Gas Stoichiometry

Name:
Period: Key

1) An 5.65 mol sample of acetone, CH_3COCH_3 , is placed in a 15.0 L evacuated rigid tank and heated to 372°C. At that temperature, all of the methanol is vaporized and some of the acetone decomposes to form ethyl ketone gas and methane gas, as represented in the equation below.

$$CH_3COCH_{3(g)} \longrightarrow CH_2CO_{(g)} + CH_{4(g)}$$

(a) The reaction mixture contains 2.30 mol of $CH_{4(g)}$ at equilibrium at 327°C.

(i) Calculate the number of moles of $CH_2CO_{(g)}$ in the tank.

$2.30\ mol\ CH_4 \cdot \frac{1\ mol\ CH_2CO}{1\ mol\ CH_4} = 2.30\ mol\ CH_2CO$

(ii) Calculate the number of grams of $CH_3COCH_{3(g)}$ remaining in the tank.

$2.30\ mol\ CH_4 \cdot \frac{1\ mol\ CH_3COCH_3}{1\ mol\ CH_4} = 2.30\ mol\ CH_3COCH_3\ used$

$5.65\ mol - 2.30\ mol = 3.35\ mol\ CH_3COCH_3 \cdot \frac{58.08\ g}{1\ mol\ CH_3COCH_3} = 195\ g\ CH_3COCH_3$

(iii) Calculate the total moles of .gas in the tank.

$3.35\ mol + 2.30\ mol + 2.30\ mol = 7.95\ moles\ of\ gas$
$CH_3COCH_3 \quad CH_4 \quad CH_2CO$

(iv) Calculate the mole fraction of $CH_{4(g)}$ in the tank.

$\frac{2.30\ mol\ CH_4}{7.95\ mol} = 0.289$

2) Methane, $CH_{4(g)}$, will combust to form carbon dioxide and water.

A) Write a balanced chemical equation for the reactions.

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$