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## Chemistry ib data booklet

(Head of Mathematics and Science, Biology, Chemistry, Environmental Sciences and ESS Tutor at Edge Learning Center) When studying IB chemistry, there are a number of themes of areas and concepts that need depth of data and information that is impossible to dedicate to memory. For this purpose, IB Chemistry provides a handy resource in the form of a data booklet for works two and three. Within this booklet there is information about periodic trends, energy values for connections, values of enthalpia and entropy and key formulas. Although it is a vital tool, it must be used wisely too much time can be spent in search of small details. This blog aims to give advice on how to use the data provided and what should really be dedicated to memory. Read more about chemistry in Luke's previous SAT Chemistry Subject Overview blog The first two sections of the data booklet and the key formula and physical constants. This is important information, and some are more relevant than others, depending on the choice of option for paper 3. From the section of the relevant equations for the core, this should only be necessary in relation to variations of the Arrhenius equation. Other equations should be easily recalled when necessary. It is nice to have a safety net, but the recall and application of formulas should be of a different nature. Physical constants will also be useful if forgotten, but vital ones should be easily recalled for use, and a data booklet is not required. The next few sections are useful to have if details need to be clarified, but should not be necessary in most of the issues within these papers. Sections covering trends are almost never used in questions for physical values, including trends that are remembered and that will answer most questions. Connection data such as length, power, and thermodynamic properties is useful to have, but won't use all the time. Most of the questions that need information for these sections will be a reference in the question itself. Nevertheless, information about spectrochemical series and ligand structure could be important for cementing ideas and concepts of transfer. Acid and basic strength are given in a tricky way in the form of a bead or pkb. This relies on the student to remember the trend and its application in different question settings. It is also likely that you will be asked to refer to the correct table, especially for the choice of indicators. Information in the form of a series of activities and reduction potential could prove vital if a question is asked in designing a voltaic cell. This idea is largely not over and most of the time the relevant potentials will be given by question. Analytical techniques of peak identity tables are likely to be the most important table in the entire data booklet. There will regularly be a question of two or more techniques used to identify the compound being looked at, so that with these tables score a lot of points. The final set of tables are information relating to certain options and so can come in handy for tricky paper 3 questions. Also, the second column of key equations from the first table is associated with certain options and is likely to play a role, although

they are rarely needed. In conclusion, given the use of the data booklet, it should be a safety net for the vital information that the student should have in memory. An important tool when the question directs you to a specific table, because this information will always refer to details that would not be reasonable to learn within the time frame of IB chemistry. In short, the data booklet should barely be used, and then only when directed, it reduces the time wastage to answer questions. The best way is to practice exercises that well establish the trend and constant information and reduce the need for data booklets. Need help with an IB course? The Edge offers a free trial lesson\*(English/maths/physics/biology/chemistry/history) to new students, so join our class and learn how to apply the knowledge you learn in school to your IB/AP/IGCSE exams. SIGN UP HERE! See The Edge's other IB Blogs Causeway Bay: 2972 2555 /Mong Kok: 2783 7100 About The Edge The Edge Learning Center is a major provider of test preparation, academic teaching and counseling services for admissions to Hong Kong. Founded in 2008, The Edge has helped thousands of students improve their ACT and SAT scores, as well as their IB and AP grades. The AC team just completed a very successful year in which 84.62% of their clients were accepted into one of their top 3 schools, and a staggering 48.15% of their Ivy Plus\* applicants were accepted. (The overall acceptance rate was only 7.61 %) Check out the rest of our 2017 enrollment results! \*Ivy Plus: All Schools Ivy League + Stanford & MIT by Chris; Chris is available for private instruction. IMPORTANT NOTE: To get the most out of this blog post, please have a hard copy of the fourth edition of the IB Data Booklet available to you. These following 2 blogs will help you in the data booklet during papers 2 and 3. I will talk about some information you may have met in class or read in textbooks and how your data booklet might convey this same information differently; different conventions and nomenclature can lead to problems. I will also write about specific types of questions that require the use of the booklet, but not always in the most obvious way. We will work our way through in the order of the site so you can follow up with your own version. Make sure it's the latest (Release 4 – First Estimate 2016). Ask your teacher to send you an email if you don't have an electronic version. I'm not going to cover every table in the book, just the ones I think I need an address for. Content Page: This may be done but make sure you're able to manage the content page. Especially note that some tables contain data about multiple properties. For example, Table 8 contains information about energy 1. ionization, electron affinity and electronegativity, so if you scan only page titles, you may miss