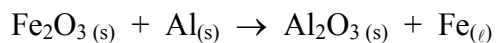


Name: \_\_\_\_\_

Section: 1 2 3 4 5

**Stoichiometry Workshop – Week of September 20**

1. The thermite reaction, which is used to weld rails together in the building of railroads, is described by the following (*unbalanced*) equation:



Calculate the mass of iron that can be prepared from 150 g of aluminum and 250 g of iron(III) oxide.

2. Vitamin A has a molar mass of 286.4 g and a general molecular formula of  $C_xH_yE$ , where E is an unspecified element. Vitamin A is 83.86% C and 10.56% H by mass. Determine the molecular formula of vitamin A.

3. The gasoline additive MTBE (methyl *tert*-butyl ether) improves the performance of gasoline and makes it burn more cleanly. However, its use is being phased out due to concerns about groundwater contamination and adverse effects on human health.

MTBE is composed of carbon, hydrogen, and perhaps oxygen. When a 10.00 g sample of MTBE is burned in an excess of oxygen gas, the products are 24.96 g of carbon dioxide and 12.27 g of water.

- a. Determine the minimum mass of oxygen gas that is required for complete combustion of 10.00 g MTBE. Hint: it is *not* necessary to know the formula of MTBE to answer this question.

- b. Determine the empirical formula of MTBE.

- c. The mass of a sample of MTBE vapor is found to be approximately twice the mass of an equal volume of carbon dioxide gas at the same temperature and pressure. Determine the molecular formula of MTBE.

- d. Write a balanced reaction for the combustion of MTBE.



- c. Calculate how much carbon dioxide would be given off upon treatment of 1.000 g of lime with an excess of hydrochloric acid.
- d. Calculate the minimum amount of 1 M hydrochloric acid that is required to react completely with 1.000 g of lime.

- e. A different sample contains a mixture of only magnesium carbonate and calcium carbonate in an unknown ratio. When 1.000 g of this sample is treated with an excess of hydrochloric acid, 0.500 g of carbon dioxide is formed. Calculate the mass percent of magnesium carbonate and calcium carbonate in the mixture. Note: this question is *hard*!

**PERIODIC CHART OF THE ELEMENTS**

IA	IIA	IIIB	IVB	VB	VIB	VIIIB	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	INERT GASES				
1 H 1.00797														1 H 1.00797	2 He 4.0026				
3 Li 6.939	4 Be 9.0122													5 B 10.811	6 C 12.0112	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.183
11 Na 22.9898	12 Mg 24.312													13 Al 26.9815	14 Si 28.086	15 P 30.9738	16 S 32.064	17 Cl 35.453	18 Ar 39.948
19 K 39.102	20 Ca 40.08	21 Sc 44.956	22 Ti 47.90	23 V 50.942	24 Cr 51.996	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.9216	34 Se 78.96	35 Br 79.909	36 Kr 83.80		
37 Rb 85.47	38 Sr 87.62	39 Y 88.905	40 Zr 91.22	41 Nb 92.906	42 Mo 95.94	43 Tc (99)	44 Ru 101.07	45 Rh 102.905	46 Pd 106.4	47 Ag 107.870	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.904	54 Xe 131.30		
55 Cs 132.905	56 Ba 137.34	*57 La 138.91	72 Hf 178.49	73 Ta 180.948	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 196.967	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.980	84 Po (210)	85 At (210)	86 Rn (222)		
87 Fr (223)	88 Ra (226)	†89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 ? (271)	111 ? (272)	112 ? (277)								

Numbers in parenthesis are mass numbers of most stable or most common isotope.

Atomic weights corrected to conform to the 1963 values of the Commission on Atomic Weights.

The group designations used here are the former Chemical Abstract Service numbers.

\* Lanthanide Series

58 Ce 140.12	59 Pr 140.907	60 Nd 144.24	61 Pm (147)	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.924	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.97
--------------------	---------------------	--------------------	-------------------	--------------------	--------------------	--------------------	---------------------	--------------------	---------------------	--------------------	---------------------	--------------------	--------------------

† Actinide Series

90 Th 232.038	91 Pa (231)	92 U 238.03	93 Np (237)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (249)	99 Es (254)	100 Fm (253)	101 Md (256)	102 No (256)	103 Lr (257)
---------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	--------------------	--------------------	--------------------	--------------------

<http://chemlab.pc.maricopa.edu/periodic/printable.gif>

H = hydrogen

C = carbon

O = oxygen

Mg = magnesium

Al = aluminum

Cl = chlorine

Ca = calcium

Fe = iron