

Things to remember in the last hour before the exam: Level 1 Acids and Bases

(This is not a revision sheet – you've done that by now – it's a list of things you might want to remind yourself about ...)

1. Atomic Number = # of protons. Since atoms are neutral overall, # protons (+) = # electrons (-).
Mass number = # of protons PLUS neutrons.
2. Elements are arranged in periodic table in order of increasing atomic number. Columns = groups, rows = periods. Group # or group #-10 = # of valence electrons. E.g. Al group 13, has 3 valence electrons.
3. Most of the mass of an atom is made up of the protons and neutrons, in the nucleus. Electrons very light.
4. Electrons arranged with up to 2 in 1st shell, up to 8 in 2nd shell, up to 8 in 3rd shell. E.g. ${}_{20}\text{Ca}$ is arranged 2.8.8.2 Electron arrangement also called "electron configuration" sometimes.
5. Isotopes – atoms of same element (so same atomic #) but a different mass # (different # of neutrons).

Chemically identical as the same element with same electron arrangement. E.g. ${}_{17}^{35}\text{Cl}$ and ${}_{17}^{37}\text{Cl}$.

6. Formulae. Use brackets if you use a polyatomic ion more than once e.g. NaOH needs no brackets but $\text{Cu}(\text{OH})_2$ does. Polyatomic ions to know are ammonium NH_4^+ , hydroxide OH^- , nitrate NO_3^- , hydrogen carbonate HCO_3^- , sulfate SO_4^{2-} , and carbonate CO_3^{2-} .
7. Know that iron(II) hydroxide has the Fe^{2+} ion = $\text{Fe}(\text{OH})_2$ and iron(III) nitrate contains the Fe^{3+} ion = $\text{Fe}(\text{NO}_3)_3$. There is no metal atom called iron(II) or iron(III) – the atom is just iron, Fe.
8. Know that sulfides contains S^{2-} ion and sulfates contains SO_4^{2-} ion.
9. When writing an ionic formula the positive and negative charges cancel out e.g. Cu^{2+} needs 2 x – so 2 x Cl^- making the formula is CuCl_2 . "Drop and swap" or "crossing-over" taught to some students does NOT explain why something has a formula, it might just help you work out what the formula is!
10. Some metals lose electrons & some non-metals gain electrons..... to achieve a full valence shell.... because this is a stable arrangement. They do not WANT to.... Or NEED to... some just do! No happy/unhappy atoms!
11. pH. $\text{pH} < 7 = \text{acid}$. Solutions that are acidic have more H^+ ions than OH^- ions. $\text{pH} 7 = \text{neutral}$, when the concentration of $\text{H}^+ = \text{OH}^-$. Solutions that are alkaline have more OH^- ions than H^+ ions.
12. Acids to know are sulfuric H_2SO_4 , hydrochloric HCl and nitric HNO_3 . All acids release H^+ ions in water. Alkalis to know are sodium hydroxide NaOH , ammonia NH_3 and maybe sodium carbonate Na_2CO_3 and hydrogen carbonate NaHCO_3 . Alkalis release OH^- ions in water OR react with water to release OH^- ions.
13. Alkali is a base that is soluble in water. Both bases & alkalis can neutralise an acid – but you can only measure the pH of an alkali.

14. Indicators: litmus red in acid & blue in alkali. Universal indicator red, orange or yellow in acids, light green in neutral, & dark green, blue or purple in alkalis. Indicator colour depends on H^+ & OH^- ion concentrations.
15. General equations for reactions of acids: the salt made is a chloride, nitrate or sulfate depending on the acid used.
- Acid + metal* \rightarrow salt + hydrogen *reactive metal e.g. Mg. Remember Cu doesn't react.
 - Acid + base** \rightarrow salt + water **base is metal oxide e.g. CuO or metal hydroxide e.g. NaOH
 - Acid + carbonate/hydrogen carbonate \rightarrow salt + water + carbon dioxide
16. Making a salt. (see 15.) Take some acid and add excess metal or base or carbonate. Filter off excess (unreacted) metal or base or carbonate. Evaporate the solution gently or leave in a dish in a warm place to allow water to evaporate. What is left will be crystals of the salt.
17. Balancing chemical equations: # of each type of atom (the reactants), on left of \rightarrow , must equal # of each type of atom on right of \rightarrow (the products). Make sure you get any ionic formulae right before you try and balance. You can only balance by placing numbers in front of a chemical formula e.g. 2HCl means HCl HCl
 $HCl + Mg \rightarrow MgCl_2 + H_2$ (unbalanced). $2HCl + Mg \rightarrow MgCl_2 + H_2$ (balanced)
 $ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$ (already balanced).
 $Cu(OH)_2 + HCl \rightarrow CuCl_2 + H_2O$ (unbal.). $Cu(OH)_2 + 2HCl \rightarrow CuCl_2 + 2H_2O$ (bal.).
 $CuCO_3 + HNO_3 \rightarrow Cu(NO_3)_2 + H_2O + CO_2$ (unbal.). $CuCO_3 + 2HNO_3 \rightarrow Cu(NO_3)_2 + H_2O + CO_2$ (bal.).
18. Rates. Rate is an amount per time. Rates (of reaction) increase or decrease. Make sure you talk about collisions between (named) particles AND more (or less) collisions per time and not just "more collisions".
- Increase in concentration: talk about more particles of per volume, so there are more collisions between and per time = increased rate of reaction. Decrease vice versa. You can only change the concentration of a solution e.g. hydrochloric acid solution, sodium thiosulfate solution etc.
 - Increase in surface area: talk about more particles of immediately exposed for collisions with so there are more collisions between and per time = increased rate of reaction. Decrease vice versa. You can only change the SA of a solid e.g. calcium carbonate lumps, magnesium metal etc.
 - Increase in temperature: Particles have more energy so they are moving faster and collide more often and with more energy (don't say with more FORCE) so there are more successful collisions per time = increased rate of reaction. Decrease vice versa.
 - Catalysts: Speed up chemical reactions by making more of the particle collisions successful collisions BUT DON'T GET USED UP. Don't assume there is a catalyst for every chemical reaction.
19. Rates experiments: flasks on digital balances lose mass as a gas is escaping – can use this to follow rate by plotting mass of gas released vs time.

20. Graphs with this shape. Steepest gradient (AT START) = greatest rate. less steep gradient = rate is decreased. horizontal line = reaction finished (as one of the chemicals has all reacted).

