
    e. magnetic

VOCAB: kinetic molecular theory
law of definite composition
law of multiple proportions

Measurement – Ch. 2

11. In a lab, the average measured density for Pre-1982 pennies was 7.98 g/cm^3. Given that the literature value for the density is 8.92 g/cm^3, calculate the percent error.
12. How many sig figs are in the following numbers?
    a. 2.35 c. 89.70
    b. 34,000 d. 0.0052
13. Convert the following numbers into or out of scientific notation.
    a. 548,000 c. 1.200×10^{-3}
    b. 0.0000770 d. 9.25×10^{7}
14. Osmium is the densest element with a density of 22.57 g/cm^3. Find the mass of a 56.2 cm^3 sample of osmium.
15. Perform the following SI prefix conversions.
    a. 65.2 mm = ? dm c. 65,000 μL = ? mL
    b. 2.3 kg = ?g d. 0.502 km = ? cm
16. How many milliliters are in a 2.0 quart jug of milk?
17. Mr. C. spent last weekend grading lab notebooks. If he spent 5.5 min on each notebook, how many *hours* did it take him to grade all 95 notebooks?
18. Calculate the density from the slope of a "Mass vs. Volume" graph.
19. Record the appropriate # of SigFigs when measuring.

VOCAB: accuracy vs. precision

Electrons in Atoms – Ch. 4 & 5

20. Calculate the wavelength if the frequency is 2.5×10^5 Hz.
21. Find the energy of a photon if frequency is 7.31×10^{14} Hz.
22. Describe how Bohr's model explains the bright lines (red, green, violet, violet) in the emission spectrum of hydrogen.
23. What is the primary difference between the *modern* model of the atom and *Bohr's* model?
24. Draw orbital diagrams for the following elements.

Symbol	Atomic #	Orbital Diagram
F		
V		

25. Explain why chromium's electron configuration is [Ar] $4s^1 3d^5$ instead of the expected configuration of [Ar] $4s^2 3d^4$.

Electrons in Atoms – Ch. 4 & 5 (continued)

26. Give the shorthand electron configuration for the following.

Symbol	# e^-	Shorthand e^- Configuration
Pd		
At		

27. Predict the ions that will form from the following atoms and give the shorthand configuration of the ion.

Atom	Ion	Noble Gas	Shorthand e^- Configuration
Rb			
Te			

VOCAB: excited state/ground state
wave-particle duality
valence/core e^-
Pauli Exculsion Principle
photon
Hund's Rule
Aufbau Principle
Heisenberg Uncertainty Principle

Periodic Table – Ch. 5

28. How did Mendeleev and Mosely arrange the elements in the periodic table?
29. Circle the atom with the LARGER radius.
    a. Ra N
    b. Ne Xe
30. Circle the particle with the LARGER radius.
    a. Cl Cl^-
    b. Mg Mg^{2+}
31. Circle the atom with the HIGHER first ionization energy.
    a. Li Cs
    b. Ba As
32. Circle the atom with the HIGHER melting point.
    a. Cl Si
    b. Cs W
33. Why are there small jumps in the 1st ionization energies of the elements as you move across a period?
34. Why is there a large increase in ionization energy when the 4th electron is removed from aluminum?

VOCAB: ionization energy periodic law
metals/nonmetals/metalloids shielding

Chemical Bonding – Ch. 6 & 7

35. Based on their electronegativities (p151), are the bonds in the following substances IONIC, POLAR, or NONPOLAR?
    a. MgO c. LiCl
    b. H_2O d. Br_2
36. Are the following properties characteristics of ionic, covalent, or metallic bonding?
    a. These bonds are formed by delocalized electrons in an "electron sea."
    b. These bonds involve a transfer of electrons.
    c. Substances containing these bonds are malleable and have very high melting points.
    d. Substances containing these bonds do not conduct electricity and have low melting points.
    e. Compounds containing these bonds have a crystal lattice structure.
    f. These bonds are formed by sharing electrons.
37. Use Lewis Diagrams to show the formation of MgO.
38. Use Lewis Diagrams to show the formation of H_2O.
39. Explain the relationship between potential energy and stability.
40. Write formulas for the following compounds (HINT: First determine ionic/acid/covalent).
    a. calcium bromide d. silicon dioxide
    b. iron(III) sulfate e. dinitrogen tetroxide
    c. hydrofluoric acid f. sulfurous acid
41. Write names for the following compounds (HINT: First determine ionic/acid/covalent).
    a. $CrCl_3$ d. $MgSO_4$
    b. Cu_2CO_3 e. P_4O_6
    c. $AsCl_5$ f. $HClO_3$
42. Explain the difference between nonpolar covalent, polar covalent, and ionic bonds in terms of *sharing of electrons* and *electric charge*.

