Tutorial 1 **CH 105** **2022**

1. Sodium azide (NaN_3) is an essential component of the safety airbags used in vehicles.

(a) Write down the balanced chemical reaction that causes the inflation of the airbag following a collision.

(b) If we need to inflate a 45.0 L airbag, how much sodium azide (in grams) should we use?

(c) An equivalent amount of hazardous sodium is produced during this reaction. How is this sodium regulated so that it does not affect the passenger during the opening of the airbag?

2. Blast furnace is regarded as the heart of the steel industry, where the iron ore is converted into molten iron. Here, a significant amount of coke is required for the operation of the furnace, which results in a huge carbon footprint for iron production.

(a) What is the specific chemical role of coke in this process?

Can use the Ellingham diagram to support your answer of Q2(a)?

(b) $CaCO_3$ is also added in the blast furnace. Is this addition really necessary for good quality iron production?

3. The Arkel-de Boer process has been developed for purifying titanium (Ti).

(a) Describe the basic chemistry behind the process?

(b) Do you think Kroll's method is better for purifying Ti compared to the Arkel-de Boer process?

4. Addition of aluminum (Al) foil in acidic water results in H_2 production. However, the addition of silver (Ag) doesn't display the same reaction. Can you explain this observation with the concept of the standard reduction potential.
   Following are the standard reduction potential of the two metals vs. standard hydrogen electrode (SHE):
   E^0 (Al^{+3}/Al) = -1.66 V
   E^0 (Ag^{+}/Ag) = +0.80 V