Summary: Calculations from Equations

The mole is the unit in which amounts of substance are measured in chemistry.

The mole is defined as that amount **of substance that contains the same number of particles as there are atoms in exactly 12 g of the isotope carbon 12.**

The number of particles in a mole is found to be $6.02 * 10^{23}$ this number is called the Avogadro constant and has the symbol N_A

WHEN DOING CALCULATIONS REMEMBER

1. To define the particles you are talking about.
Is your mole of oxygen $6.02 * 10^{23}$ oxygen **atoms** which weigh 16 g
or $6.02 * 10^{23}$ oxygen **molecules** which weigh 32 g?

2. Substances are often not pure, but are diluted in solutions.
The quantity of substance in a solution is called its concentration.
Concentration can be expressed in several different ways:
grams per liter shortened to g/L or g L^{-1}
grams per cubic decimeter short to g/dm^3 or g dm^{-3}
moles per liter shortened to mol/L or mol L^{-1}
moles per cubic decimeter shortened to mol/dm^{-3} or mol dm^{-3}

3. Volumes are measured in several different units:

1 dm^3 = 1 liter = 1 000 cm^3 = 1000 mL

KEY RELATIONSHIPS

In the laboratory, substances are most conveniently measured out by weighing for solids and by volume for liquids and gases.
The relationships between amount of substance, number of particles, mass of solid, and volume of gas are very important:

amount	**number of particles**	**mass of solid**	**volume of gas**
1 mole	= $6.02 * 10^{23}$	= A_r or M_r in grams	= *22.4 dm^3 at s.t.p

Many calculations involve converting from one part of this relationship to another; always go back to this key line at the start of your calculation.
*Standard temperature and pressure are 273 K and 1 atmosphere (101.325 kPa).
Often room temperature, 298 K is used: at room temperature a mole of any gas has a volume of 24 dm^3.
In electrolysis, the amount of charge involved in the reaction at the electrodes is important:
1 mole of electrons = 96 500 coulombs = 1Faraday

CALCULATIONS FROM CHEMICAL EQUATIONS

Always try to work through the following steps in this order:
1. write down the balanced equation for the reaction;
2. work out the number of moles of the substance whose amount/mass/volume is given;
3. from the balanced equation, read off the mole ratios (the stoichiometry) ;
4. using this mole ratio, work out the number of moles of the unknown substance;
5. using the key relationships above, convert the moles into the units asked for;
6. give your answer to 3 significant figures and remember to put in the units.