<table>
<thead>
<tr>
<th>Code</th>
<th>Topic / concept</th>
<th>Objectives</th>
<th>Strategies</th>
<th>Math skills used/ needed</th>
<th>Application or integration; 1 in the same subject; 2- in other subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>C01</td>
<td>تجارب التفريغ الكهربائي</td>
<td>• أن يتعرف على أنابيب التفريغ الكهربائي • أن يتعرف على مبدأ عمل أنابيب التفريغ الكهربائي • تعرف على مكونات جهاز التفريغ الكهربائي وأهمية هذه الأجزاء • تصميم تجارب مماثلة لتجارب التفريغ الكهربائي للتعرف على خواص أشعة الفائض • تعرف على جهاز التفريغ الكهربائي</td>
<td>التعرف على جهاز التفريغ الكهربائي</td>
<td>لا يوجد N/A</td>
<td>للمادة علاقة كبيرة بمادة الفيزياء حيث يمكن من خلال الخلايا الكهربائية التعرف على المصطلحات الآنية الكاثود، الأندو، والتعرف على مصطلحات الغاز المخلخل، ملف رومكورف و... الخ</td>
</tr>
</tbody>
</table>

This is very related to physics where it can be used for electric cells, using the terms anode, cathode, and gases under low pressure, Ruhmkorff coil...etc.
<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>كتلة الذرية والنظائر</td>
<td>atomic masses and isotopes</td>
</tr>
<tr>
<td>أن يتعرف على كيفية حساب الكتلة الذرية للعناصر</td>
<td>How to calculate the atomic masses for elements.</td>
</tr>
<tr>
<td>أن يتعرف على سبب إعداد كتلة نظر الكربون 12 أساسا لقياس الكتلة الذرية للعناصر</td>
<td>Explains why the isotope for carbon-12 atom is used as a standard to measure atomic masses with.</td>
</tr>
<tr>
<td>أن يتعرف على طريقة حساب الكتلة الذرية لعنصر إعدادا على نظائر ونسبة وجودها في الطبيعة</td>
<td>How to calculate the relative atomic mass of an element depending on its isotopes and the percentage of abundance in nature.</td>
</tr>
<tr>
<td>أن يحسب الكتلة الذرية لعدد من العناصر والنظائر</td>
<td>Calculate atomic masses for number many elements and isotopes.</td>
</tr>
<tr>
<td>شرح سبب لجوء العلماء للتعامل مع وحدات كتلة كبيرة مثل الغرام في التعامل مع تفاعلات العناصر معا لتكوين المركبات</td>
<td>Explain why scientists use large mass units when dealing with elements reactions to produce compounds.</td>
</tr>
<tr>
<td>شرح كيفية حساب الكتلة الذرية للعناصر إعدادا على كتلة نظير الكربون 12 لعداد من العناصر إعدادا على كتلة نظير الكربون 12</td>
<td>Explain how to calculate the atomic mass depending on the carbon 12 isotope.</td>
</tr>
<tr>
<td>إعطاء أمثلة لحساب الكتلة الذرية لعدد من النظائر</td>
<td>Practice calculating atomic masses for different elements using carbon 12</td>
</tr>
<tr>
<td>استخدام عمليات الضرب والقسمة وال налогов والفاصل العشرية التي يصعب على الطالب التعامل معها</td>
<td>Use basic mathematical skills Addition, subtraction, division, decimal fractions.</td>
</tr>
<tr>
<td>لمادة علاقة كبيرة</td>
<td>There is a close relation with physics, and math.</td>
</tr>
<tr>
<td>مادة ع起义اء الرياضيات</td>
<td>التدرب على الحسابات الرياضية مثل القسمة والضرب</td>
</tr>
</tbody>
</table>
The Mole concept

• To know that the atomic mass of any element contains a constant number of atoms equal to Avogadro number which is named “Mole”.