something that matters. Similarly, Table 12 is simply described as Thermodynamic data, which is quite unclear; however, this table contains some incredibly useful information (see later) and is one of the most commonly used tables in exams. Table 1 – Some relevant equations: The main question here will be whether you saw or were taught these equations in the same way using the same format and symbols. Also, be aware that you will not have to be able to use all these equations; relevant specification points are given in the left column (which is not true for the data booklet in some other group 4 cases); HL doesn't start until 12.1 and you'll only study one of the A-D options. These are the only equations you're likely to get, so every other one you've met along the way will have to be remembered, such as:  $[raw] [raw]$  I have chosen some equations in this table that could present some confusion about possible inconsistencies with how you learned them in class: •16.2, 2. form of the Arrhenius equation - the shape of the equation given here is typical, but has been changed in recent years so that it now shows no obvious similarity to  $y = mx + c$ . The given equation can be rewritten as:  $[crude] [crude]$  In this form it is clear that  $\ln k$  vs  $(1/T)$  will give a straight line with gradient  $(-E_a/R)$ . •16.2, the third form of the Arrhenius equation - this equation is designed for use when data is limited or when data falls very close to a straight line best fits. One danger with using this equation via a graphic method is that if you accidentally select two points that are not so close to the best fit line (and worse, they are on different sides) then you will end up with a significant floor or overestimation of activation energy. •B.7 & D.4, Henderson-Hasselbalch equation - have for example the shape of the equation here seems to be associated with acidic tampons (use of pKa and HA). However, it is still possible to use this form of equation to determine the pH of the base buffer. e.g. The two main types present in the Clipboard are NH3 and NH4+; however, you will find the pKb value for NH3 only in the data booklet and without mentioning NH4+. The shape of the Henderson-Hasselbalch equation given uses only pKa and you cannot simply insert the pKb in its place without some other modifications. Therefore, you will need to calculate the acid (NH4+) base (NH3) using  $pK_a = 14 - pK_b$ . In this example,  $pK_a$  NH4+ is 9.25 (14-4.75) and this value can go directly into the equation. I'll leave you to try and finish the question using this advice. Make sure you know what type of A is given, which is HA. Type A – does not have to have a negative charge, but simply has one H+ less than HA. In the example above, NH3 is A-a HA is NH4+. In a recent paper, students had to do a blood pH based on buffer-based hydrogen carbonate. However, many were confused because the species given did not appear to be a conjugated acid-base pair; concentrations of aqueous HCO3- and CO2 were instead given. Students should have noticed that aqueous CO2 is effectively H2CO3 and thus acts as HA in the equation. Many students swapped HCO3- for HA because it contains hydrogen atom. •C3 & D.8, Nuclear Half-Life Equations – I was surprised to see students mistakenly symbol for half-life  $(t_{1/2})$  for  $t \times 1/2$ ; you may have used the k symbol in your lessons instead of  $t_{1/2}$ . Also, do not confuse the decay constant ( $\lambda$ ) for half-life. Table 2 – Physical Constants and Unit Conversions: There are a small number of points to clarify here. •Make sure you know the difference between STP, SATP, standard conditions, and standard states. You should have met stp (standard temperature and pressure) in class, but you may not have heard of SATP. Satp conditions are identical to the most commonly used RTP (room temperature and pressure). The standard conditions, which are a pervasion part of the equations for standard enthalpy changes, are slightly different and are not mentioned in Table 2. My advice is that where the definition includes a phrase under standard conditions, replace this with 298 K and 100 kPa, which is very specific. •We hope you will be aware that balance constants do not have units (you do not need to know why). However, the value for Kw in Table 2 gives units as mol<sup>2</sup> dm<sup>-6</sup> which is contrary to the IB specification. Ignore the volumes and do not refer to them or use them in calculations involving Kw, although you should remember the concentrations you calculate using Kw will have units mol dm<sup>-3</sup>. •Table 2 refers to amu in the final entry. You may have used amu in class, or you may have used to indicate a unit of unified atomic mass. Technically, the term amu is outdated and not carbon-12-based. However, many sources still use amu as a term synonymous with you and have a re-defined amu For your needs, amu and you are identical units. Table 5 – Alphabetical List of Elements: In the past I have wondered about the purpose of this table, but then I forget that students are far less familiar with the periodic table and it is not fair to assume that they will know where to look for the element or that, intuitively, the correct symbol. My sense is that this table is designed to prevent students from wasting time searching the periodic table for unknown elements, and then ending up confusing, say, yttrium (Y) for ytterbium (Yb). You really shouldn't use the wrong symbols for elements with respect to the presence of Table 5. If the question refers to an element you haven't heard of or aren't sure about then don't use the periodic table, but use Table 5 to find it (easy because it's alphabetical). This is especially useful when compiling nuclear equations involving difficult, rarer elements such as lutetium, bismuth, etc. After identifying the exact symbol and atomic number using Table 5, you can use the periodic table to determine the symbol and atomic number of the radioactive decay product (because you know where to start, i.e. where to start. Table 6 - Periodic table: Just a few potential problems to solve