

Complete the following problems. You must show your work to receive full credit. Show your answers to the correct number of significant figures with the correct units.

1. Write overall reactions and net ionic equations for the following. Identify the states of the products in the reaction. (8 points).

a. Aqueous sodium carbonate reacts with aqueous silver nitrate.

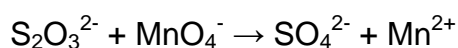


b. Aqueous calcium hydroxide reacts with aqueous sulfuric acid.

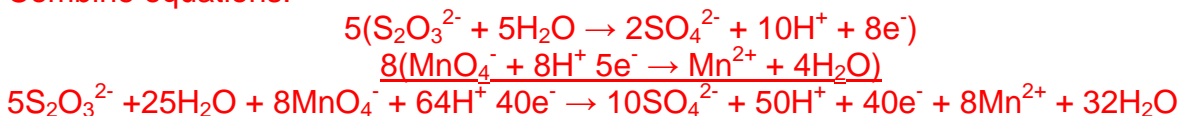


Net Ionic Reaction: Same as overall reaction since all ions undergo some change

2. Balance the oxidation-reduction reaction below in acidic solution. (9 pts.)



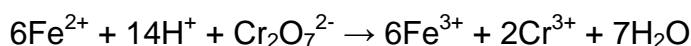
Combine equations:



Cancelling redundant terms:



3. An iron ore sample weighing 0.9132 g is dissolved in HCl(aq) , and the iron is obtained as $\text{Fe}^{2+}(\text{aq})$. This solution is then titrated with 28.72 mL of 0.05051 M $\text{K}_2\text{Cr}_2\text{O}_7(\text{aq})$ using the balanced reaction below. What is the mass percent of iron in the iron ore? (9 pts)



$$0.02872 \text{ L} \times \frac{0.05051 \text{ mol Cr}_2\text{O}_7^{2-}}{1 \text{ L}} \times \frac{6 \text{ mol Fe}^{2+}}{1 \text{ mol mol Cr}_2\text{O}_7^{2-}} \times \frac{1 \text{ mol Fe}}{1 \text{ mol Fe}^{2+}} \times \frac{55.847 \text{ g Fe}}{1 \text{ mol Fe}} = 0.4860_8 \text{ g Fe}$$

$$\frac{0.4860_{\text{g Fe}}}{0.9132 \text{ g ore}} \times 100\% = 53.23 \% \text{ Fe}$$

Possibly Useful Information

TABLE 5.1 Solubility Guidelines for Common Ionic Solids

Follow the lower-numbered guideline when two guidelines are in conflict. This leads to the correct prediction in most cases.

1. Salts of group 1 cations (with some exceptions for Li^+) and the NH_4^+ cation are soluble.
2. Nitrates, acetates, and perchlorates are soluble.
3. Salts of silver, lead, and mercury(I) are insoluble.
4. Chlorides, bromides, and iodides are soluble.
5. Carbonates, phosphates, sulfides, oxides, and hydroxides are insoluble (sulfides of group 2 cations and hydroxides of Ca^{2+} , Sr^{2+} , and Ba^{2+} are slightly soluble).
6. Sulfates are soluble except for those of calcium, strontium, and barium.

TABLE 5.3 Some Common Gas-Forming Reactions

Ion	Reaction
HSO_3^-	$\text{HSO}_3^- + \text{H}^+ \longrightarrow \text{SO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
SO_3^{2-}	$\text{SO}_3^{2-} + 2 \text{H}^+ \longrightarrow \text{SO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
HCO_3^-	$\text{HCO}_3^- + \text{H}^+ \longrightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
CO_3^{2-}	$\text{CO}_3^{2-} + 2 \text{H}^+ \longrightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
S^{2-}	$\text{S}^{2-} + 2 \text{H}^+ \longrightarrow \text{H}_2\text{S}(\text{g})$
NH_4^+	$\text{NH}_4^+ + \text{OH}^- \longrightarrow \text{NH}_3(\text{g}) + \text{H}_2\text{O}(\text{l})$

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1 1A																	18 8A
1 H 1.00794	2 2A											13 3A	14 4A	15 5A	16 6A	17 7A	2 He 4.00260
3 Li 6.941	4 Be 9.01218											5 B 10.811	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.1797
11 Na 22.9898	12 Mg 24.3050	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B		10 10B	11 11B	12 12B	13 Al 26.9815	14 Si 28.0855	15 P 30.9738	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.9961	25 Mn 54.9381	26 Fe 55.847	27 Co 58.9332	28 Ni 58.693	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.9059	40 Zr 91.224	41 Nb 92.9064	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.906	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.757	52 Te 127.60	53 I 126.904	54 Xe 131.29
55 Cs 132.905	56 Ba 137.327	57 *La 138.906	72 Hf 178.49	73 Ta 180.948	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.967	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.025	89 †Ac 227.028	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (271)	111 Rg (272)							

*Lanthanide series	<div>58 Ce 140.115</div>	<div>59 Pr 140.908</div>	<div>60 Nd 144.24</div>	<div>61 Pm (145)</div>	<div>62 Sm 150.36</div>	<div>63 Eu 151.965</div>	<div>64 Gd 157.25</div>	<div>65 Tb 158.925</div>	<div>66 Dy 162.50</div>	<div>67 Ho 164.930</div>	<div>68 Er 167.26</div>	<div>69 Tm 168.934</div>	<div>70 Yb 173.04</div>	<div>71 Lu 174.967</div>
†Actinide series	<div>90 Th 232.038</div>	<div>91 Pa 231.036</div>	<div>92 U 238.029</div>	<div>93 Np 237.048</div>	<div>94 Pu (244)</div>	<div>95 Am (243)</div>	<div>96 Cm (247)</div>	<div>97 Bk (247)</div>	<div>98 Cf (251)</div>	<div>99 Es (252)</div>	<div>100 Fm (257)</div>	<div>101 Md (258)</div>	<div>102 No (259)</div>	<div>103 Lr (262)</div>