1) a) How many moles in 33.0 kg of ammonium sulfate $(NH_4)_2SO_4$. ................................................................

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   b) What is the mass of 0.040 moles of oxygen, $O_2$? ................................................................

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2) a) What maximum mass of methanol that can be made when 12 g of hydrogen reacts with an excess of carbon monoxide?      $CO + 2H_2 \rightarrow CH_3OH$

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   b) In a reaction, 60 g of methanol was formed from 12 g of hydrogen. Calculate the percentage yield.

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3) Calculate the percentage atom economy to make iron from iron(III) oxide by reaction with carbon monoxide.      $Fe_2O_3 + 3CO \rightarrow 2Fe + 2CO_2$

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4) What volume of hydrogen gas is formed, measured at room temperature and pressure, when 0.65 g of zinc reacts with sulfuric acid?      $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

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5) What volume of carbon dioxide gas is formed when 100 cm$^3$ of propane gas burns (both gases are at room temperature and pressure)?      $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

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6) 0.595 g of tin (Sn) reacts with 0.71 g of chlorine ($Cl_2$) to form tin chloride. Find the simplest molar ratio in which tin reacts with chlorine and use it to find the formula of the tin chloride. Finally, write a balanced equation for the reaction.

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7) Lead reacts with chlorine to form lead(II) chloride. When 6.21 g of lead reacts with 2.84 g of chlorine, which is the limiting reagent and what mass of lead(II) chloride is formed?

$Pb + Cl_2 \rightarrow PbCl_2$

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8) Find the concentration of oxalic acid ($H_2C_2O_4$) in mol/dm$^3$ and g/dm$^3$ given that 25.0 cm$^3$ of this solution reacts with 22.8 cm$^3$ 0.100 mol/dm$^3$ sodium hydroxide solution in a titration.

$H_2C_2O_4 + 2NaOH \rightarrow Na_2C_2O_4 + 2H_2O$

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| Area | Strength | To develop | Area | Strength | To develop | Area | Strength | To develop |
|---|---|---|---|---|---|---|---|---|
| Done with care and thoroughness | | | Can work out % atom economy | | | Understands limiting reagents | | |
| Shows suitable working | | | Can work out % yield | | | Work out moles for solutions | | |
| Can work out $M_r$ | | | Understands why yield < 100% | | | Convert mol/dm$^3$ to g/dm$^3$ | | |
| Work out moles from mass | | | Work out gas volume from mass or mol | | | Does not round too much | | |
| Can work out mass from moles | | | Understands reacting gas volumes | | | Gives units | | |
| Use equation to find reacting moles | | | Deduce molar reacting ratio from mass | | | | | |