Chemistry Mid-Term Exam Review Spring 2017

Unit 1 – Measurement & Math

- Accuracy & Precision (recognizing given lab data)
- Density calculations
- Number of SFs in a measurement, Round answers to correct number of SFs
- Percent Error
- Unit conversions in metric system

1.) 2.02×10^{15} µg = ___ g
2.02×10^{9} g

2.) 1.29×10^{-7} m = ___ nm
1.29×10^{2} nm or 129 nm

3.) 13.5 dm^3 = ___ cm^3
1.35×10^{4} cm^3 or 13,500 cm^3

4.) 1.64×10^{9} kg = ___ g
1.64×10^{12} g

5.) What is the mass of a cube of aluminum (density = 2.702 g/cm^3) with each side measuring 2.00 cm? 21.6 g

*Use the information in the table below to answer the questions that follow.

Number of nickels	15		Mass of graduated cylinder + 50 mL water	50.00 g		Mass of nickels, water + cylinder	73.50 g
Volume of water	50.0 mL		Volume of water + nickels	53.0 mL		Volume of nickels	3.0 mL

6.) What is the mass of 15 nickels? 23.50 g

7.) What is the density of 15 nickels? 7.8 g/mL

Unit 2 – Matter & Change

- Chemical vs. physical properties, changes
- Compounds vs. elements
- Location of metals, nonmetals, metalloids (properties of each also)
- Mixtures vs. pure substances
- Periods & groups (definitions, names, locations)

*Classify each of the following as an **element**, a **compound**, a **solution**, or a **heterogeneous mixture**.

8.) flat soda
Solution

9.) potassium iodide
compound

10.) soil
heterogeneous mixture

11.) iodine
Element

12.) chromium
element

13.) potassium iodide dissolved in water
solution

*Classify each of the following as **chemical**, **physical**, or **nuclear** changes.

14.) shredding cheese
Physical

15.) melting cheese
physical

16.) digesting cheese
chemical

17.) fission of uranium
Nuclear

18.) creating salt from sodium & chlorine
chemical

19.) sprinkling salt on french fries
physical

*In what group (give number) are each of the following elements found on the Periodic Table?

20.) alkali metals
1

21.) transition metals
3 – 12

22.) noble gases
18

23.) halogens
17

24.) alkaline earth metals
2

Unit 3 – Atoms

- Determining number of protons, neutrons, electrons in an isotope
- Grams ←→ moles ←→ atoms or molecules conversions
- Isotopes (definition, calculation of average atomic mass, mass #, and atomic #)
- Thomson's discovery, points of Dalton's atomic theory, results of gold foil experiment

*Which scientist…

25.) discovered the nucleus?

26.) discovered the neutron?

Chemistry Mid-Term Exam Review Spring 2017

Rutherford Chadwick

27.) first did experiments to support his ideas on atoms? 28.) discovered the electron?

Dalton Thomson

29.) proposed that electrons move in fixed paths around the nucleus?

Bohr

*Solve the following problems.

30.) How many molecules are contained in a 75.0 gram sample of CO_2?

1.03×10^{24} mcs

31.) What is the mass (in grams) of 6.92 moles of $Ca(NO_3)_2$?

1140 g

32.) How many moles are equal to 3.97×10^{25} molecules of PCl_3?

65.9 moles

Unit 4 – Electrons

- Aufbau principle, Hund's rule
- Proportionality relationships (Energy, Frequency, Wavelength)/EM Spectrum
- Shapes of orbitals
- Determine location on periodic table given an electron configuration
- Dot diagrams, valence electrons, HOELs
- Energy calculations in the hydrogen atom (diagram at top of p. 8 of Reference Tables)
- Ground state vs. excited state (definitions, emission & absorption of energy)
- Lowest to highest energy orbitals, sublevels, energy levels

33.) Write the electron configuration for nickel (Ni) and selenium (Se).