• To know that Avogadro number = $6.02 \times 10^{23}$

• To recognize that the atomic mass of any element contains a constant number of atoms equal to Avogadro number

• To recognize that atomic mass in grams of any element equals to one mole.
<table>
<thead>
<tr>
<th>C04</th>
<th>Stoichiometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>حسابات المول</td>
<td></td>
</tr>
<tr>
<td>• أن يحسب عدد مولات كتلة محددة من عنصر</td>
<td></td>
</tr>
<tr>
<td>• أن يحسب عدد ذرات كتلة محددة من عنصر</td>
<td></td>
</tr>
<tr>
<td>• أن يحسب كتلة عنصر بمعلومية عدد مولاته أو ذراته</td>
<td></td>
</tr>
<tr>
<td>• To calculate the number of moles in a specific mass of an element.</td>
<td></td>
</tr>
<tr>
<td>• To calculate no. of atoms in a specific mass of an element.</td>
<td></td>
</tr>
<tr>
<td>• To calculate the mass of element knowing the number of moles or atoms</td>
<td></td>
</tr>
<tr>
<td>• إعطاء أمثلة حسابية كثيرة لحساب عدد ذرات عنصر ما أو معرفة عدد مولاته أو عدد ذراته أو كتلته</td>
<td></td>
</tr>
<tr>
<td>• توضيح أن مفهوم المول ينطبق أيضاً على الأيونات والجزيئات</td>
<td></td>
</tr>
<tr>
<td>• Give many examples to calculate the no. of atoms of a specific element or finding its no. of moles or atoms of mass.</td>
<td></td>
</tr>
<tr>
<td>• Explain that mole concept applicable for both atoms and molecules</td>
<td></td>
</tr>
<tr>
<td>استخدام عملية القسمة استخدام عملية الضرب التعامل مع الأس Use of division and multiplication and exponents.</td>
<td></td>
</tr>
<tr>
<td>التدرب على العمليات الحسابية Calculations</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C05</th>
<th>The Percent of composition for elements in a compound.</th>
</tr>
</thead>
<tbody>
<tr>
<td>النسب المئوية لكتل العناصر في المركب (صفحة 22)</td>
<td></td>
</tr>
<tr>
<td>• يتعرف على طريقة لحساب النسبة المئوية الكتلة للعناصر الداخلة في تكوين المركب</td>
<td></td>
</tr>
<tr>
<td>• يحسب النسبة المئوية الكتلة للعناصر الداخلة في تكوين مركب</td>
<td></td>
</tr>
<tr>
<td>• Know the way to calculate the percentage of composition for elements in a compound.</td>
<td></td>
</tr>
<tr>
<td>• Calculate the percentage composition for elements in compounds.</td>
<td></td>
</tr>
<tr>
<td>• إعطاء أمثلة يشرح من خلالها كيفية حساب نسبة المئوية لعناصر الداخلة في تكوين المركب.</td>
<td></td>
</tr>
<tr>
<td>• Give examples to explain how to calculate the percentage of composition for elements in a compound.</td>
<td></td>
</tr>
<tr>
<td>استخدام عملية القسمة استخدام عملية الضرب التعامل مع الأسس للكتلة مع النسبة المئوية Use basic mathematical skills and work with exponents, dealing with percentages</td>
<td></td>
</tr>
<tr>
<td>علاقة بمادة الرياضيات التدرب على العمليات الحسابية وخاصة التي تحتوي على الأسس Relation with math and practice math skills.</td>
<td></td>
</tr>
</tbody>
</table>
### C06

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>تحديد الصيغة الأولية والجزئية للمركبات الكيميائية</td>
<td></td>
</tr>
<tr>
<td>Determining the empirical and molecular formulae for chemical compounds.</td>
<td></td>
</tr>
<tr>
<td>• أن يتوصل إلى تحديد الصيغة الأولية للمركب</td>
<td></td>
</tr>
<tr>
<td>• To be able to determine the empirical formula of a compound</td>
<td></td>
</tr>
<tr>
<td>• أن يتوصل إلى تحديد الصيغة الجزئية للمركب</td>
<td></td>
</tr>
<tr>
<td>• To determine the molecular formula of the compound</td>
<td></td>
</tr>
<tr>
<td>• التوصل إلى حساب كل من الصيغتين الأولية والجزئية</td>
<td></td>
</tr>
<tr>
<td>• To be able to determine the empirical and molecular formulae for a compound.</td>
<td></td>
</tr>
</tbody>
</table>