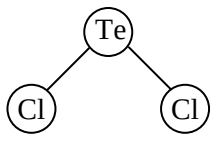
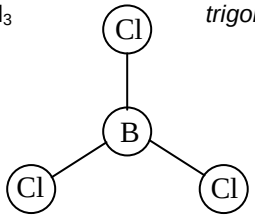
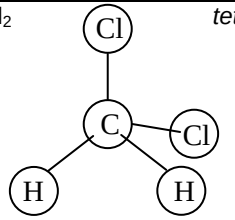
VOCAB: bond energy (bond length) electronegativity
chemical bond potential energy
dipole

Molecular Structure – Ch. 6

43. Explain the main idea of the VSEPR Theory.
44. For each of the following molecules, draw the Lewis electron dot diagram, give the shape and bond angle(s), and state whether the molecule is polar or nonpolar. Show your work in the spaces provided for counting valence e^- and e^- pairs.

	Number of valence e^-	Lewis Diagram	Counting e^- pairs	Molecular Shape & Bond Angle(s)	Molecular Polarity
SiO_2					
AsF_5					

45. Draw the dipole moments for each bond in the following molecules and circle whether the molecule is polar or nonpolar.

$TeCl_2$ *bent*	BCl_3 *trigonal planar*	CH_2Cl_2 *tetrahedral*
		
polar nonpolar	polar nonpolar	polar nonpolar

VOCAB: octet rule bond angle lone pairs
expanded octet dipole moment bonding pairs

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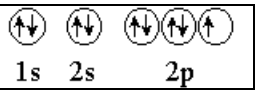
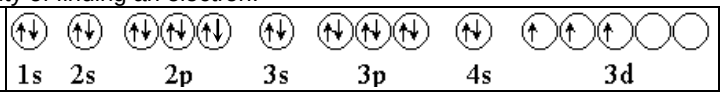
ANSWER KEY

1. a. Thomson, b. Millikan, c. Chadwick, d. Rutherford, e. Dalton
2. Dalton's billiard ball model-sphere of uniform density. Thomson's plum pudding model-negative electrons dispersed in positive atom. Rutherford's nuclear model-dense, positive nucleus surrounded by negative electrons. Bohr's planetary model-electrons move in circular orbits in specific energy levels. Schrödinger's electron cloud model-electrons move within orbitals not in specific orbits. (Chadwick then added neutrons to the nucleus.)
3. $^{14}_{6}C,\ ^{53}_{24}Cr,\ ^{63}_{28}Ni,\ ^{92}_{40}Zr$
4.

Symbol	**Zn**	Ca	Se	Ar
Atomic #	30	**20**	34	18
Mass #	**65**	41	**74**	**40**
# of protons	30	20	**34**	18
# of neutrons	35	**21**	40	22
# of electrons	30	20	34	**18**

