CHEM 112 **Exam I** **September 14th, 2022**

INSTRUCTIONS (Read and follow carefully)

Using only a #2 pencil (do not use ink) on the gray side of the "Grade Master Answer Sheet," complete the following:

1. Your **First and Last Name** in the "Name" section of the sheet.

2. Depending on your instructor, print "**Lipatov**" OR "**Zhu**" in the "Teacher" section.

3. In the "Student ID Number" write down your student ID from your Grubby card. Darken the corresponding rectangle with the number. See example →

4. There are multiple versions of the test.

DO NOT LOOK AT OTHER TESTS OR SCANTRONS.

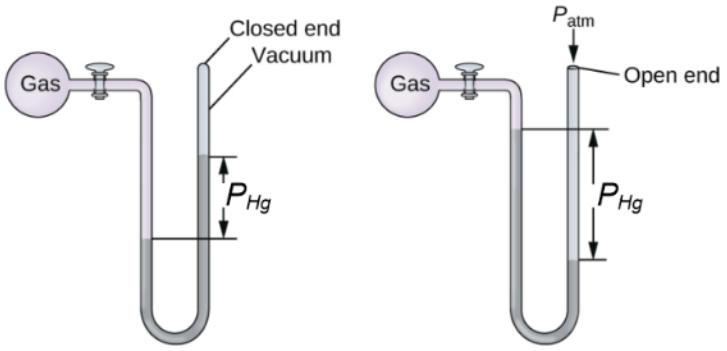
5. Darken the corresponding rectangle on the answer scantron sheet for all your answers. Your instructor will keep original answer sheets. Also, mark the answer on your test sheet, as this will be your only record of your answers.

6. There are 34 questions on the exam, and printing has been done on both sides of the page. Answer all questions (each answer has the same point value) but budget your time so that you do not spend too much time on any one question. You are provided with scratch paper. There is only one correct answer to each question. A question for which more than one answer is marked will be counted wrong. It is to your advantage to answer every question, so make sure every question has been answered before you hand in your answer sheet. Remember, some answers are rounded. Pick the closest one.

7. When you are finished with the exam, turn in only your "Grade Master Answer Sheet" and make sure that all of the information requested above has been provided and correctly filled in on the form.

8. Answers will be posted on D2L following the exam, and test grades will be on D2L by the end of the week.

9. It is in your best interest to save this copy of your test for question or answer issues later.A



PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H 1.008																	2 He 4.003
2	3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.179
3	11 Na 22.990	12 Mg 24.305											13 Al 26.981	14 Si 28.085	15 P 30.974	16 S 32.06	17 Cl 35.453	18 Ar 39.948
4	19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.867	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.38	31 Ga 69.723	32 Ge 72.630	33 As 74.922	34 Se 78.971	35 Br 79.904	36 Kr 83.798
5	37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.95	43 Tc [98]	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
6	55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po [209]	85 At [210]	86 Rn [222]
7	87 Fr [223]	88 Ra [226]	89 Ac [227]															

GROUP

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm [145]	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.05	71 Lu 174.97
90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np [237]	94 Pu [244]	95 Am [243]	96 Cm [247]	97 Bk [247]	98 Cf [251]	99 Es [252]	100 Fm [257]	101 Md [258]	102 No [259]	103 Lr [266]

Temperature Conversion

$^oF = 9/5(^oC) + 32$

$^oC = 5/9(^oF - 32)$

$K = 273.15 + ^oC$

Constants

$N = 6.0223 \times 10^{23}$

$c = 3.00 \times 10^8$ m/s

$h = 6.63 \times 10^{-34}$ J·s

Energy and Electromagnetic Wave

$v = c / \lambda$

$E = h(c/\lambda)$

$E = hv$ $\quad Hz = s^{-1}$

Gas Law

$PV = nRT$ $\quad P_1V_1/T_1 = P_2V_2/T_2$

$R = 0.0821$ L•atm/ mol•K

STP gas law = 0 ^oC, 1atm

1atm = 760torr = 760 mmHg

Colligative Properties

$\Delta T_f = iK_fm$

$\Delta T_b = iK_bm$

Thermodynamics

$\Delta H^o_{rxn} = \Sigma n\Delta H^o_f$ (products)-$\Sigma m\Delta H^o_f$(reactants)