### C07

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>حساب حرارة التفاعل باستخدام طاقات الرابط</td>
<td></td>
</tr>
<tr>
<td>Calculating the change in enthalpy using the values of bond energies</td>
<td></td>
</tr>
<tr>
<td>• أن يتعرف على التغير في المحتوى الحراري</td>
<td></td>
</tr>
<tr>
<td>• Know the meaning of change in the heat content.</td>
<td></td>
</tr>
<tr>
<td>• إن يحسب حرارة التفاعل الكيميائي بواسطة طاقة الرابط</td>
<td></td>
</tr>
<tr>
<td>• Calculate the enthalpy change for a chemical reaction using bond energies</td>
<td></td>
</tr>
<tr>
<td>• أن يميز بين أنواع التفاعل من حيث قيمة حرارة التفاعل</td>
<td></td>
</tr>
<tr>
<td>• Distinguish between types of chemical reactions in terms</td>
<td></td>
</tr>
<tr>
<td>• أن يستنتج أن التفاعل طارد أم ماس للحرارة نتيجة حساب طاقات الروابط في المتفاعلات والنتائج</td>
<td></td>
</tr>
<tr>
<td>• Addition, subtraction, division, multiplication</td>
<td></td>
</tr>
</tbody>
</table>

| مراجعة رموز لويس |
| Review electron dot notation (Lewis symbols) |
| استخدام الجداول لحساب قيم طاقات الروابط |
| Use the periodic table to calculate energy values of bonds. |
| مراجعة موانع المعادلات الكيميائية البسيطة |
| Review balancing equations. |
| حساب الطاقة اللازمة لكسر الروابط أو تكوينها مع الذ_pen الأعتبار عدد مولات الروابط |
| • Add, subtract, divide, multiply |

### C08

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>للمادة علاقة بمادة الأحياء</td>
<td></td>
</tr>
<tr>
<td>• This has a relation with biology, since it can be used to detect for a chemical or tissues in a crime location.</td>
<td></td>
</tr>
<tr>
<td>التحرير عن المادة الكيميائية أو أنسجة عضوية في مسرح جريمة</td>
<td></td>
</tr>
<tr>
<td>• استخدم عملية القسمة</td>
<td></td>
</tr>
<tr>
<td>• Use basic mathematical skills and work with exponents, dealing with percentages</td>
<td></td>
</tr>
<tr>
<td>• استخدم عملية الجمع</td>
<td></td>
</tr>
<tr>
<td>• Add, subtract, divide, multiply</td>
<td></td>
</tr>
<tr>
<td>• شرح مفهوم الطاقة الممتصلة والطازجة وكيفية التعبير عنها بمعادلة كيميائية من حيث وضعها مع التفاعلات أو النواتج</td>
<td></td>
</tr>
<tr>
<td>• Add, subtract, multiply, divide</td>
<td></td>
</tr>
</tbody>
</table>

| علاقنة لمادة الرياضيات |
| • Add, subtract, multiply, divide |
| • علاقنة لمادة الفيزياء |
| • شرح مفهوم الطاقة الممتصلة والطازجة وكيفية التعبير عنها بمعادلة كيميائية من حيث وضعها مع التفاعلات أو النواتج |

| مراجعة موانع المعادلات الكيميائية البسيطة |
| Review balancing equations. |
| • علاقنة لمادة الرياضيات |
| • Add, subtract, multiply, divide |

| مراجعة موانع المعادلات الكيميائية البسيطة |
| Review balancing equations. |
| • علاقنة لمادة الفيزياء |
| • شرح مفهوم الطاقة الممتصلة والطازجة وكيفية التعبير عنها بمعادلة كيميائية من حيث وضعها مع التفاعلات أو النواتج |
| • Add, subtract, multiply, divide |

| مراجعة موانع المعادلات الكيميائية البسيطة |
| Review balancing equations. |
| • علاقنة لمادة الرياضيات |
| • Add, subtract, multiply, divide |

| مراجعة موانع المعادلات الكيميائية البسيطة |
| Review balancing equations. |
| • علاقنة لمادة الفيزياء |
| • شرح مفهوم الطاقة الممتصلة والطازجة وكيفية التعبير عنها بمعادلة كيميائية من حيث وضعها مع التفاعلات أو النواتج |
| • Add, subtract, multiply, divide |

| مراجعة موانع المعادلات الكيميائية البسيطة |
| Review balancing equations. |
| • علاقنة لمادة الرياضيات |
| • Add, subtract, multiply, divide |

