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

MET 321 Calculations Lab #1 01

2013S

1. Create a worksheet that computes the total cost savings per month expected by installing a timer switch for the exhaust fan in MI 128B. The user should be able to input the following:

   Assumptions
   Fuel Cost ($/10^6 BTUs)
   BTU Delivery Efficiency
   ElectrictyCost ($/kWhr)

   User Selected Bases
   Motor, W
   CFM (STP)
   Time on (hr)
   Outside Air T (°F)
   hrs/month

2. Metallic iron is made by reacting magnetite and carbon at 1100 °C in a crucible. The gas evolved from the process is 25 % CO_2 and 75% CO. Calculate the following:
   a) Carbon needed to produce 1 pound of iron.
   b) STP volume of produced gas per ton (2000 pounds) of iron produced.
   c) Volume of gas in part b if the gas is at the operating temperature of 1100 °C and pressure of 740 mmHg.

3. A copper matte smelting furnace charge has the ratios Cu:S:Fe 1:1.2:4. Once melted the matte retains 98% of the Cu and 75% of the S. If the matte is a stoichiometric mixture of Cu_2S and FeS find
   a) Matte grade (i.e. %Cu).
   b) Percent Fe recovered in the matte

4. A gas mixture of equal molar amounts of carbon monoxide and dioxide flowing at 100 ml/min (STP) is passed over carbon at 800 °C. The exit gas composition is 49% CO and 51% CO_2.

   $2CO = C + CO_2$

   Find the rate of deposition of C in mg/hr.

Acknowledgment: These problems are from Reinhardt Schuhmann's text *Metallurgical Engineering Principles* (problems: 2.1, 2.3, 2.4) and are reproduced here for educational use.