here. First, pay attention to the two decimal place values given for relative atomic masses. You are expected to use these values in calculations. While using rounded integer values may not cause too many problems, it certainly has the ability to. Calculations of empirical formulas can be ejected if 1.00 rather than 1.01 are used for hydrogen, and questions involving determining the identity of an unknown element can give the wrong element. There are many elements where it is inappropriate to round to an integer, e.g., Cl, Cu, Mg, Ba, Zn to name just a few. Master tip, use the values provided. The second question surrounds how the data in the periodic area is displayed. The key is provided to make it clear that the largest number in each entry is the atomic number, and the highest value is the relative atomic mass (RAM). However, students get confused especially since the convention for writing this information is for an element in, for example, the nuclear equation: where is A RAM and Z is the atomic number Remember, atomic numbers are always numbers, but RAV's will be average and therefore have decimal places. Also, with the exception of hydrogen, RAM is always larger than the atomic number. Table 7 – Melting and boiling points: for some reason, these are quoted at 101.325 kPa (one atmosphere), not the usual 100 kPa. I think it is safe to assume that the melting and boiling points do not change much between these pressures and so you can easily determine the appropriate states of matter for the elements when writing equations for a standard enthalpy formation change. Table 8 – 1st Ionization Energy, Electron Affinity and Electronegativity: I have already mentioned earlier that this table contains a mass of data and looks very tight; what I want to focus on are values and how IB expects you to use them. The electronegativity values in Table 8 can be used to determine the connection, and therefore molecular polarity. In order for the molecule to be polar, the sum of dipole moments of individual connections must be non-zero, i.e. dipoles should not be cancelled. This necessarily means that the bonds within the polar molecule must also be polar. This is where the difficulty arises because agreeing on what makes a link polar is not universal. Technically, if atoms are different elements, the bond will be polar to some extent; however, in many cases the difference is so small that it means little to the characteristics of the molecule, that is, the molecule will still behave as if it were not polar. Many definitions of polar connection will refer to the difference of 0.5 to 2.0 units on the Pauling scale, but this is not a fixed rule. For IB questions, simply use the single decimal place values given in Table 8. If the values are identical, for example, if the values are identical. Difficulties arise with hydrocarbons that show asymmetry, such as 2-methylpropan. Carbon is more electronegative (2.5) than hydrogen (2.2) and in 2-methylpropan dikola they do not cancel out giving the molecule a net dipole moment. However, the molecular dipole moment is very small as a result of poorly polar (basically non-polar) C-H connections. It is safe on this level to assume that all unsubstituted hydrocarbons will be non-polar. Table 10, 11 and 18 – Bond Lengths, Bond and Lattice Enthalpies: my main point here is to be aware that this data is in a format you may not be too familiar with. Normally, you'll get this data in a spreadsheet, but the IB Data Booklet uses a matrix table in which each cell corresponds to a combination of two variables specified as row or column headings. Note that more bonds are not included in the table, but below it, so that the table applies only to individual bonds. Table 12 – Thermodynamic data: There is a lot of information in this table, so make sure you know what's in here. Often the questions will refer to the data booklet, but they can not determine a specific table, and this one is one of the most commonly used. You should be familiar with using standard enthalpy changes in formation and standard entropy, but you may not have used the standard Gibbs free energy change forming so much. [Crude] Suffice it to say that you can create energy cycles for [crude] [crude] in the same way as you can for [crude] [crude]. You can also use the following equation to determine Gibbs' free change in reaction energy: [raw] Also, keep in effect that water has multiple inputs both as running water and as steam. Thermodynamic data differ depending on the state of matter. This is particularly important when analysing which include non-binding conditions, e.g. Table 13 – Enthalpies of Combustion: All I want to point out here is that the standard enthalpy change in sulfur combustion is also the same as the standard enthalpy change in sulphur dioxide formation: Table 16 – Ligands: the structure of EDTA shown in Table 16 shows it only as a bidentate ligand (using a lone pair on each of the two nitrogen atoms). However, more commonly, EDTA is described as a hexadentate ligand that is in a state of chelate metal ions. To do this, EDTA must exist as a tetraanion, i.e. as EDTA<sup>4-</sup>. To do this, hydrogen ion is weaged from each of the carboxyle moieties leaving behind four carboxylate groups that can coordinate with a metal ion via a negative charge. Table 17 – Color Wheel: In case you are unsure what you might do with this diagram, the color wheel is used to determine the likely color of the solution with respect to the photon(s) light information absorbed by the solution. It is easy to use: if you know the color or wavelength of the absorbed photon, the solution will take over the appearance of the complementary color to the one absorbed that is simply the color directly opposite to the color wheel, e.g. You can also work backwards from the color of the solution, e.g. In the second part of our blog, which we expect to publish at the end of April (well before your exam!) we will look at the other half of Data Booklet. Be we will certainly exclaim if you have any questions! Questions!

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