<p>| مراجعة موانع المعادلات الكيميائية البسيطة |
| Review balancing equations. |
| • علاقنة لمادة الفيزياء |
| • شرح مفهوم الطاقة الممتصلة والطازجة وكيفية التعبير عنها بمعادلة كيميائية من حيث وضعها مع التفاعلات أو النواتج |
| • Add, subtract, multiply, divide |</p>
<table>
<thead>
<tr>
<th>C08</th>
<th>Types of Polymers</th>
<th></th>
<th>endothermic and exothermic reaction and writing an equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>أنواع الميلمرات</td>
<td>أن يعرف على الميلمرات</td>
<td>• Know what is a polymer</td>
<td>لها علاقة بمادة الفيزياء للميلمرات من حيث كثافة، درجات انصهارها، حجمها وتوثيقها للبيئة</td>
</tr>
<tr>
<td>87 صفحة</td>
<td>أن يعرف على ميلمر متعدد الإثيلين</td>
<td>• List some products that is classified as polymers.</td>
<td>It has a relation with physics, and physical properties m and polymerization concerning density, melting points, size and environmental pollution</td>
</tr>
<tr>
<td>Types of</td>
<td>أن يعرف على ميلمر متعدد</td>
<td>• Know polyethylene</td>
<td></td>
</tr>
<tr>
<td>Polymers</td>
<td>الإثيلين</td>
<td>• Write an equation showing the polymerization of three monomers of ethene</td>
<td></td>
</tr>
<tr>
<td>• To know how Teflon is formed</td>
<td>• Know polyethylene</td>
<td>• To conclude if the reaction is exothermic or endothermic as a result of the chemical bond energies of the reactants and products.</td>
<td></td>
</tr>
<tr>
<td>• Recognize a polymer with polyethylene</td>
<td><strong>Calculate the energy required to break or to form bonds, taking into account the number of moles of bonds.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>C08</strong></td>
<td><strong>Types of Polymers</strong></td>
<td><strong>endothermic and exothermic reaction and writing an equations</strong></td>
<td></td>
</tr>
</tbody>
</table>
of the polymers they are using such as erasers, book covers, mobiles sharpeners… And indicate that all are artificial materials are produced by polymerization.

- Classify polymers into natural and man made
- Explain how ethene molecules bind together to form polyethylene.
- Ask students to represent the polymerization process by binding their hands together
- Watch a website or an animation about polymerization to see how it happens,

| C09 | التعرف على الميلمرات الطبيعية | • أعطاء أمثلة على الميلمرات الطبيعية
|     | أن يكتب معادلة توضح بلمرة 3 جزيئات من البروتين | • شرح ما هي وحدات البناء لكل من النشا، السليلوز، والبروتين
|     | أن يحدد وحدات البناء في كل من النشا والبروتين | • Give examples of natural polymers
|     | • Recognize the natural | • لها علاقة بمادة الأحياء التعرف على بعض المركبات في الكيمياء الحيوية وأهميتها وما وحدات البناء بها

