

Question 10 (Answer: **D**)

- Use the equation's ratios: 3 mol CuO reacts with 2 mol NH₃ to give 3 mol Cu and 1 mol N₂.
- Convert masses to moles with the M_r values given before comparing anything.
- Copper is reduced from +2 to 0, so the ammonia is the reducing agent.

Question 11 (Answer: **C**)

- One mole of any substance contains the Avogadro number of particles.
- Argon is monatomic, so one mole of argon is one mole of *atoms*.
- That is 6.02×10^{23} .

Question 10 (Answer: **D**)

- Work in moles: $M_r = 46$, so 4.6 g of ethanol is 0.10 mol.
- The equation gives 2 mol of CO₂ per mol of ethanol, so 0.20 mol = 8.8 g.
- Always go mass → moles → ratio → moles → mass; comparing masses directly is the trap.

Question 12 (Answer: **C**)

- M_r of CaCO₃ = 40 + 12 + 48 = 100, so 10.0 g is 0.100 mol.
- The equation gives one CO₂ per CaCO₃, so 0.100 mol of gas.
- $0.100 \times 6.02 \times 10^{23} = 6.02 \times 10^{22}$ molecules.

3(a)	M1 2H ₂ O M2 state symbols (aq) and (l)
3(b)	neutralisation
3(c)	$0.0100 \times 1000 \div 40 = 0.25(0)$
3(d)	burette
3(e)	M1 mol H ₂ SO ₄ needed = $0.0100 \div 2 = 0.005(00)$ M2 vol of H ₂ SO ₄ needed = $0.005(00) \div 0.200 \times 1000 = 25 \text{ (cm}^3\text{)}$
3(f)	M1 yellow M2 orange
3(g)	repeat steps 1 and 3 without indicator
3(h)(i)	M1 (a solution containing the) maximum concentration of a solute dissolved in the solvent M2 at a specified temperature
3(h)(ii)	solubility decreases as temperature decreases
3(h)(iii)	none

3(a)	$\rightarrow \text{BaSO}_4(\text{s}) + 2\text{NaCl}(\text{aq})$ M1 2NaCl (only) M2 (s) and (aq)
3(b)	M1 $M_r \text{BaCl}_2 = 208$ M2 $208 \times 0.1 = 20.8$
3(c)	$0.100 \div 1.25 (\times 1000) = 80 \text{ (cm}^3\text{)}$
3(d)	white
3(e)	residue
3(f)	M1 rinsing the residue (with water) M2 (mass was greater) because (dry) residue contains solid sodium chloride / NaCl adds to the mass (of residue)
3(g)	precipitation
3(h)	M1 named soluble barium salt other than barium chloride e.g. (barium) nitrate M2 named soluble sulfate salt other than sodium sulphate e.g. potassium (sulfate) / ammonium (sulfate) M3 named insoluble barium salt other than barium sulfate e.g. (barium) carbonate

Question 9 (Answer: **A**)

- Moles: $\text{CaCO}_3 = 1.00/100 = 0.0100$; $\text{HCl} = 0.0500 \times 0.0500 = 0.00250$.
- The equation needs 2 mol of HCl per mol of CaCO_3 , so 0.0100 mol would need 0.0200 mol of acid.
- Only 0.00250 mol is present, so the acid is limiting and the carbonate is in large excess.

Question 20 (Answer: **B**)

- Hydrated copper(II) sulfate is the familiar blue $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.
- Hydrated cobalt(II) chloride is $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$.
- So $x = 5$ and $y = 6$.

Question 9 (Answer: **A**)

- Moles = concentration $\times$ volume in $\text{dm}^3 = 0.50 \times 0.500 = 0.25 \text{ mol}$.
- M_r of NaOH = $23 + 16 + 1 = 40$.
- Mass = $0.25 \times 40 = 10 \text{ g}$.

Question 12 (Answer: **C**)

- One NH_3 molecule contains four atoms: one N and three H.
- So 2.00 mol of ammonia holds 8.00 mol of atoms.
- $8.00 \times 6.02 \times 10^{23} = 4.82 \times 10^{24}$.