Name: _____

Chemistry 150   **Exam 1**

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 = 6.022×10^{23} $^{units}/_{mol}$

$32.00\,^{o}F = 0.000\,^{o}C = 273.15K$

1 foot = 12 inches

1 inch = 2.54cm (exactly)

1 pound = 453.6 g = 16 ounces

1 gallon = 3.785L

1 amu = 1.6605×10^{-24} g

Masses of subatomic particles:

   Proton   1.00728amu = 1.6726×10^{-24} g

   Neutron 1.00866amu = 1.6749×10^{-24} g

   Electron 0.000549amu = 9.1094×10^{-28} g

$R = 0.08206\,^{L \cdot atm}/_{mol \cdot K}$

1 H 1.0079																		2 He 4.0026
3 Li 6.941	4 Be 9.0122											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180
11 Na 22.990	12 Mg 24.305											13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.066	17 Cl 35.453	18 Ar 39.948
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.88	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.69	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	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
55 Cs 132.91	56 Ba 137.33	71 Lu 174.97	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)
87 Fr (223)	88 Ra 226.03	103 Lr (260)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 Ds (269)	111 Rg (272)	112 Cn (277)	113	114	115	116	117	118

57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.97	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.94	70 Yb 173.04
89 Ac 227.03	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (258)	101 Md (258)	102 No (259)

Score

Name: _____

Multiple Choice: Circle the letter of the most correct response. (4pts. per question)

1. Under what conditions is a gas *least* "ideal"?
   a. Low temperature, low pressure
   b. High temperature, low pressure
   c. 25°C, 1.00atm
   d. High temperature, high pressure
   e. **Low temperature, high pressure**

2. Which distance is *smallest*?
   a. 0.112mm
   b. 1.62×10^8 μm
   c. 7.25m
   d. 9.37×10^{-9} km
   e. **4.38×10^{-7} m**

3. Different isotopes of an element:
   a. **Have the same number of protons**
   b. Have the same charge
   c. Have the same number of electrons
   d. Have the same mass number
   e. Have the same number of neutrons

4. Which of the following formulas is *most ionic*?
   a. **BaF_2**
   b. HgO
   c. NO_2
   d. NiI_2
   e. Mn_2S_3

5. The volume of a gas:
   a. Decreases as the temperature increases
   b. Is constant as the amount of gas is increased
   c. Is always a constant
   d. **Decreases as the pressure increases**
   e. Increases as the kinetic energy decreases

6. Which of the following sets of elements contains a metal, a metalloid/semi-metal and a nonmetal?
   a. **As, O, Rb**
   b. Fe, He, Pb
   c. N, O, Se
   d. F, Ar, Ti
   e. K, Mo, U

7. Which of the following polyatomic ions has the *most oxygen atoms*?
   a. **phosphate**
   b. hydroxide
   c. cyanide
   d. hypochlorite
   e. nitrate

8. Which of the following organic molecules has the *fewest carbon atoms*?
   a. **Methyl amine**
   b. Hexene
   c. Butanol
   d. Ethane
   e. Propyne

9. Which of the following is *not* a correct gas law relationship?
   a. $PV = nRT$
   b. $n_1T_1 = n_2T_2$
   c. **$V_1n_1 = V_2n_2$**
   d. $P_1V_1 = P_2V_2$
   e. $P_1 / T_1 = P_2 / T_2$

10. Complete each row of the following table (3pts per box):

Symbol	Number of Protons	Number of Neutrons	Number of Electrons	Atomic Number	Mass Number	Charge
N	**7**	**8**	**10**	7	15	-3
Ca	**20**	**19**	20	**20**	39	**0**
Bi	83	125	80	**83**	**208**	**+3**
Mg	**12**	13	12	**12**	**25**	**0**

Score

Name: _____

Short Problems: Show your work, your final answer must be written in the "Answer" box to receive full credit.(8pts each)

11. What is the formula weight of strontium nitrate? (Atomic # of strontium = 38)

$Sr(NO_3)_2$ → 87.62+2(14.007)+6(15.999) = 211.628

> **Answer 11:**
>
> $211.628^g/_{mol}$

12. How many sodium atoms are present in a 14.192g sample of sodium (Atomic # = 11)?

(14.192g)(1mol/22.990g)($6.022 \times 10^{23\ atoms}/_{mol}$) = 3.717×10^{23} Na atoms

> **Answer 12:**
>
> 3.717×10^{23} Na atoms

13. What is the mass in grams of 0.914mols of aluminum (Atomic # = 13)?

(0.914mols Al)($26.982^g/_{mol}$) = 24.7grams

> **Answer 13:**
>
> 24.7grams

14. What is the mass in grams of a sample of krypton (Atomic # = 36) that contains 6.81×10^{22} Kr atoms?

(6.81×10^{22} Kr atoms)(1mol/6.022×10^{23} Kr atoms)($83.80^g/_{mol}$) = 9.48g

> **Answer 14:**
>
> 9.48g

15. A new Ford F-150 has a 36.28 gallon fuel tank. What is this volume in milliliters?

(36.28gal)($3.785^L/_{gal}$)($1000^{mL}/_L$) = 1.373×10^5 mL

> **Answer 15:**
>
> 1.373×10^5 mL

16. What is the volume of 3.118mols of ideal gas at 18.62ºC and 0.4382atm pressure?

(0.4382atm)V = (3.118mols)($0.08206^{L \cdot atm}/_{mol \cdot K}$)(18.62+273.15K)
V = 170.4L

> **Answer 16:**
>
> 170.4L

17. You have a 24.92L sample of gas at 45.18°C and 1.002atm. What is the volume of this gas if the temperature is decreased to 2.76°C?

$V_1 / T_1 = V_2 / T_2$
(24.92L) / (45.18+273.15K) = V_2 / (2.76+273.15K)
V_2 = 21.60L

> **Answer 17:**
>
> 21.60L

> *Score*

Name: _____

Problem:

18. You are working in a food production facility and have found an unlabelled barrel. From inventory records, you know that it is either fructose which has a molecular weight of about $180\,^g/_{mol}$ or ethyl benzoate which has a molecular weight of about $150\,^g/_{mol}$. You send a sample for analysis and receive the following results: %C = 71.98, %H = 6.711, %O = 21.31. What is the *empirical* formula of this substance? What is the molecular weight of this empirical formula? Does the barrel contain fructose or ethyl benzoate? Explain. (15pts)

C → 71.98g/12.011$^g/_{mol}$ = 5.993mols → 4.5 → 9

H → 6.711g/1.0079$^g/_{mol}$ = 6.658mols → 5 → 10

O → 21.31g/15.999$^g/_{mol}$ = 1.332mols → 1 → 2

Empirical formula = $C_9H_{10}O_2$ → 150.176$^g/_{mol}$

Since the molecular formula must be a multiple of the empirical formula, the barrel must contain ethylbenzoate.