

## AS Common Mistakes

### Electronic Structure

Getting subshells and orbitals mixed up. For example  $1s^22s^22p^6$  etc shows subshells not orbitals.

Reactivity is either removal or gain of electrons i.e. metals lose, non-metals gain. Affected by size.

Chemical properties = reactivity Physical properties = boiling pt, melting pt, density etc.

When writing out for example  $Mg^{2+}$ , the number of electrons is usually still written as for the element i.e. 12 and not 10.



Getting the definitions for relative atomic mass and relative isotopic mass confused. Saying “average” for the isotope definition is not good!

Not being very good with isotopes in mass spectra e.g. the various combinations of  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$ . Not being sure how to calculate the abundances when given the relative atomic mass of the isotopes.

AQA: students struggle with the time of flight mass spectrometer. They often don't know much/anything about electrospray. And those calculations with kinetic energy and  $v=d/t$  cause massive problems, particularly what to do with 'm' and Avogadro. Divide m by Avogadro then 1000.

### Ionisation Energy

Not using the correct terms i.e. nuclear charge, shielding and atomic radius. Or not knowing when to talk about each. Not mentioning shielding across a period.

Getting successive ionisation of the same element, mixed up with going across a period i.e. changing element. Not knowing what group the element is in when they see the “big jump” in values.

Getting the small dips between groups 2 and 3 and 5 and 6 mixed up or missing it all together.

Not realising a massive dip means group 8 on one period to group 1 on the next.

### Group 2

Not knowing a definition for electronegativity and why F is the most electronegative.

Not sure about reactivity trends of metals as they don't know what reactivity means i.e. how easy can it lose electrons.

Getting reactivity and melting point mixed up. Not sure what melting points of metals are i.e. refers to how strong the attraction is between the ions → size and charge.

Edexcel: Not knowing the products of thermal decomposition reactions of nitrates and carbonates well enough.

## Group 7

Getting halogens and halides mixed up: halogens oxidise and halides reduce. Their reactivities are opposite:  $F_2$  is most reactive but  $F^-$  is least reactive. Halogens gain an electron i.e. smaller = more reactive and halides lose electrons like metals.

Not sure which halogen has the highest boiling point, still not sure when to talk about intermolecular forces.

Ionic equations! Generally students aren't very good with these. Halogen displacement reaction should be easy but people get it wrong. Just miss out the metal:  $Cl_2 + 2Br^- \rightarrow Br_2 + 2Cl^-$ . It's just redox.

Edexcel and AQA: Halide reaction with  $H_2SO_4$ !! This is usually a big weak point in this topic. They have no idea what's even going i.e. trying to reduce sulphur and proving that iodide is the best reducing agent.

## Periodicity

Melting point trends across a period. Metallic  $\rightarrow$  giant covalent (highest)  $\rightarrow$  simple covalent (lowest). Getting this trend mixed up with something else or talking about intermolecular forces at the wrong time.

## Bonding

Students get dot and cross for covalent and ionic mixed up, especially A2 students. Not noticing the question asks for outer electrons only. Especially the metal ion that has no outer electrons in ionic compounds.

Getting conduction mixed up between ionic and metallic. Ionic has free ions but metallic has free electrons. They often say they opposite.

Ionic formulae!! Not sure what charge or formula ions like sulphate have. And if given a new ion, can't work out the charge from the formula.

Polar versus non-polar molecules always causes problems. Need to talk about dipoles cancelling.

Maybe the worst one at AS is talking about intermolecular forces at the wrong time or saying breaking covalent bonds for simple covalent boiling points. A massive mistake!

Forgetting to talk about size a lot in these questions i.e. HCl versus HBr. Students want to talk about electronegativity. It's just size and London or van der waals.

Not knowing which molecules have which forces.

Not knowing where van der waals or London forces come from in the first place.

Drawing hydrogen bonds wrongly i.e. need 180 degree angle. But often they get angles mixed up with the water angle. Or then draw the water angle as 180 degrees! Need the normal 104.5 for water and 180 for the H-bond.

Shape topic: Not knowing the basic 7 shapes well enough or having an example for each. Not knowing the standard phrases for why a molecule has a certain shape i.e. no. of bonds and lone pairs and minimising repulsion.

Not knowing what to do when given a new molecule to work out the shape, especially if it doesn't fit one of the standard 7 shapes e.g. 3 bonding pairs and 2 lone pairs.

## **Energetics**

Bond enthalpy calculations: carelessness! Students often get these wrong when it is a GCSE level question. Not dividing at the end if calculating bond enthalpy. Don't know that this is only for gases and why values don't match experimental values.

$Q=mc\Delta T$ : not using the correct mass for  $m$  (mass of water). Biggest mistake is the sign at the end. Always check if endo or exothermic from the temperature change. Not sure what moles to use if more than one reactant given.

Hess: not sure how to construct the cycle as they don't understand what it actually is. They don't look at the data to see what "type" of question it is i.e. usually combustion or formation. Arrows point either up or down. If it's formation draw the arrows upwards, if not formation, draw them pointing down. Not clear on definition for formation. Don't know what to do if it isn't a formation or combustion question.

## **Kinetics**

Not talking enough about successful collisions rather than just collisions.

Initial rate is when time = 0.

Maxwell-Boltzmann: drawing a higher  $T$  curve to the left of the original curve. And it is too steep with a peak that is too high. Not realising the curve doesn't show temperature but the effect of temperature on energy. It's a probability curve. Average energy and most probable energy are not the same i.e. average a bit further to the right of the peak.

