September 26, 2017

Do not open the exam until you are told to do so.

Cell phones and other electronic devices must be turned off and stowed out of sight (your sight and mine). Calculator policy is in effect. Infractions will cost you points!

ALL outside paper must be stowed out of sight. You have a responsibility to keep your gaze confined to your own desk. Unauthorized materials will result in your exam being removed and a score of 0 assigned.

If you reach a point where you need more scratch paper than the space available, ask a proctor. Since partial credit is based on showing your work, be sure to write your name on your scratch paper, turn it in, and note on the exam answer sheet if you have work elsewhere that you want considered.

You have a responsibility to keep your gaze confined to your own desk. Wandering eyes may result in your being asked to move, or may result in your exam being removed and a score of 0 assigned.

Please clearly and legibly write your name, in ink, at the top of both pages of your answer sheet. Your score will not be recorded and your exam will not be returned if this is not done.

All answers should be rounded to the appropriate precision (correct significant figures.)

Atomic weights are provided in the Periodic Table. These values must be used.

Be certain your answers are clear. If an answer is not clear, it will probably be considered wrong.

Use your time effectively.

When authorized to open your exam, you may carefully remove this cover sheet. When you are finished with your exam, please turn in **the two answer sheets.** Make sure your name is clearly written on every page. (Problem numbers may not appear exactly in order in your exam. As long as you have the right number of pages as announced by the Proctors, don't be concerned about it.)

Time is up at 12:15!!

Potentially useful information:
6.022×10^{23}

THE PERIODIC TABLE

	1	2											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 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
3	11 Na 22.99	12 Mg 24.31	3	4	5	6	7	8	9	10	11	12	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.63	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.96	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
6	55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
7	87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (267)	105 Db (268)	106 Sg (271)	107 Bh (270)	108 Hs (270)	109 Mt (278)	110 Ds (281)	111 Rg (282)	112 Cn (285)	113 Nh (286)	114 Fl (289)	115 Mc (289)	116 Lv (293)	117 Ts (294)	118 Og (294)

58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.1	71 Lu 175.0
90 Th 232.0	91 Pa 231.0	92 U 238.0	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 (262)

Atomic weights based on IUPAC 2009, 2007 (publ 2011, 2009).

name_____

Scored grade (instructor use only!)_____

1. Write **balanced** chemical equations, with appropriate phase labels, for the following reactions. In both cases, you may use as much scratch space as you need, but write your final answer **legibly** in the box.

a. [10 pts] **Copper(II) oxide reacts with methane to produce carbon monoxide, water, and copper.**

(remember to balance rxn and include phase labels)

b. [10] **Ethanol (C_2H_6O) combusts.

(remember to balance rxn and include phase labels)

2. (a) [2] Beryllium has two naturally occurring isotopes, ^{9}Be and ^{10}Be. An atom of ^{9}Be has mass = 9.012182 μ. What can you conclude about the abundance of ^{10}Be, based on the average mass given in the periodic table? (Hint: what's the approximate percent abundance of ^{9}Be?) *Briefly* support any assertions you make.

(b) [3] How many protons, neutrons and electrons are in a single $^{10}Be^{2+}$ ion?

protons _____ neutrons _____ electrons _____

name_____

3. [2 pts] A student preparing for an experiment weighs an empty beaker and records its mass as 63.347 g. She then adds a sample of copper(II) oxide, weighs the beaker containing the sample, and records the mass as 64.037 g. What is the mass of the sample, in grams? (Record your answer, rounded to the appropriate precision, in the space.)

Answer: _____

4. (a) [1 pt] A covalent compound of Si and Cl consists of 20.9% Si by mass. What is the % Cl in the compound?

Answer: _____

(b) [3 pts] What is the **empirical formula** of the compound? **Show your work below** to earn credit, and write the formula in the space.

Answer: _____

(c) [2] Write two other possible chemical formulas that are consistent with the empirical formula you wrote above.

_____ _____

(d) [2] A different experiment indicates that the compound described in (a) has a molar mass of approximately 270 g/mol. What is the chemical formula of the compound?

_____

name_____

5. (a) [3] What is the molar mass of $Hg(MnO_4)_2$? **Show your work** below, and report your answer, with appropriate rounding and unit(s), in the space provided.

Answer: _____

(b) [6] Consider a 5.00-mol sample of $Hg(MnO_4)_2$.

What is the mass of the sample? _____

How many **moles of O** are present? _____

How many **atoms of Mn** are present? _____

6. [2 pts each] **Clearly** indicate whether each statement is TRUE or FALSE. If we can't tell which you mean, it's wrong.

_____ H_2 is diatomic, but not binary.

_____ H can form both H^+ and H^- ions.

_____ Hydrogen is a gas at room temperature.

_____ Hydrogen is a metal.

_____ In the most common isotope of hydrogen, the atoms have one electron, one proton and one neutron.

_____ The number of electrons and protons in an atom or ion must always be equal.

7. [2 pts each] Fill in the blanks. (In some cases there could be more than one acceptable answer; pick **one**.)

_____ An element that always forms +2 ions in compounds.

_____ A substance that exists as individual gas-phase atoms under normal laboratory conditions.

_____ An element that forms covalent compounds but doesn't form monatomic ions.

_____ A nonmetal in period 5.

name_____

8. [2 pts each] Give a **correct systematic name** for each of the following. Spelling counts.

_____ $Zn(ClO_3)_2$

_____ SO_3

_____ IF_5

_____ FeO

_____ NH_3

9. [2 pts each] Give the correct **chemical formula** for each of the following.

_____ elemental potassium

_____ dihydrogen arsenate ion

_____ sulfurous acid

_____ silver thiosulfate

_____ calcium phosphate

_____ silicon tetrachloride

_____ elemental bromine

_____ sodium hypoiodite

10. $2\ Mg + O_2 \rightarrow 2\ MgO$

A student carries out the reaction above, starting with 48 g of Mg and 48 g of O_2 in a sealed container.

(a) [6 pts] What mass of product is formed from the complete reaction? (Show work, include unit(s), round appropriately)

Answer: _____

(b) [4 pts] Which reactant is left over, and what mass of that reactant remains after the reaction is complete? (Show work, include unit(s), round appropriately)

Answer: _____