It has a relation with biology, to know the
<table>
<thead>
<tr>
<th></th>
<th>polymers.</th>
<th>Explain what is meant by building units of starch cellulose and protein</th>
<th>n/A</th>
<th>biochemical and its importance as building blocks.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Write equation to show the formation of a 3 monomers (amino acid) for protein polymer.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Identify the units of building of starch and proteins.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topic / concept</td>
<td>Objectives</td>
<td>Strategies</td>
<td>Math skills used/ needed</td>
<td>Application or integration; 1 in the same subject; 2- in other subjects</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------</td>
<td>------------</td>
<td>--------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>C10</td>
<td>النظرية الميكانيكية الموجودة للذرة Mechanical wave theory of the atom</td>
<td>To describe the location of the electron in an atom using the four quantum numbers.</td>
<td>استخدام أسهل ميسر في الشرح وهو تشبه الأعداد الكمية بالبناء الذي يحتوي على طوابق وشقق ووضوح القيم التي تأخذها أرقام الكم بناء على هذا التشبه الميسر</td>
<td>الجمع والطرح والفترات Addition, subtraction and intervals.</td>
</tr>
<tr>
<td>C11</td>
<td>Modern periodic table</td>
<td>Use Edu-wave website to shoe clarify this topic.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-----------------------</td>
<td>-----------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>الجوّل الدورى الحديث</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>أن يستنتج العلاقة بين التوزيع الإلكتروني للعنصر وموقعه في الجدول الدوري To conclude the relation between the electronic configuration and the location of an element in the periodic table.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>مراجعة الطلاب بالتوّزيع الإلكتروني</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>تحديد رقم الدورة والمجموعة للعنصر وخصوصة العناصر الانتقالية</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>إعطاء نموذج لجدول دوري أصم يحتوي على بعض العناصر الافتراضية وتحديد توزيعها الإلكتروني الموقع الإلكتروني</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Review the students with the electron configuration, Determining the period and group no, the element belongs to, and the transitional elements in particular in the periodic table Give a clear periodic table with some symbolic elements and ask student to determine its electronic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Addition and subtraction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>الفهم والطرح</td>
<td>vitamin B12 in the body</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C12</td>
<td>أشكال الأجزاء</td>
<td>To identify the Spatial form of the molecule</td>
<td>قياس الزوايا بالدرجات</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>--------------</td>
<td>-----------------------------------------------</td>
<td>----------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Molecular shapes</td>
<td>An agent understands the shapes of the molecule.</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Use atom models.</td>
<td>- Use the Eduwave website.</td>
<td></td>
<td></td>
</tr>
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<td></td>
<td>- Use a table that illustrates the five shapes and the angles (it is important to assure the right drawing of the molecule and the presence of lone pairs.)</td>
<td>- Using degree to measure angles.</td>
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</tbody>
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<thead>
<tr>
<th>C13</th>
<th>التهجيج والأفلاك المهجنة</th>
<th>To explain the hybridization concept of orbits and reasons behind its hypothesizing its existence.</th>
<th>N/A</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hybridization and hybridized orbits</td>
<td>Start with identifying the central atom.</td>
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<tr>
<td></td>
<td>- To draw a relation between the shape of the molecule.</td>
<td>- Identifying the polarity of a molecule and its ability to dissolve in different solvents.</td>
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<td></td>
<td>- Write the distribution of the electron pair.</td>
<td>- Determination of the central atom's polarity and its ability to dissolve in different solvents.</td>
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<td>- Determine the nature of the central atom and the electronic orbitals.</td>
<td>- Donald.</td>
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<td>- An agent establishes the nature of the central atom and the distribution of the electron pair.</td>
<td>- Donald.</td>
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<td>- Write the hybridization concept of orbits and reasons behind its hypothesizing its existence.</td>
<td>- Donald.</td>
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<td>- To draw a relation between the shape of the molecule.</td>
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</table>
and the hybridization in the central atom.

- Write the electron configuration
- Identify the hybridized orbit and draw them.
- Use the Edu-wave website.

<table>
<thead>
<tr>
<th>C14</th>
<th>تركز المحاليل وخصائصها الطبيعية</th>
</tr>
</thead>
<tbody>
<tr>
<td>The concentrate ion of solutions and its physical properties</td>
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</tbody>
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1. To perform calculation related to the ways of expressing solutions concentrations (the percentage of the solute in mass, morality, molality).
2. Prepare the solution in the lab with different concentrations using the different methods of expressing the concentration.
3. Explain the calculation steps related to concentration.

- Prepare the solution in the lab with different concentrations using the different methods of expressing the concentration.
- Explain the calculation steps related to concentration.
- Give an enrichment activity by giving a solution with unknown concentration and

- 1 تحضّر محاليل تتركز مختلفة باستخدام طرق التعبير عن التركيز
- 2 توضيح طريقة إجراء الحسابات المتعلقة بالتركيز
- 3 يمكن إعطاء نشاط إثرائي للطلاب لمحلول جاهز والطلب إعداد تركيزه (استخدام المختبر)

- Division particularly with decimal points,

- From the daily activities: preparing medicines, paints, and detergents.