Getting Maxwell-Boltzmann mixed up with energy/reaction profile diagrams (the ones that show activation energy with the hump).

## **Equilibrium**

Don't know definition of equilibrium: concentrations are constant but rates of forward and backwards reaction are equal. Often get these mixed up.

Not always clear on what happens to the equilibrium position when conditions are changed, especially temperature.

AQA... $K_c$ : most difficult part is to get equilibrium concentrations. Need one equilibrium value to start with, so look for it and then it's just ratios. Students not clear on this even at A2.

Not sure what the point of  $K_c$  is. It's just a number to show where equilibrium position is.

Edexcel and AQA....Units: put in  $\text{mol dm}^{-3}$  into  $K_c$  expression and cancel, add indices and invert indices.

## Redox

Often not sure of ion formulae and rules for working out oxidation states. If given an unusual ion they can't work out the oxidation state of an atom in that compound.

A lot of students don't know what 'ate' (element plus several oxygens) and 'ide' (just the element) mean in ion names.

Confusion over an oxidising agent getting reduced and a reducing agent getting oxidised.

Half equations are always a problem but really important.

Ionic equations from chemical equations still a problem i.e. split aqueous into ions and cancel.

Not good at recognising redox reactions in multiple choice questions versus neutralisation.

Not knowing which elements to look at first to find out what has been oxidised or reduced: C, N, S and halogens.

## Moles

Often problems with general moles calculations. Not realising they are all the same and need to do the same three steps: moles  $\rightarrow$  ratios  $\rightarrow$  convert answer to another unit.

Percentage Yield: not realising there is an equation ( $\text{actual/theoretical} \times 100$ ) and that always start by working out theoretical yield.

$PV=nRT$ : volume units are the big problem ( $\text{cm}^3 \rightarrow \text{m}^3$ ). Also not realising it is only for gases and therefore can't use the moles of a solid i.e. need to use the equation and ratios to get gas moles.

Avogadro: this thing about how many atoms, ions etc causes problems. Moles  $\times$  Avogadro  $\times$  whatever they ask for. Are they asking for number of ions, atoms etc?

Titration: not knowing how to make a standard solution properly. Percentage errors, not sure where the error in the apparatus comes from i.e. either given or half the smallest graduation. Not knowing when to  $\times 2$  i.e. when the apparatus is read twice (burette, thermometer, balance). Not being very good at reducing the percentage error, just think of the calculation and making the bottom line larger. Not sure about concordant values and using the rough titre to calculate the mean value ☹. Sad times.

Getting confused by the question i.e. adding water or removing a  $25\text{cm}^3$  portion and how it effects the calculation. Or when to use the titre. Back titration (requires a subtraction) versus normal titration, how do you know which to do? Not realising that they usually put the thing of known concentration in the burette but they could put it in the flask, which means the titre is used at the end.

**Organic:** just generally not knowing the reactions for each molecule type well enough. Miscounting the longest chain when naming molecules. Not writing two numbers for example 2,2-dimethyl. Using commas and dashes incorrectly in names or not using them at all. Not being very good with skeletal formula.

**Isomers:** not knowing the criteria for E/Z isomers. Not knowing the difference between cis and trans and Z and E. Not knowing that the priority rules is done atom by atom and not by group. Not knowing that alkene to cycloalkane is a functional group isomer. Not knowing the definitions of structural and stereoisomers well. Not knowing that E/Z is a subcategory of stereoisomerism.

## Alkanes

AQA: Thermal versus catalytic cracking conditions and products.

Radicals: propagation steps. Not clear on what the overall equation is and ways to remember propagation. Especially if they change the halogen or starting compound. Also, further reactions i.e. do the reaction until no hydrogens remain. The two propagation steps added together = the overall equation.

Edexcel: Missing out hydrogen in reforming equations.

## Alkenes

Mechanism: drawing the first arrow towards the alkene is a massive common error. Always from the alkene as it is electron rich. Draw towards the +.

AQA: not knowing that there are two different mechanisms for adding water to an alkene. One in this topic and one in the alcohols topic. Don't get them mixed up!

Edexcel and OCR: Being confused between sigma and pi-bonds.

Being confused about the major v minor product and the explanation for it.

Polymers: not drawing the polymer correctly from the alkene (best to draw vertical bonds around the C=C). Polymer "grows" from the C=C.

## Alcohols

Dehydration can give two products if an unsymmetrical alcohol is used. Possibly 3 if the alkene can then do geometric isomerism.

Oxidation: Not saying acidified when talking about potassium dichromate. Not being able to write out equations for these oxidation reactions using [O]. Getting reflux and distillation apparatus mixed up or not being able to draw it properly.

## Haloalkanes

When to do elimination versus substitution i.e. ethanolic OH<sup>-</sup> for elimination.

AQA and OCR: Ozone: the propagation equations confuse as slightly different from the other radical topic.

Rate of hydrolysis: not knowing what this refers to i.e. how quickly does the C-halogen bond break. Always I<sup>-</sup> is the fastest reaction. Talking about electronegativity instead of size as an explanation.

Edexcel: When using  $\text{NH}_3$  as a nucleophile, not putting a + on the N and when removing the +, not drawing the arrow towards the +. Getting confused about further reactions i.e. the amine formed can react again with a haloalkane until a quaternary amine is formed.

### **Infra-red**

Making this more difficult than necessary. Just look for C=O and O-H at 1700 and 3200. Acid versus alcohol: acid has much broader OH peak. There is always a sharp ish C-H peak at around 3000, don't get that mixed up with the OH peaks.