Answer EITHER Question 2 below OR Question 3 printed on page 9. Only one of these two questions will be graded. If you start both questions, be sure to cross out the question you do not want graded. The Section II score weighting for the question you choose is 20 percent.

2. Answer the following questions that relate to chemical reactions.

(a) Iron(III) oxide can be reduced with carbon monoxide according to the following equation.

$$Fe_2O_3(s) + 3\,CO(g) \rightarrow 2\,Fe(s) + 3\,CO_2(g)$$
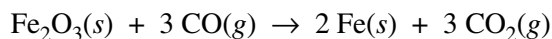
A 16.2 L sample of $CO(g)$ at 1.50 atm and 200.°C is combined with 15.39 g of $Fe_2O_3(s)$.

 (i) How many moles of $CO(g)$ are available for the reaction?

 (ii) What is the limiting reactant for the reaction? Justify your answer with calculations.

(iii) How many moles of $Fe(s)$ are formed in the reaction?

(b) In a reaction vessel, 0.600 mol of $Ba(NO_3)_2(s)$ and 0.300 mol of $H_3PO_4(aq)$ are combined with deionized water to a final volume of 2.00 L. The reaction represented below occurs.

$$3\,Ba(NO_3)_2(aq) + 2\,H_3PO_4(aq) \rightarrow Ba_3(PO_4)_2(s) + 6\,HNO_3(aq)$$
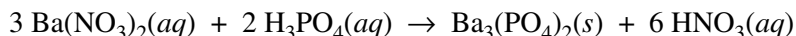
 (i) Calculate the mass of $Ba_3(PO_4)_2(s)$ formed.

 (ii) Calculate the pH of the resulting solution.

(iii) What is the concentration, in mol L^{-1}, of the nitrate ion, $NO_3^-(aq)$, after the reaction reaches completion?

GO ON TO THE NEXT PAGE.