# Exam 1 (2/21/18, Sturgeon) Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### General Chemistry (Chem 140)

*Material Covered*: Chapter 1, 2, and 3

**1** **18**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1  **H**  1.008 | **2** |  |  |  |  |  |  |  |  |  |  | **13** | **14** | **15** | **16** | **17** | 2  **He**  4.003 |
| 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 |
| 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 |
| 19  **K**  39.10 | 20  **Ca**  40.08 | 21  **Sc**  44.96 | 22  **Ti**  47.88 | 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**  65.39 | 31  **Ga**  69.72 | 32  **Ge**  72.61 | 33  **As**  74.92 | 34  **Se**  78.96 | 35  **Br**  79.90 | 36  **Kr**  83.80 |
| 37  **Rb**  85.47 | 38  **Sr**  87.62 | 39  **Y**  88.91 | 40  **Zr**  91.22 | 41  **Nb**  92.91 | 42  **Mo**  95.94 | 43  **Tc**  (98) | 44  **Ru**  101.1 | 45  **Rh**  102.9 | 46  **Pd**  106.4 | 47  **Ag**  107.87 | 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 |
| 55  **Cs**  132.9 | 56  **Ba**  137.3 | 57  **La**  138.9 | 72  **Hf**  178.5 | 73  **Ta**  181.0 | 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) |
| 87  **Fr**  (223) | 88  **Ra**  226.0 | 89  **Ac**  227.0 | 104  **Rf**  (267) | 105  **Db**  (268) | 106  **Sg**  (269) | 107  **Bh**  (270) | 108  **Hs**  (277) | 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**  173.0 | 71  **Lu**  175.0 |
| 90  **Th**  232.0 | 91  **Pa**  231.0 | 92  **U**  238.0 | 93  **Np**  237.0 | 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**  (260) |

###### Conversion Factors

1 km = 1000 meters (m) 1 kg = 1000 grams (g) 1 L = 1000 milliliters (mL) 1cm3 = 1 mL

K = °C + 273 1 in = 2.54 cm (exact #) Avogadro’s number = 6.02 x 1023 (molecules or atoms)/mole

***SHOW YOUR WORK***

(for partial credit)

**Exam instructions**: This is a closed book, closed note exam. You are required to bring a calculator. Please use the periodic table provided. You may not use your cell phone or other device unless approved. You will have 50 minutes to complete this exam.

*I agree to follow the guidelines listed above and state that I have neither given nor received any unauthorized aid on this exam.*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (*signature*)

*Scratch paper…*

1) (3 pts ea) Perform the following operations; your response will be graded for proper ***significant figures***.

a) Convert 242.71 mL to L

b) Convert 82.9 inches to centimeters.

c) 412.32 + 8.8 =

e) Determine the density (in g/mL) of a sheet of metal that is 2.8 cmx 2.8 cm (square), 0.34 cm thick, and weights 936 mg.

f) How many moles of lithium chloride are in 2.8 grams of lithium chloride?

g) What is the mass, in grams, of 0.0564 moles of salicylic acid (138.12 g/mol)?

2) (20 pts) Supply the missing name or chemical formula for each of the following compounds.

HCl (aq) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Potassium hydroxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

MgSO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Lithium bromide \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Al2(CO3)3\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Calcium oxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

FeCl3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Sodium bicarbonate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

NaNO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ammonium perchlorate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3) (12 pts) Write out the ***balanced*** chemical equations/reactions as described; include physical states.

a) Magnesium metal reacts with oxygen gas to form solid magnesium oxide.

b) Aqueous nitric acid reacts with zinc metal to form aqueous zinc nitrate and hydrogen gas.

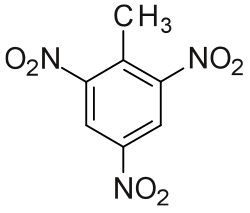
c) One mole of liquid pentane (C5H12) will react with 8 moles of oxygen gas in a combustion reaction. As with all combustion reactions, this reaction forms gaseous carbon dioxide and gaseous water as products.

4) (18 pts) Please complete the following table; ***note are neutral some are ions***.

|  |  |  |  |
| --- | --- | --- | --- |
| Element/Ion | ***Protons*** | ***Neutrons*** | ***Electrons*** |
| 88Sr  (neutral) |  |  |  |
| 25 \_\_\_  (neutral) | 12 |  |  |
| 107Ag+  (cation) |  |  |  |
| \_\_\_ \_\_\_  (neutral) |  | 48 | 36 |
| 81Br -  (anion) |  |  |  |
| 32 \_\_\_2-  (di-anion) |  |  | 18 |

5) The following questions refer to trinitrotoluene (TNT). The structure is shown below and a molecular formula is C7H5N3O6. *Significant figures matter.* ***SHOW YOUR WORK.***

a) (5 pts) What is the molar mass (g/mol) of TNT?



b) (4 pts) Balance the following reaction:

2 C7H5N3O6 (s) → \_\_\_\_ N2 (g) + \_\_\_\_ H2O (g) + \_\_\_\_ CO (g) + \_\_\_\_ C (s)

c) (4 pts) How many moles of TNT are in 2.78 grams of TNT?

d) (6 pts) When TNT is detonated, the decomposition reaction produces large quantities of gas;

how many moles of ***gas total*** are generated from the 2.78 grams of TNT?

(*you may start with your answer in part c*)…

6) The synthesis of ammonia (NH3), designed by the chemist Fritz Haber, has had significant consequences on world food production. The reaction is presented below:

a) (1 pt) Balance the chemical reaction 🡪 \_\_\_\_ N2 (g) + \_\_\_\_ H2 (g) 🡪 \_\_\_\_ NH3 (g)

b) (8 pts) Consider a circumstance where 32.7 grams of N2 are consumed; how many grams of hydrogen will also be consumed?

c) (4 pts) If the reaction vessel above contained 10.23 grams of H2 gas, how many grams of H2 gas are leftover after all of the N2 is consumed?

***END of EXAM***