

# Chemistry 150

# Exam 2

Be sure to put your name on each page. This page can be removed from your exam so that you will have a Periodic Table handy throughout the exam, it does not need to be turned in. Show all your work for non-multiple choice problems which require any sort of calculation, no credit will be given for answers without work shown. If you have shown a significant amount of work or multiple drawings for a problem, draw a box around what you consider your final answer.

Avogadro's Number =  $6.022 \times 10^{23}$  units/mol

$32.00^\circ\text{F} = 0.000^\circ\text{C} = 273.15\text{K}$

1 foot = 12 inches

1 inch = 2.54cm (exactly)

1 pound = 453.6 g = 16 ounces

1 amu =  $1.6605 \times 10^{-24}$  g

Masses of subatomic particles:

Proton  $1.00728\text{amu} = 1.6726 \times 10^{-24}$  g

Neutron  $1.00866\text{amu} = 1.6749 \times 10^{-24}$  g

Electron  $0.000549\text{amu} = 9.1094 \times 10^{-28}$  g

Density of Water =  $1.000\text{g/mL}$

$R = 0.08206 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$

$PV = nRT$

1 <b>H</b> 1.0079																	2 <b>He</b> 4.0026
3 <b>Li</b> 6.941	4 <b>Be</b> 9.0122											5 <b>B</b> 10.811	6 <b>C</b> 12.011	7 <b>N</b> 14.007	8 <b>O</b> 15.999	9 <b>F</b> 18.998	10 <b>Ne</b> 20.180
11 <b>Na</b> 22.990	12 <b>Mg</b> 24.305											13 <b>Al</b> 26.982	14 <b>Si</b> 28.086	15 <b>P</b> 30.974	16 <b>S</b> 32.066	17 <b>Cl</b> 35.453	18 <b>Ar</b> 39.948
19 <b>K</b> 39.098	20 <b>Ca</b> 40.078	21 <b>Sc</b> 44.956	22 <b>Ti</b> 47.88	23 <b>V</b> 50.942	24 <b>Cr</b> 51.996	25 <b>Mn</b> 54.938	26 <b>Fe</b> 55.847	27 <b>Co</b> 58.933	28 <b>Ni</b> 58.69	29 <b>Cu</b> 63.546	30 <b>Zn</b> 65.39	31 <b>Ga</b> 69.723	32 <b>Ge</b> 72.61	33 <b>As</b> 74.922	34 <b>Se</b> 78.96	35 <b>Br</b> 79.904	36 <b>Kr</b> 83.80
37 <b>Rb</b> 85.468	38 <b>Sr</b> 87.62	39 <b>Y</b> 88.906	40 <b>Zr</b> 91.224	41 <b>Nb</b> 92.906	42 <b>Mo</b> 95.94	43 <b>Tc</b> (98)	44 <b>Ru</b> 101.07	45 <b>Rh</b> 102.91	46 <b>Pd</b> 106.42	47 <b>Ag</b> 107.87	48 <b>Cd</b> 112.41	49 <b>In</b> 114.82	50 <b>Sn</b> 118.71	51 <b>Sb</b> 121.76	52 <b>Te</b> 127.60	53 <b>I</b> 126.90	54 <b>Xe</b> 131.29
55 <b>Cs</b> 132.91	56 <b>Ba</b> 137.33	57 <b>La</b> 138.91	72 <b>Hf</b> 178.49	73 <b>Ta</b> 180.95	74 <b>W</b> 183.84	75 <b>Re</b> 186.21	76 <b>Os</b> 190.23	77 <b>Ir</b> 192.22	78 <b>Pt</b> 195.08	79 <b>Au</b> 196.97	80 <b>Hg</b> 200.59	81 <b>Tl</b> 204.38	82 <b>Pb</b> 207.2	83 <b>Bi</b> 208.98	84 <b>Po</b> (209)	85 <b>At</b> (210)	86 <b>Rn</b> (222)
87 <b>Fr</b> (223)	88 <b>Ra</b> 226.03	89 <b>Ac</b> 227.03	104 <b>Rf</b> (261)	105 <b>Db</b> (262)	106 <b>Sg</b> (263)	107 <b>Bh</b> (262)	108 <b>Hs</b> (265)	109 <b>Mt</b> (266)	110 <b>(269)</b>	111 <b>(272)</b>	112 <b>(277)</b>		114 <b>(279)</b>		116 <b>(289)</b>		

58 <b>Ce</b> 140.12	59 <b>Pr</b> 140.91	60 <b>Nd</b> 144.24	61 <b>Pm</b> (145)	62 <b>Sm</b> 150.36	63 <b>Eu</b> 151.97	64 <b>Gd</b> 157.25	65 <b>Tb</b> 158.93	66 <b>Dy</b> 162.50	67 <b>Ho</b> 164.93	68 <b>Er</b> 167.26	69 <b>Tm</b> 168.94	70 <b>Yb</b> 173.04	71 <b>Lu</b> 174.97
90 <b>Th</b> 232.04	91 <b>Pa</b> 231.04	92 <b>U</b> 238.03	93 <b>Np</b> 237.05	94 <b>Pu</b> (244)	95 <b>Am</b> (243)	96 <b>Cm</b> (247)	97 <b>Bk</b> (247)	98 <b>Cf</b> (251)	99 <b>Es</b> (252)	100 <b>Fm</b> (258)	101 <b>Md</b> (258)	102 <b>No</b> (259)	103 <b>Lr</b> (260)

Score
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**Multiple Choice: Circle the letter of the most correct response. (7pts. per question)**