$\Delta E = \Delta H - P\,\Delta V$

$q_1 = -q_2$ $\quad w = -P\Delta V$ $\quad 1L•atm = 101.3J$

$C = m·s$ $\quad q = m·s·\Delta t$ $\quad E = q + w$

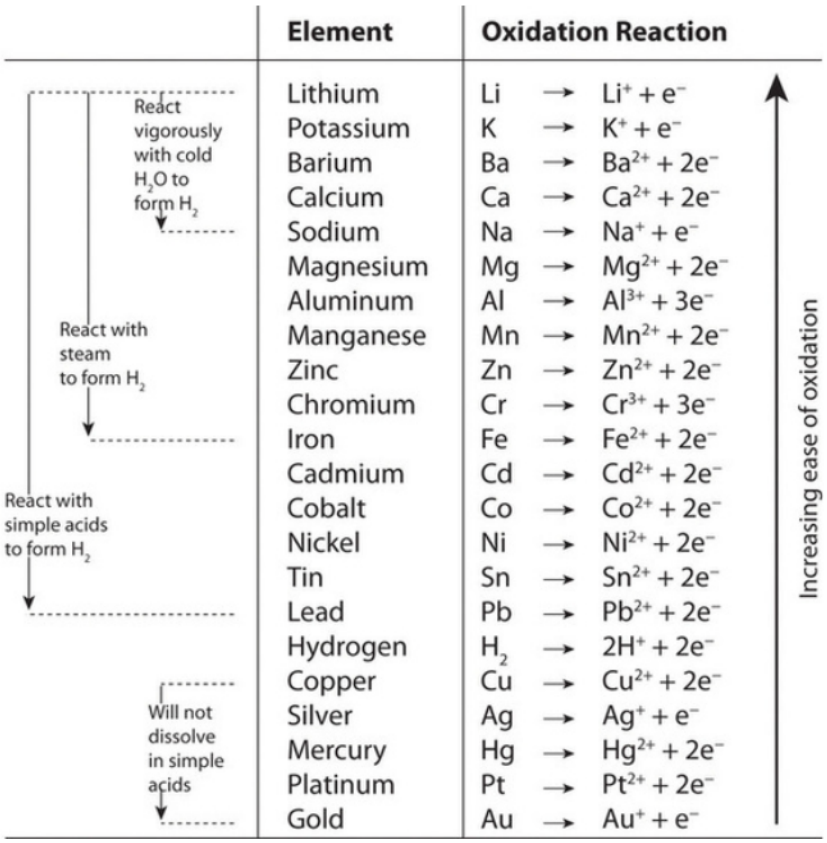
Soluble Compounds

1. All salts of the alkali metals (Group 1A) are soluble.
2. All salts containing NH_4^+, NO_3^-, ClO_4^-, ClO_3^-, and $C_2H_3O_2^-$ are soluble.
3. All chlorides, bromides, and iodides (salts containing Cl^-, Br^-, or I^-) are soluble except when combined with Ag^+, Pb^{2+}, and Hg_2^{2+} (note the subscript 2).
4. All salts containing SO_4^{2-} are soluble except those of Pb^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, and Hg_2^{2+}.

Insoluble Compounds

5. All metal hydroxides (ionic compounds containing OH^-) and all metal oxides (ionic compounds containing O^{2-} are insoluble except those of Group 1A and those of Ca^{2+}, Sr^{2+}, and Ba^{2+}.
   - When metal oxides do dissolve, they react with water to form hydroxides. The oxide ion, O^{2-}, does not exist in water. For example:

     $Na_2O(s) + H_2O \longrightarrow 2NaOH(aq)$
6. All salts containing PO_4^{3-}, CO_3^{2-}, SO_3^{2-} and S^{2-} are insoluble except those of Group 1A and NH_4^+



Element	Oxidation Reaction
Lithium	$Li \rightarrow Li^+ + e^-$
Potassium	$K \rightarrow K^+ + e^-$
Barium	$Ba \rightarrow Ba^{2+} + 2e^-$
Calcium	$Ca \rightarrow Ca^{2+} + 2e^-$
Sodium	$Na \rightarrow Na^+ + e^-$
Magnesium	$Mg \rightarrow Mg^{2+} + 2e^-$
Aluminum	$Al \rightarrow Al^{3+} + 3e^-$
Manganese	$Mn \rightarrow Mn^{2+} + 2e^-$
Zinc	$Zn \rightarrow Zn^{2+} + 2e^-$
Chromium	$Cr \rightarrow Cr^{3+} + 3e^-$
Iron	$Fe \rightarrow Fe^{2+} + 2e^-$
Cadmium	$Cd \rightarrow Cd^{2+} + 2e^-$
Cobalt	$Co \rightarrow Co^{2+} + 2e^-$
Nickel	$Ni \rightarrow Ni^{2+} + 2e^-$
Tin	$Sn \rightarrow Sn^{2+} + 2e^-$
Lead	$Pb \rightarrow Pb^{2+} + 2e^-$
Hydrogen	$H_2 \rightarrow 2H^+ + 2e^-$
Copper	$Cu \rightarrow Cu^{2+} + 2e^-$
Silver	$Ag \rightarrow Ag^+ + e^-$
Mercury	$Hg \rightarrow Hg^{2+} + 2e^-$
Platinum	$Pt \rightarrow Pt^{2+} + 2e^-$
Gold	$Au \rightarrow Au^+ + e^-$

Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Chem 112 General Chemistry Exam 1 Fall 2022

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. The correct IUPAC name for $Ca(NO_3)_2 \cdot 4H_2O$.
a. calcium nitrate hydrate
b. calcium(II) nitrate tetrahydrate
c. calcium dinitrate tetrahydrate
d. calcium dinitrate hydrate
e. calcium nitrate tetrahydrate

____ 2. Which has the correct name-formula combination?
a. Titanium(IV) phosphide - TiP
b. Nickel(II) oxide - NiO_2
c. Manganese(II) sulfide - MnS
d. Iron(II) nitride - FeN
e. Copper(II) fluoride - CuF

____ 3. Which of the following is a chemical change?
a. A diamond is heated in air to 800 °C, and forms CO and CO_2
b. Light refracts through a brilliant-cut diamond
c. A small industrial diamond is used to cut glass.
d. An uncut diamond is chiseled out of its ore.
e. A diamond wheel is used to cut a gemstone

____ 4. A temperature of 103°F or higher is considered a medical emergency. Patient A comes in with a temperature of 38°C. Patient B comes in with a temperature of 313 K. Is either patient having a medical emergency?
a. Yes, both patients
b. No, neither patient
c. Yes, patient B only
d. Not enough information to determine
e. Yes, patient A only

____ 5. Calculate the answer and report the correct number of significant figures, when dividing 1.030 g by 2.87 mL
a. 0.359 g/mL
b. 0.3589 g/mL
c. 0.358 g/mL
d. 0.36 g/mL
e. 0.35 g/mL

____ 6. A student is determining the density of an unknown metal with a mass of 32.56 g. The student partially fills a graduated cylinder with water and measures the volume of the water by itself as 14.78 mL. The student then adds the metal to the water and measures the new volume as 20.44 mL. What is the identity of the metal?
a. Iron, d = 7.87 g/cm^3
b. Lead, d=11.3 g/ml
c. Magnesium, d =1.74 g/ml
d. Tin, d=5.75 g/ml
e. Aluminium, d = 2.70 g/ml

____ 7. How many protons (p) and electrons (e) are found in a Se^{2-} ion?
a. 36p, 34e
b. 34p, 34e
c. 32p, 34e
d. 34p, 32e
e. 34p, 36e

____ 8. Classify the following compounds as ionic or covalent (molecular): OF_2, CuO, SeO_2.
a. ionic, ionic, covalent
b. covalent, ionic, covalent
c. ionic, ionic, covalent
d. ionic, covalent, ionic
e. covalent, covalent, ionic

____ 9. Predict the chemical formula for the ionic compound formed by the elements Ba and S
a. Ba_2S
b. BaS
c. Ba_2S_3
d. Ba_2S_2
e. BaS_2

____ 10. Which scientist is known for developing the Periodic Table of the Elements?
a. Ernest Rutherford
b. ALbert Einstein
c. James Chadwick
d. Dmitri Mendeleev
e. J. J. Thomson

____ 11. A chemist is trying to identify an unknown metal, and finds that 25.0 cm^3 of the substance has a mass of 224.43 g at 20°C. Which of the following metals is it?
a. Silver, d = 10.5 g/cm^3
b. Copper, d = 8.98 g/cm^3
c. Aluminum, d = 2.70 g/cm^3
d. Iron, d = 7.87 g/cm^3
e. Gold, d = 19.32 g/cm^3

____ 12. Which of the following elements would be chemically similar to oxygen (O, Z = 8)?
a. S, Z = 16
b. As, Z = 33
c. Ca, Z = 20
d. Br, Z = 35
e. Sc, Z = 21

____ 13. A race car has a maximum speed of 0.104 km/s. What is this speed in miles per hour?
a. 233 miles per hour
b. 388 miles per hour
c. 98.0 miles per hour
d. 602 miles per hour
e. 3.88 miles per hour

____ 14. Which of the following numbers contains three significant figures?
a. 0.23
b. 0.2303
c. 0.00230
d. 2.300
e. 0.023

