South Dakota School of Mines and Technology
Department of Materials and Metallurgical Engineering

2013S

5. One hundred tons of molten, hard lead in an iron kettle contains 97.4% Pb and 2.6 % Sb. The lead is to be softened by removing the antimony by the addition of 2.6 tons of PbO, which will promote the formation of Sb_2O_3. The oxides will float as a slag on the metal phase. After processing the lead, the slag phase is found to contain 22 % Sb.

   a) What is final % Sb in the metallic product?

   b) Will the slag be a solid or a liquid phase?

6. One hundred tons of flotation concentrate are roasted per hour using dry air. The concentrate contains 74.5% ZnS, 10.5% PbS, and 5% FeS_2 . The balance is gangue. The metallic elements are converted to ZnO, Fe_3O_4, and PbO while the S reports to the gas phase containing 5% SO_2 and 2 % SO_3.

   a) How much air in STP ft^3/hr is needed?

   b) What is the excess air, as percent, being supplied to the roaster compared to the air needed just to form the specified metal oxides and SO_2?

   c) What is the exit gas analysis?

   d) If the S in the gas leaving the flue is all converted to sulfuric acid, how many tons/hr of the acid is produced?

7. Determine the mineralogic analysis of mixture of chalcopyrite, pyrite, and chalcocite if the atomic analysis from the SEM is
   41% S
   30% Fe
   Bal Cu
   .

Metal	Mineral	Formula
Iron	Magnetite	Fe_3O_4
	Hematite	Fe_2O_3
	Limonite	$2Fe_2O_3 \cdot 3H_2O$
	Siderite	$FeCO_3$
	Pyrite	FeS_2
Copper	Native Copper	Cu
	Chalcocite	Cu_2S
	Covellite	CuS
	Chalcopyrite	$CuFeS_2$
	Cuprite	Cu_2O