- From the daily activities: preparing medicines, paints, and detergents.
| C15 | Chemical equation | ask student to find it  
concentration | Chemical equation  
1. Translate the chemical  
equation to symbolic  
equation  
2. Balance the equation and  
determine the type of  
reaction  
- Make sure the  
students write the  
correct symbol for  
elements or  
molecular formula  
compounds and  
molecules.  
- Explain the basics of  
balancing equations  
especially reactions  
of oxidation and  
reduction. |
|-----|-------------------|-------------------|-------------------|
| C16 | Chemical equation  
1. An equilibrium  
constant is used to  
calculate the  
amounts of the  
reactants and  
products at  
equilibrium.  
2. Solves problems  
about concentration  
and the different  
states of the  
reaction  
- Solves varied problems  
about concentration  
and makes sure to  
overcome the  
mathematical  
obstacles the students  
face. | Addition an  
subtraction  
- Adds and  
subtracts  
- Multiplication  
addition, subtraction,  
and division. | 
Manufacturing ammonia  
using Haber process. |
<table>
<thead>
<tr>
<th>C17</th>
<th>التصاوع</th>
<th>To be introduced to isomerisation concept and draw compounds that are isomers</th>
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<td>Topic / concept</td>
<td>Objectives</td>
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| C19  | Order of the reaction | • تعيين رتبة التفاعل حسابياً 
• أن يعلم أن سرعة التفاعل العملية والتي تظهر زيادة سرعة التفاعل بزيادة تركيز المواد المتفاعلة كلاً مرفوعًا إلى قوى معينة تسمى رتبة التفاعل حسب قانون سرعة التفاعل 
• إن تنتسب طردياً مع تراكيز المواد المتفاعلة كلاً مرفوعًا إلى قوى معينة تسمى رتبة التفاعل حسب قانون سرعة التفاعل 
• أن يستخدم البيانات في الجداول المناسبة والتي تحدد التراكيز الإبتدائية والسرعة الإبتدائية في عدد من التجارب لنفس المادة لحساب رتبة التفاعل 
• To conclude that the rate of the reaction is directly proportional with the reactant concentration where each is raised to a specific power called the order of the reaction according to the rate law. 
• Use the data in proper tables that identify the (initial concentration , | • إجراء بعض التجارب العملية والتي تظهر زيادة سرعة التفاعل بزيادة تركيز المواد المتفاعلة (تفاعلات حدوث فوران أو إطلاق غازات) 
• شرح كيفية التوصل إلى حساب رتبة التفاعل عبر استخدام بيانات السرعة والتراكيز الإبتدائية لمادة ما ثم السرعة والتراكيز بعد أن ينخفض فترات مثالية لحساب قيم سرعة التفاعل مقترنة بقيم (التركيز × ثابت التفاعل) مرفوعًا لقوة أسبعة مجهرة والتي تتمثل رتبة التفاعل والذي قد يكون إحدى أو ثنائي أو ثلاثي الخ... 
• التدرب على إيجاد رتبة التفاعل للمواد الداخلية للتفاعل | Use of exponents 
Division | يمكن ربط السرعة مع التصادمات الفعالة بين المواد المتفاعلة في درس اللاحق في مادة الكيمياء كما يمكن ربطه مع حركة سيارات تسير بسرعات مختلفة بطريقة علمية وارتفاع الإصطدامات وفعاليتها 
• الربط مع مادة الرياضيات والتعامل مع الأسس والتعامل مع الأسس | • Speed of the reaction is related to the effective collisions of the reactants in the next lesson of the same grade 
• It could be connected with cars accidents and the speed they are driving in and its effectiveness. 
• Relate to math by using exponents. |
initial speed, in number of experiments for the same substance) to calculate the order of reaction