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^8$ $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^4$

34.) Identify the highest occupied energy level (HOEL) and # of valence electrons for nickel and selenium.

HOEL = 4 val e-= 2 HOEL = 4 val e-= 6

35.) Write the noble gas configurations for nickel and selenium.

$[Ar]\ 4s^2\ 3d^8$ $[Ar]\ 4s^2\ 3d^{10}\ 4p^4$

36.) Draw the electron dot diagrams for nickel and selenium.

:Ni . .

: Se .

.

37.) Draw the orbital notation for the HOEL of nickel and selenium.

↑↓ ↑↓ ↑↓ ↑ ↑

4s 4s 4p

38.) Determine the four quantum numbers for the last electron added to nickel and selenium.

n = 3, ℓ = 2, m = 0, $\mathcal{s}$ = - ½ n = 4, ℓ = 1, m = -1, $\mathcal{s}$ = - ½

Unit 5 – Periodic Table & Periodic Law

- History of periodic table (Mendeleev, Moseley)
- Main group elements (valence e- , lose vs. gain e- , size difference between atom & ion, oxidation #)
- Periodic law & periodic trends (atomic radius, ionization energy, electronegativity, metallic & nonmetallic character)

39.) How is an element's location on the Periodic Table related to its HOEL?

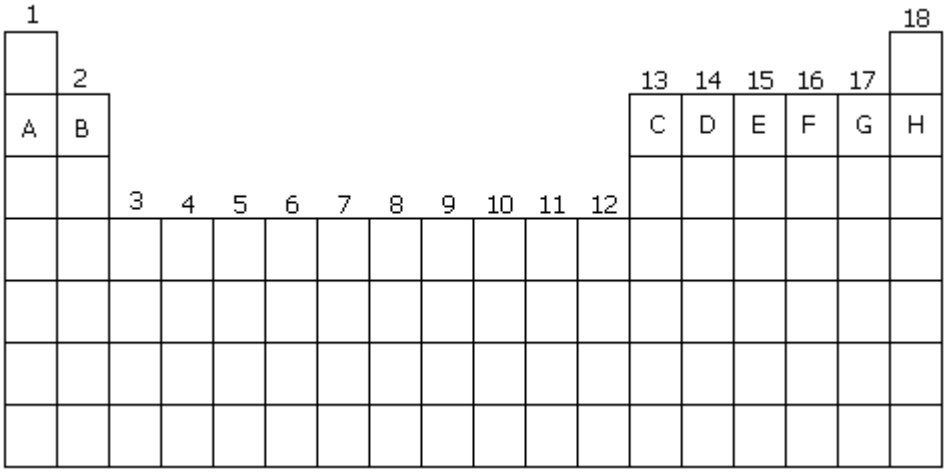
Element's HOEL is the period where it is located on the Periodic Table.

40.) How is an element's location on the Periodic Table related to its number of valence electrons?

The number of valence electrons is equal to the 'A' group number.

*Use the following Periodic Table to answer the questions that follow.

Chemistry Mid-Term Exam Review Spring 2017



41.) Which element has an oxidation number of -1? G
42.) Which element is unreactive? H
43.) Which element(s) are metals? A, B
44.) Which element's electron configuration ends with $2s^2$? B
45.) Which element has 5 electrons in its HOEL? E
46.) Which element(s) are metalloids? C

47.) Which element is the most reactive metal? A
48.) Which element is the most reactive nonmetal? G

*Without looking at the Periodic Table, write the expected outer electron configuration for the element in…

49.) Period 2, Group 14 — $2s^2\ 2p^2$
50.) Period 5, Group 17 — $5s^2\ 4d^{10}\ 5p^5$
51.) Period 3, Group 1 — $3s^1$

Unit 6 – Bonding

- Definitions of ionic and covalent bonding – types of elements involved, electronegativity differences
- Intermolecular forces (hydrogen bonding, dipole-dipole, London dispersion)
- Molecular polarity
- Properties of ionic and molecular substances
- Why atoms bond together

*Identify the predominant type of bonding in the following compounds (**ionic**, **covalent**, or **both**)…

52.) CO_2 — Covalent
53.) Na_2SO_4 — both
54.) $MgBr_2$ — ionic
55.) Ag_2CO_3 — both

*Between what types of substances do the following intermolecular forces (IMFs) occur?

