Titration Problem

1. 37.2 ml of 0.325 M HNO_3 are titrated with 47.0 ml of 0.115 M $Ba(OH)_2$.
   a. Has the equivalence point been reached?

   b. What is the concentration of H^+ ions in excess after the reaction goes to completion?

   c. What is the pH?

   d. How much more $Ba(OH)_2$ must be added to reach the equivalence point?

Oxidation Numbers

Rules for Assigning Oxidation Numbers
(see also Zumdahl, Table 4.3 for these rules in a different format)

1. The oxidation number of an atom in pure elemental form (*e.g.*, Zn, Cu, H_2, O_2) is 0.
2. The sum of the oxidation numbers of the atoms in any uncharged molecule or compound is 0. The sum of the oxidation numbers of the atoms in a charged species (such as a polyatomic ion) is equal to the charge of the species.
3. a. Within compounds, alkali metals have oxidation number +1 (*e.g.*, NaCl).
   b. Within compounds, alkaline earth metals have oxidation number +2 (*e.g.*, $BaCl_2$).
   c. Within compounds, hydrogen (H) has oxidation number +1, except in compounds with alkali metals or alkaline earth metals.
   d. Within compounds, fluorine (F) has oxidation number –1.
   e. Within compounds, oxygen (O) has oxidation number –2, except in compounds with fluorine.
   f. Within compounds, the other halogens have oxidation number –1, except in compounds with fluorine or oxygen.

PERIODIC CHART OF THE ELEMENTS

IA	IIA	IIIB	IVB	VB	VIB	VIIB	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

1. Assign the oxidation state of each atom within the following compounds:
   a. Li_3N

   b. NH_3

   c. N_2H_4

   d. NO_2

   e. KNO_3

   f. BrF_3

   g. HOBr

   h. NaH

2. Identify whether the following balanced reactions are oxidation–reduction reactions. If so, identify which element is oxidized and which is reduced. Write the oxidation and reduction half reactions.
   a. $2\ C_2H_{6\,(g)} + 7\ O_{2\,(g)} \rightarrow 4\ CO_{2\,(g)} + 6\ H_2O_{\,(g)}$

   b. $CuSO_{4\,(aq)} + Na_2CO_{3\,(aq)} \rightarrow CuCO_{3\,(s)} + Na_2SO_{4\,(aq)}$

   c. $2\ CuCl_{(aq)} \rightarrow CuCl_{2\,(aq)} + Cu_{\,(s)}$