

Grade 9 checklist

10 skills. Tick each one when you can do it. For grade 9 you need the skills for the grades below it too.

Quantitative chemistry

- ☐ **Find M_r from mass and moles** $M_r = \text{mass} \div \text{moles}$, then use it to identify a substance or element. (Moles)
- ☐ **Scale reacting masses in kilograms or tonnes** Mass ratios work in any unit as long as you use the same unit throughout. (Amounts of substances in equations)
- ☐ **Find a missing mass, then balance** Use conservation of mass to find the unknown mass before converting all masses to moles. (Using moles to balance equations)
- ☐ **Calculate the mass of excess reactant left** Moles left over = moles at the start – moles that reacted; then convert to a mass. (Limiting reactants)
- ☐ **Solve multi-step titration problems** Use ratios other than 1 : 1 and convert the final answer to g/dm^3 when asked. (Concentrations in mol/dm^3)
- ☐ **Link masses and gas volumes in reactions** E.g. find the volume of gas made from a given mass of a solid reactant. (Volumes of gases)

Chemical changes

- ☐ **Balance ionic equations with different ion charges** Match the electrons lost and gained, e.g. $2\text{Al} + 3\text{Cu}^{2+} \rightarrow 2\text{Al}^{3+} + 3\text{Cu}$. (Oxidation and reduction in terms of electrons)
- ☐ **Separate strength from concentration in unfamiliar data** For example, explain why a concentrated weak acid can have a lower pH than a very dilute strong acid. (Strong and weak acids)

Energy changes

- ☐ **Calculate an unknown bond energy** Put the known values into overall energy change = bonds broken – bonds made and rearrange to find the missing bond energy. (Energy change of reactions (bond energies))
- ☐ **Explain the electrode reactions using electrons** Hydrogen loses electrons (is oxidised) at the negative electrode; oxygen gains electrons (is reduced) at the positive electrode. (Fuel cells)

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