Question 1- Thermo-decomposition of of calcium carbonate is

$$CaCO_3 \rightarrow CaO + CO_2$$

If 100 kg of calcium carbonate is heated what mass of calcium oxide will form? (Show all working)

Molar Mass for $CaCO_3$ = 40.1 + 12.0 + 16.0 × 3 = 100.1 gmol^{-1}
Amount of $CaCO_3$ in 100kg = 100 000g ÷ 100.1gmol^{-1} = 999.001 mol
Ratio $CaCO_3$: CaO = 1 : 1
Amount of CaO = 999.001 mol
Molar Mass for CaO = 40.1 + 16.0 = 56.1 gmol^{-1}
Mass of CaO = 56.1 gmol^{-1} × 999.001 mol = 56 043.96 g = 56.0 kg (3sf)

Question 2- Iron oxide is reduced to iron by carbon monoxide according to the equation:

$$Fe_2O_3 + 3\ CO \rightarrow 2\ Fe + 3\ CO_2$$
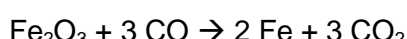
Calculate the mass of iron which could be obtained from 160 kg of iron oxide

Molar Mass for Fe_2O_3 = 55.9 × 2 + 16.0 × 3 = 159.8 gmol^{-1}
Amount of Fe in 160kg = 160 000g ÷ 159.8gmol^{-1} = 1001.252 mol
Ratio Fe_2O_3 : Fe = 1 : 2
Amount of Fe = 1001.252 mol × 2 = 2002.503 mol
Molar Mass for Fe = 55.9 gmol^{-1}
Mass of Fe = 2002.503 mol × 55.9 gmol^{-1} = 111 939.9 g = 112 kg (3sf)

Question 3- Zinc and iodine react to form zinc iodide, according to the equation:

$$Zn + I_2 \rightarrow ZnI_2$$
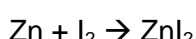
A student weighs out exactly 0.65 g of zinc and reacts it with excess iodine. What weight of zinc iodide would be formed

Molar Mass for Zn = 65.4 gmol^{-1}
Amount of Zn in 0.65 g = 0.65 g ÷ 65.4 gmol^{-1} = 0.009939 mol
Ratio Zn : ZnI_2 = 1 : 1
Amount of ZnI_2 = 0.009939 mol
Molar Mass for ZnI_2 = 65.4 + 126.9 × 2 = 319.2 gmol^{-1}
Mass of ZnI_2 = 0.009939 mol × 319.2 gmol^{-1} = 3.17 g (3sf)