- Under which of the following conditions is a gas most “ideal”?
  - High temperature, high pressure
  - High volume, low pressure
  - Low pressure, high temperature
  - High pressure, high volume
  - Room temperature, 25°C
- Consider the following reaction:
$$a \text{K}_3\text{PO}_4(\text{aq}) + b \text{Ca}(\text{NO}_3)_2(\text{aq}) \rightarrow c \text{Ca}_3(\text{PO}_4)_2(\text{s}) + d \text{KNO}_3(\text{aq})$$
For every mol of  $\text{K}_3\text{PO}_4(\text{aq})$  that reacts, how many mols of  $\text{Ca}_3(\text{PO}_4)_2(\text{s})$  are formed?
  - 0.25 mols
  - 0.5 mols
  - 1 mol
  - 2 mols
  - 3 mols
- Which of the following is a correct gas law relationship?
  - $PT = nRV$
  - $n_1T_1 = n_2T_2$
  - $V_1n_1 = V_2n_2$
  - $P_1T_1 = P_2T_2$
  - $P_1 / V_1 = P_2 / V_2$
- Which of the following combinations of aqueous solutions would you expect to form a precipitate?
  - Ammonium phosphate + Potassium carbonate
  - Sodium hydroxide + Nitric acid
  - Hydrochloric acid + Lithium sulfite
  - Sodium acetate + Nickel(II) nitrate
  - Silver(I) nitrate + Potassium carbonate
- Which of the following is **not** a redox reaction?
  - $\text{Mg}(\text{s}) + 2 \text{HCl}(\text{aq}) \rightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g})$
  - $4 \text{Fe}(\text{s}) + 3 \text{O}_2(\text{g}) \rightarrow 2 \text{Fe}_2\text{O}_3(\text{s})$
  - $2 \text{C}_2\text{H}_2(\text{g}) + 5 \text{O}_2(\text{g}) \rightarrow 4 \text{CO}_2(\text{g}) + 2 \text{H}_2\text{O}(\text{g})$
  - $\text{NH}_4\text{NO}_3(\text{aq}) + \text{NaC}_2\text{H}_3\text{O}_2(\text{aq}) \rightarrow \text{NH}_4\text{C}_2\text{H}_3\text{O}_2(\text{aq}) + \text{NaNO}_3(\text{aq})$
  - $2 \text{CuNO}_3(\text{aq}) + \text{Sn}(\text{s}) \rightarrow 2 \text{Cu}(\text{s}) + \text{Sn}(\text{NO}_3)_2(\text{aq})$
- In which of the following formulas does phosphorus have the **lowest** oxidation number?
  - $\text{Na}_3\text{PO}_4$
  - $\text{PH}_3$
  - $\text{H}_3\text{PO}$
  - $\text{P}_4$
  - $\text{KH}_2\text{PO}_3$

7. Which of the following would you expect to be *insoluble* in water?
- NaI
  - Pb(NO<sub>3</sub>)<sub>2</sub>
  - NH<sub>4</sub>C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>
  - BaSO<sub>4</sub>
  - FeSO<sub>4</sub>
8. Consider the following reaction:
- $$\text{Mn(NO}_3)_3(\text{aq}) + \text{CrSO}_4(\text{aq}) \rightarrow \text{MnSO}_4(\text{aq}) + \text{Cr(NO}_3)_3(\text{aq})$$
- What is being *oxidized* in this reaction?
- Mn(NO<sub>3</sub>)<sub>3</sub>(aq)
  - CrSO<sub>4</sub>(aq)
  - MnSO<sub>4</sub>(aq)
  - Cr(NO<sub>3</sub>)<sub>3</sub>(aq)
  - This is not a redox reaction

**Multiple Choice Calculations (12pts each):**

9. What is the pressure of 4.936mols of ideal gas at 28.61°C in a 50.0L vessel?
- 0.0862atm
  - 0.232atm
  - 2.44atm
  - 4.31atm
  - 11.6atm
10. A 2.65L steel tank contains an ideal gas at 15.83°C and 1.15atm. What is the temperature of the tank if the pressure changes to 1.48atm?
- 48.6°C
  - 12.3°C
  - 20.4°C
  - 98.8°C
  - 155°C
11. A reaction produces 834.1mL of ideal gas at 1.06atm pressure and 32.87°C. How many mols of gas did the reaction produce?
- 0.0352 mols
  - 0.328 mols
  - 1.06 mols
  - 35.2 mols
  - 328 mols
12. You have dissolved 10.00g of magnesium acetate in enough water to make 250.00mL of solution. What is the concentration of the resulting solution?
- 2.809x10<sup>-4</sup> M
  - 4.799x10<sup>-4</sup> M
  - 7.023x10<sup>-2</sup> M
  - 0.2809 M
  - 0.4799 M

**Problems: (23pts each)**

13. You would like to take some atmospheric measurements. You fill a weather balloon to a volume of 375.0L at 22.18°C and 0.938atm pressure. How many mols of gas are contained in the balloon? After you release the balloon, it rises to an altitude where the temperature is -8.46°C and the pressure is 0.613atm. A small hole in the balloon has allowed 12.50% of the original gas to escape. What is the volume of the balloon at this altitude?

14. 100.0mL of 1.183M iron(III) nitrate solution is combined with 100.0mL of 1.299M sodium carbonate solution.

- Write a correctly balanced net ionic equation for the reaction that takes place.
- How many grams of precipitate will this reaction form?
- You recover 9.614g of precipitate. What is the percent yield?