56.) hydrogen bonding — NH_3, H_2O, HF
57.) dipole-dipole forces — polar molecules
58.) London dispersion forces — all molecules

Unit 7 – Chemical Formulas

- Empirical and molecular formulas (definitions, differentiating between the two, calculate using %)
- Nomenclature – writing formulas and naming compounds
- Oxidation numbers & % composition by mass of elements in a compound

*Write the formula for…

59.) potassium carbonate — K_2CO_3
60.) chromium (III) nitrate — $Cr(NO_3)_3$
61.) dinitrogen pentoxide — N_2O_5
62.) zinc sulfide — ZnS
63.) magnesium dichromate — $MgCr_2O_7$
64.) lead (IV) sulfate — $Pb(SO_4)_2$

*Name the following compounds…

65.) Na_2CrO_4 — Sodium chromate
66.) AgBr — silver bromide
67.) SO_3 — sulfur trioxide
68.) $Ca(ClO_3)_2$ — Calcium chlorate
69.) $PbSO_4$ — lead (II) sulfate
70.) $Fe(OH)_3$ — iron (III) hydroxide

*Which compound has the highest percent by mass of nitrogen?

71.) (A) NO_2 (B) $Be(NO_2)_2$ (C) $NaNO_3$

(A) 30.45% N (B) 27.73% N (C) 16.48% N, so (A)

*Find the oxidation number of nitrogen in the following compounds…

72.) $Zn(NO_3)_2$ 73.) $Zn(NO_2)_2$ 74.) Mg_3N_2 75.) N_2O_4

+5 +3 -3 +4

*Solve.

76.) What is the empirical formula of a compound containing 56.5% potassium, 8.7% carbon, and 34.8% oxygen?

K_2CO_3

77.) A compound has the empirical formula CH_2O. If the molar mass of the actual formula is 180 g/mole, what is the molecular (actual) formula for the compound?

$C_6H_{12}O_6$

*Fill in the charts…

Unit 3

Name	Symbol	# of p^+	# of e^-	# of n^o	Atomic #	Mass #
Tin-118	^{118}Sn	50	50	68	50	118
iron – 56	^{56}Fe	26	26	30	26	56
Nitrogen-14	$^{14}N^{-3}$	7	10	7	7	14
Silicon-28	^{28}Si	14	14	14	14	28

Unit 4

Energy	Wavelength (long/short)	Frequency (high/low)
High	Short	High
Low	Long	Low

Unit 5

	Across a Period (left to right)	Down a Group (top to bottom)	Noble Gases Included? (yes or no)
Atomic Radius	Decreases	Increases	Yes
Electronegativity	Increases	Decreases	No
Electron Affinity	Increases	Decreases	No
Ionization Energy	Increases	Decreases	Yes
Metallic Character	Decreases	Increases	Yes
Nonmetallic Character	Increases	Decreases	No

Unit 6

Compound	Lewis Structure	Shape	Molecular Polarity
H_2O	H : O : H	Bent	Polar

Chemistry Mid-Term Exam Review Spring 2017

CF_4	. . : F : . . . . . . : F : C : F : . . . . . . : F : . .	Tetrahedral	Nonpolar
CO_2	. . . . : O : : C : : O :	Linear	Nonpolar
NH_3	. . H : N : H . . H	Trigonal pyramid	Polar
NO_2^{-1}	. . : O : : N . . . . : O : . .	Bent whole structure in brackets with -1 written on outside of brackets	polar