Using mole calculations to solve problems

This resource accompanies the infographic **Moles and Avogadro's number** in *Education in Chemistry* which can be viewed at: https://rsc.li/3Ksvr07

Learning objectives

1. Recall how to use simple mole calculations to calculate masses, moles, or relative formula masses.
2. Practice rearranging equations.
3. Develop confidence in decoding complex word problems.

The accompanying student worksheet is designed to support students in using simple mole calculations learned in pre-16 chemistry, embedded within more complex problems and multi-step calculations of the form encountered at a more advanced level.

Answers: moles, mass, and relative formula mass

Part 1: Working out the moles from the mass of a known substance

Practice questions

1. $600\ mg = 0.60\ g$
$mol(C_{34}H_{24}N_6Na_4O_{14}S_4) = 0.00063\ mol\ or\ 6.3\ x\ 10^{-4}\ mol\ (to\ 2\ sf)$

2. $Mr(C_8H_9NO_2) = 151$
$mass(C_8H_9NO_2) = 0.50\ g$
$mol(C_8H_9NO_2) = 0.0033\ mol\ or\ 3.3\ x\ 10^{-3}\ (to\ 2\ sf)$

Part 2: Working out the mass given the number of moles of a known substance

Practice questions

1.

(a) $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

(b) $mol(Mg) = 0.40\ mol$
$mass(Mg) = 0.96\ g\ (to\ 2\ sf)$

(c) Possible answers include:
Incomplete reaction
Impurities on the surface of the magnesium metal will not burn
Magnesium held by the tongs will not burn

2.

(a) $Mr(C_7H_6O_3) = 138$
$mol(C_7H_6O_3) = 0.014\ mol\ (to\ 2\ sf)$

(b) $mol(C_9H_8O_4) = 0.0072\ mol\ (to\ 2\ sf)$
$Mr(C_9H_8O_4) = 180$
$mass(C_9H_8O_4) = 1.3\ g\ (to\ 2\ sf)$

(c) Percentage of aspirin in the product = 76% $(to\ 2\ sf)$

Part 3: Working out the identity of a substance from a known mass and known number of moles

Practice questions

1.

(a) $Mr(C_6H_6) = 78$
$mol(C_6H_6) = 0.0513\ mol\ (to\ 3\ sf)$

(b) $mol(chlorobenzene) = 0.0513\ mol$
$Mr(chlorobenzene) = 181.5$

(c) Formula of chlorobenzene with $Mr = 181.5$ is $C_6H_3Cl_3$

$$C_6H_6 + 3Cl_2 \rightarrow C_6H_3Cl_3 + 3HCl$$

2. $mol(A_xO) = 0.1\ mol$
$Mr(A_xO) = 56$

If $x = 1$: $Ar(A) = 40$, so A would be Ca which is a metal.
If $x = 2$: $Ar(A) = 20$, so A would be Ne which is a gaseous non-metal.

So A is Ca, and the product of the reaction is CaO.