Instructions: Show all work whenever a calculation is required! You will receive credit for <u>how</u> you worked each problem as well as for the correct answer. If you need more space, you may use the back of your periodic table — Write: "See PT" in box and then attach the periodic table. BOX YOUR ANSWERS! Write legibly.

1. (6 pts) The periodic table and the elements. Which of the following is an example of

(a) alkali metal:	Al	C	K	B
(b) halogen:	S	Na	He	Br
(c) noble gas:	Ar	Fe	Be	U
(d) semi-metal:	S	As	O	Al
(e) non-metal:	Co	Cr	Se	N
(f) alkaline earth metal	Ca	Cr	Co	Cf

2. (4 pts) Convert 8.8 microliters to milliliters. Remember to always show your work.

3. (4 pts) A piece of cobalt with an irregular shape has a mass of 314 g. Knowing the density of cobalt is 8.90 g/cm^3, what is the volume (in cm^3) of the object? Show your work.

4. (4 pts) Convert a temperature of 310 K to ^oF.

5. (4 pts) How many significant figures would you use to correctly report these calculations?

(a) 98.4 X 22.75   Circle: 1 2 3 4 5 6+

(b) 19.224 – 4.17   Circle: 1 2 3 4 5 6+

(c) 55.79 X 0.010320   Circle: 1 2 3 4 5 6+

(d) (7.1 + 44.00) X π^2 Circle: 1 2 3 4 5 6+

6. (1 pt) Which one of these statements is a result of the law of definite proportions?

A. Most atoms exist as more than one isotope.

B. Isotopes have abundances, thus each element exists in a definite proportion of isotopes.

C. Pure compounds contain definite proportions of the constituent atoms.

D. A pure substance exists in a definite proportion with other pure substances.

7. (4 pts) Circle <u>all</u> examples of the law of multiple proportions.

A. NO_2 and N_2O_3 B. SO_2 and SO_3

C. NO_2 and N_2O_4 D. PF_3 and PF_5

8. (3 pts) Phosphorus exists as only one isotope (100%). Use the periodic table to give the number of protons, neutrons and electrons in a neutral atom of phosphorus.

_____ protons   _____ neutrons   ____ electrons

9. (4 points) Bromine exists in two isotopic forms. Which of the following combinations could explain the average atomic mass for bromine from the periodic table? Note percentages given are approximate. (More than one possible answer.)

A. 50% $^{79}_{35}Br$ and 50% $^{81}_{35}Br$

B. 50% $^{79}_{35}Br$ and 50% $^{80}_{35}Br$

C. 5% $^{79}_{35}Br$ and 95% $^{80}_{35}Br$

D. 95% $^{79}_{35}Br$ and 5% $^{80}_{35}Br$

10. (3 pts) How many moles of tin are in a sample with mass of 0.5377 g? Answer should have the maximum number of significant figures given the data available.

11. (2 pts) What isotope is produced when $^{244}_{95}Am$ emits an α-particle?

12. (2 pts) Write and balance the nuclear transformation reaction predicted for the unstable isotope $^{14}_{6}C$?

13. (10 pts) Nomenclature. Complete the table.
(Skip this question if you are nomenclature certified.)

Formula:	Name:
CS_2	
$MgCO_3$	
CrF_3	
P_2O_5	
$KC_2H_3O_2$	
	sodium chloride
	phosphorus tribromide
	sodium sulfate
	titanium(IV) chloride
	ammonium nitrate

14. (3 pts) Balance the following equation with the smallest whole number coefficients. (No partial credit)

___ N_2O + ___ NH_3 → ___ N_2 + ___ H_2O
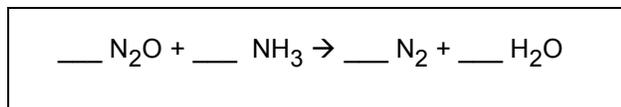
15. (3 pts) What is the molar mass of $(NH_4)_2Cr_2O_7$?

16. The following reaction is used to make extremely pure iron. Use the balanced equation to answer Questions 16(a) – (d). [Given molar masses (in g/mol): Fe_3O_4: 231.55; H_2: 2.02; Fe: 55.85; H_2O: 18.02]

Fe_3O_4 + 4 H_2 → 3 Fe + 4 H_2O
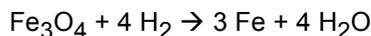
(a) (4 pts) How many moles of iron are expected from the reaction between 115 moles of H_2 with excess Fe_3O_4?

(b) (4 pts) What mass of Fe_3O_4 would be needed to react with 1.38 x 10^3 mol H_2?

(c) (4 pts) What is the limiting reagent if 170.0 g Fe_3O_4 and 22.0 g H_2 are reacted? As always, show your work.

(d) (3 pts) Suppose that the theoretical yield of iron was 2.57 mol Fe. What is the percent yield if the actual yield was determined to be 132 g?

17. (3 pts) What is the molarity of a solution prepared by dissolving 3.8 g $LiNO_3$ (MM = 68.95 g/mol) in water to make 250.0 mL?

18. (5 pts) Ibuprofen consists of carbon, hydrogen and oxygen. Elemental analysis gives 75.69 % C and 8.80 % H. What is the empirical formula of ibuprofen?

Print your name below:

For DocM to complete:

Subtotal from exam: _____

Homework: (20 max) _____

Total: _____

Answers:

1.

(a) alkali metal: K

(b) halogen: Br

(c) noble gas: Ar

(d) semi-metal: As

(e) non-metal: N (also Se)

(f) alkaline earth metal   Ca

2. 0.0088 mL.

3. 35.3 cm^3

4. 99 ºF.

5. (a) 3; (b) 4; (c) 4; (d) 3

6. C

7. A, B, D

8. 15 protons   16 neutrons 15 electrons

9. A and C

10. 4.53 X 10^{-3} mol Sn

11. $^{240}_{93}Np$

12. $^{14}_{6}C \rightarrow ^{0}_{-1}\beta + ^{14}_{7}N$

13.

Formula:	Name:
CS_2	Carbon disulfide
$MgCO_3$	Magnesium carbonate
CrF_3	Chromium(III) fluoride
P_2O_5	Diphosphorus pentoxide
$KC_2H_3O_2$	Potassium acetate
NaCl	sodium chloride
PBr_3	phosphorus tribromide
Na_2SO_4	sodium sulfate
$TiCl_4$	titanium(IV) chloride
NH_4NO_3	ammonium nitrate

14. 3 N_2O + 2 NH_3 → 4 N_2 + 3 H_2O

15. 252 g/mol

16.

(a) 86.25 mol Fe

(b) 7.99 x 10^4 g Fe_3O_4

(c) Fe_3O_4

(d) 92%

17. 0.22 M $LiNO_3$

18. $C_{13}H_{18}O_2$