5. 63.62 u
6. a. gas, b. plasma, c. solid , d. liquid
7. Solution and colloid do not settle. Colloid and suspension are heterogeneous mixtures and scatter light.
8. a. element, b. solution, c. compound, d. heterogeneous mixture
9. a. physical, b. chemical, c. chemical, d. physical
10. a. physical, b. chemical, c. chemical, d. chemical, e. physical
11. 10.5%
12. a. 3, b. 2, c. 4, d. 2
13. a. 5.48×10^{5}, b. 7.70×10^{-5}, c. 0.001200, d. 92,500,000
14. 1270 g
15. a. 0.652 dm, b. 2,300 kg, c. 65 mL, d. 50,200 cm
16. 1900 mL
17. 8.7 hours
18. slope = (mass) ÷ (volume) = density
19. always record one estimate digit
20. 1200 m
21. 4.84×10^{-19} J
22. Hydrogen atoms have specific energy levels. Therefore, the atoms can only gain or lose certain amounts of energy. When atoms lose energy, they emit photons which correspond to the lines in the emission spectrum. The more energy lost, the more energy the photon has.
23. Bohr's model stated that electrons circled the nucleus in fixed, circular paths called orbits. The modern model states that electrons move around the nucleus in orbitals where there is a probability of finding an electron.
24.

F	9	

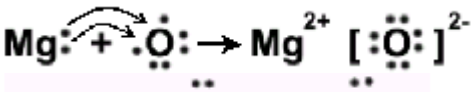
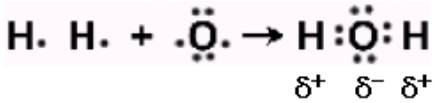
V	23	

25. In order to achieve greater stability, Cr moves one electron from the 4s-sublevel to the 3d-sublevel to make it half-full.
26.

Pd	46	[Kr] $5s^2 4d^8$
At	85	[Xe] $6s^2 4f^{14} 5d^{10} 6p^5$

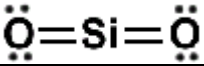
27.

Rb	Rb^+	Kr	[Ar] $4s^2 3d^{10} 4p^6$
Te	Te^{2-}	Xe	[Kr] $5s^2 4d^{10} 5p^6$

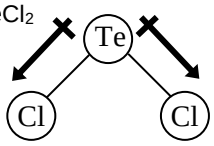
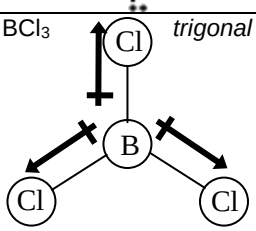
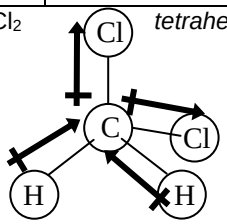
28. Mendeleev arranged the elements in order of increasing atomic mass. Mosely arranged them by increasing atomic number.
29. a. Ra, b. Xe
30. a. Cl^-, b. Mg
31. a. Li, b. As
32. a. Si, b. W
33. There are small jumps in 1st ionization energy when there is an element with increased stability (full or half-full sublevel).
34. Removing the 4th electron from aluminum represents removing a core electron.
35. a. ionic, b. polar, c. ionic, d. nonpolar
36. a. metallic, b. ionic, c. metallic, d. covalent, e. ionic, f. covalent
37. 
38. 
39. The lower the potential energy, the greater the stability.
40. a. $CaBr_2$, b. $Fe_2(SO_4)_3$, c. HF, d. SiO_2, e. N_2O_4, f. H_2SO_3

41. a. chromium(III) chloride, b. copper(I) carbonate, c. arsenic pentachloride, d. magnesium sulfate, e. tetraphosphorous hexoxide, f. chloric acid.
42. nonpolar covalent – e^- are shared equally, symmetrical orbital overlap, no separation of charge
polar covalent – e^- are shared unequally, lopsided overlap, partial charges
ionic – e^- are not shared, no overlap, complete charges
43. Electron pairs move as far apart from each other as possible in order to minimize repulsion. The number & type of electron pairs determines the bond angles and overall shape of the molecule.

44.

	Number of valence e^-	Lewis Diagram	Counting e^- pairs	Molecular Shape & Bond Angle(s)	Molecular Polarity
SiO_2	1(4)+2(6)=16		2B, 0L	linear, 180°	nonpolar
AsF_5	1(5)+5(7)=40		5B, 0L	trigonal bipyramidal, 120°/90°	nonpolar

45.

$TeCl_2$ *bent* 	BCl_3 *trigonal planar* 	CH_2Cl_2 *tetrahedral* 
(polar) nonpolar	polar (nonpolar)	(polar) nonpolar