____ 15. Write the chemical formula for diarsenic trioxide
a. As_3O_2
b. As_2O_3
c. AsO_4
d. As_2S_3
e. As_2O_4

____ 16. Write the balanced equation for the reaction of solid potassium chlorate decomposing to form solid potassium chloride and oxygen gas.
a. $2KClO_3$ (s) --> 2KCl (s) + O_6 (g)
b. $2KClO_3$ (s) --> 2KCl (s) + 6 O (g)
c. $2KClO_3$ (s) --> KCl (s) + 3 O_2 (g)
d. $2KClO_3$ (s) --> 2KCl (s) + 3 O_2 (g)
e. $KClO_3$ (s) --> KCl (s) + 3 O (g)

____ 17. The answer to the calculation below with the correct number of significant figures is 15.4+9.87+0.002=
a. 25.2720
b. 25
c. 25.3
d. 25.272
e. 25.27

____ 18. An atom of the isotope ^{197}Au contains how many protons (p), neutrons (n), and electrons (e)?
a. 79p, 197n, 79e
b. 79p, 118n, 79e
c. 197p, 118n, 79e
d. 79p, 79n, 79e
e. 197p, 197n, 197e

____ 19. Convert 32.1 in to centimeters. 1 in = 2.54 cm
a. 12.6 cm
b. 0.815 cm
c. 16.4 cm
d. 1.95 cm
e. 81.5 cm

____ 20. Which has the correct name-formula combination?
a. Calcium phosphate - $Ca_2(PO_4)_3$
b. Barium sulfate - $Ba(SO_4)_2$
c. Potassium phosphate - K_3PO_4
d. Lithium sulfate - $LiSO_4$
e. Potassium nitrate - KNO_2

____ 21. How many electrons are in a neutral carbon-14 atom?
a. 8
b. 4
c. 6
d. 14
e. 2

____ 22. Which has the correct name-formula combination?
a. Carbon tetraiodide - CI_3
b. Diphosphorus pentoxide - P_2O
c. Iodine heptafluoride - IF_7
d. Chlorine pentafluoride - ClF
e. Sulfur tetrafluoride - SF

____ 23. An unknown element X has the following isotopes: ^{64}X (64.00 amu, 49.00% abundant), ^{66}X (66.00 amu, 28.00% abundant), ^{68}X (68.00 amu, 23.00% abundant). What is the average atomic mass in amu of X?
a. 65.58 amu
b. 65.5 amu
c. 66.10 amu
d. 66.42 amu
e. 65.48 amu

____ 24. Gasoline is composed of a variety of different liquid hydrocarbons, which do not separate as time passes. Gasoline is an example of a:
a. solution
b. heterogeneous mixture
c. element
d. atom
e. compound

____ 25. Which of the following is the first step in the scientific method?
a. analysis of results
b. observation
c. experimentation
d. background research
e. hypothesis formation

____ 26. What are the coefficients in front of the H_2 and the Au if you balance the following unbalanced equation:
$Au_2S_3 + H_2 \rightarrow Au + H_2S$?
a. 3, 2
b. 1, 1
c. 6, 2
d. 6, 4
e. 3, 6

____ 27. Which will have a higher density: 1.00 g of pure gold or 1.00 kg of pure gold?
a. There's no way to determine; it depends on the temperature of samples
b. Both will have the same density
c. There's no way to determine; it depends on the atmospheric pressure during measurements
d. 1.00 g of pure gold
e. 1.00 kg of pure gold

____ 28. Which of the following is an intensive physical property of matter?
a. density
b. reactivity
c. flammability
d. volume
e. mass

____ 29. Which of the following quantities is equivalent to 3.7 cm?
a. 3.7×10^{2} mm
b. 3.7×10^{5} μm
c. 3.7×10^{-2} mm
d. 3.7×10^{-5} km
e. 3.7×10^{-3} m

____ 30. Glucose is an example of a(n)
a. atom
b. compound
c. heterogenenous mixture
d. element
e. homogeneous mixture

____ 31. Write the chemical formula for chromium(VI) sulfate
a. $Cr(SO_3)_3$
b. $Cr(SO_4)_3$
c. $CrSO_3$
d. Cr_6SO_4
e. $CrSO_4$

____ 32. How many H atoms are in **two** formula unit of $(NH_4)_2SO_4$?
a. 16
b. 32
c. 4
d. 2
e. 8

____ 33. Predict the chemical formula for the ionic compound formed by NH_4^+ and PO_4^{3-}
a. NH_4PO_4
b. $NH_{4,3}PO_4$
c. $NH_4(PO_4)_3$
d. $(NH_4)_3PO_4$
e. $(NH_4^+)_3PO_4^{3-}$

____ 34. Which element is classified as a transition metal?
a. Xenon (Xe), Z=54
b. Tellurium (Te), Z=52
c. Zirconium (Zr), Z=40
d. Lithium (Li), Z=3
e. Alumunium (Al), Z=13