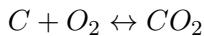
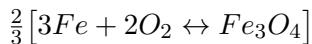
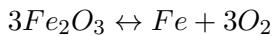
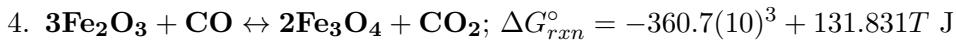
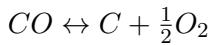
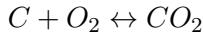
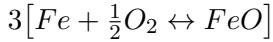
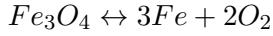
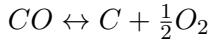
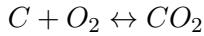
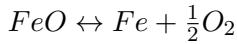
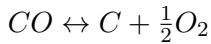
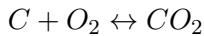
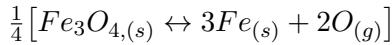


## Question 2

$\Delta G^\circ$  of relevant reactions:

$C + O_2 \leftrightarrow CO_2$	$-394(10)^3 - 0.836T$
$CO \leftrightarrow C + \frac{1}{2}O_2$	$-112.9(10)^3 - 86.5T$
$Fe_3O_{4,(s)} \leftrightarrow 3Fe_{(s)} + 2O_{(g)}$	$-(-1103.1(10)^3 + 307.4T)$
$FeO \leftrightarrow Fe + \frac{1}{2}O_2$	$-(264(10)^3 + 64.6T)$
$3Fe_2O_3 \leftrightarrow Fe + 3O_2$	$-(-815(10)^3 + 251.1T)$



## Plotting

$$\Delta G = -RT \ln k$$

$$k = \exp \frac{-\Delta G^\circ}{RT} = \frac{P_{CO_2}}{P_{CO}}$$

Let the vertical axis be:  $\frac{P_{CO}}{P_{CO} + P_{CO_2}}$

vertical axis in terms of k:  $\frac{P_{CO}}{P_{CO} + kP_{CO}} = \frac{1}{1+k}$

### equations for phase boundary curves

For each reaction  $i = 1 \dots 4$ :

$$\Delta G_i^\circ(T) = a_i + b_i T \quad \Rightarrow \quad K_i(T) = \exp\left(\frac{-\Delta G_i^\circ(T)}{RT}\right)$$

and the plotted ordinate is

$$\%CO_i(T) = 100 \cdot \frac{1}{1 + K_i(T)}.$$

Use  $R = 8.314462618 \text{ J mol}^{-1} \text{ K}^{-1}$  and the coefficients (in J/mol,  $T$  in K):

$$\begin{aligned} \Delta G_1^\circ &= -231.125 \times 10^3 - 164.186 T, \\ \Delta G_2^\circ &= -545.1 \times 10^3 + 150.264 T, \\ \Delta G_3^\circ &= -592.2 \times 10^3 + 199.264 T, \\ \Delta G_4^\circ &= -360.7 \times 10^3 + 131.831 T. \end{aligned}$$

