Assignment: sample_stoichiometry

1a) Molar mass calculations:

$Fe = 55.85\ g/mol$

$O_2 = 2 \times 16.00 = 32.00\ g/mol$

$Fe_2O_3 = (2 \times 55.85) + (3 \times 16.00) = 111.70 + 48.00 = 159.70\ g/mol$

1b) First convert starting masses to moles:

$55.85\ g\ Fe \times \frac{1\ mol\ Fe}{55.85\ g\ Fe} = 1.000\ mol\ Fe$

$32.00\ g\ O_2 \times \frac{1\ mol\ O_2}{32.00\ g\ O_2} = 1.000\ mol\ O_2$

Comparison table for Fe_2O_3 yield:

Reactant	Moles available	Yield of Fe_2O_3 (moles)
Fe	1.000 mol	$1.000\ mol\ Fe \times \frac{2\ mol\ Fe_2O_3}{4\ mol\ Fe} = 0.500\ mol$
O_2	1.000 mol	$1.000\ mol\ O_2 \times \frac{2\ mol\ Fe_2O_3}{3\ mol\ O_2} = 0.667\ mol$

Since iron produces less product, Fe is the limiting reagent.

1c) Theoretical yield calculation using the limiting reagent:

$$0.500\ mol\ Fe_2O_3 \times \frac{159.70\ g\ Fe_2O_3}{1\ mol\ Fe_2O_3} = 79.85\ g\ Fe_2O_3$$

1d) Percent yield calculation:

$$\text{Percent Yield} = \frac{\text{Actual}}{\text{Theoretical}} \times 100 = \frac{68.4\ g}{79.85\ g} \times 100 = 85.66\%$$