- Perform some experiments that show the increase of rate of reaction by increasing the concentration of the reactants. (bubbling and gas production)
- Explain how to reach to the order of the reaction using speed data and initial concentration for a substance and then the speed and concentration after a specific time to calculate the rate of reactions comparing it with the value (conc. X reaction constant) to the unknown power that will represent the order of the reaction which might be first, second, or third…etc.
- Practice to find reaction orders for
| C20 | Half-Life Change in concentration with lime half-life. | reactants and write the rate law for that reaction. | للدرس علاقة بكل من مواد الكيمياء والفيزياء الأحياء والجيولوجيا كلها ترتبط معاً في هذا الدرس مثل إضمحلال المواد وتعيين عمر الأحفاد أو الصخور. | 
|-----|---------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------------------|---|
|     | تغيير التركيز مع الزمن ونصف العمر. | تعريف فترة نصف العمر. | تعرف على فترة نصف العمر حساب نصف فترة تفاعل أحادي الرتبة وتوضيح مفهوم نصف العمر | 
| C21 | حساب نصف عمر التفاعلات أحادية الرتبة Calculating half life for first order reactions | التفاعل والوصول إلى قانون 1/2 لحساب فترة نصف العمر منشأة الطلاس في سبب عدم اعتماد فترة نصف العمر للتفاعل أحادي الرتبة على التركيز الإبداعي وايضاً اعتماد على ثابت السرعة فقط حل مسائل لحساب نصف العمر لمادة ما | للدرس علاقة بكل من مواد الكيمياء والفيزياء الأحياء والجيولوجيا كلها ترتبط معاً في هذا الدرس مثل إضمحلال المواد وتعيين عمر الأحفاد أو الصخور. | 

This topic is related to all sciences, bio, physics, chemistry and earth science, degradation of substance, rock ages and fossils.
| **To know that half life period is \((n1/2)\) is inversely proportional with reaction constant.** |
| **To observed that half life for a first order reaction depends on the speed constant only and not on the initial concentration** |
| **To calculate the half-life of a substance.** |
| **To calculate the time needed to degrade a specific percentage of a substance.** |

| **حساب الزمن الكافي لتحلل نسبة معينة من مادة ما** |
| **للمتابعة وفصل الثورة المطلقة وتثبت سرعة التفاعل** |
| **أن يعرف كثافة التنشيط عند الطاقة** |
| **أن يعرف معادلة أرتهينوس التي تربط ما بين كثافة التنشيط ودرجة الحرارة المطلقة وتثبت سرعة التفاعل** |
| **أن يحل مسائل لحساب كثافة التنشيط** |
| **A** |
| **To define activation energy** |
| **To define Arrhenius** |

| **Discuss with the students rate law and conclude the law to calculate the half-life.** |
| **Discuss why the half life of a first order reaction does not depend on the initial concentration but on the speed constant only.** |
| **Solve problems to calculate the half-life of substances.** |
| **Calculate the time needed for a specific percentage of a substance to degrade.** |

| **C22** |
| **الحسابات المتعلقة بطاقة تشغيل** |
| **الحسابات المتعلقة بطاقة تشغيل** |
| **أثناء التفاعل** |
| **أن يعرف معادلة أرتهينوس التي تربط ما بين طاقة التشغيل ودرجة الحرارة المطلقة وتثبت سرعة التفاعل** |
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| **earth science, where degradation of substance is used to determine rock age, fossils.** |
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| **أن يعرف معادلة أرتهينوس التي تربط ما بين طاقة التشغيل ودرجة الحرارة المطلقة وتثبت سرعة التفاعل** |
| **A** |
| **To define activation energy** |
| **To define Arrhenius** |

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<table>
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<tr>
<th></th>
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</tr>
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<tbody>
<tr>
<td><strong>equation that relate activation energy with absolute temperature and rate constant.</strong></td>
<td><strong>ثابت السرعة K عند درجتي حرارة مخلكتتين من معادلة أرهينيوس أن يحل مسائل لحساب طاقة التنشيط Ea وقيمة ثابت أرهينيوس A</strong></td>
<td><strong>• To solve problems related to activation energy and Arrhenius constant A.</strong></td>
<td><strong>• To solve problems to calculate the activation energy Ea and Arrhenius constant A</strong></td>
</tr>
<tr>
<td><strong>C23</strong></td>
<td><strong>القوى النسبية للحمض والقواعد</strong></td>
<td><strong>• تصنيف الحمض إلى القواعد ضعفت قوة قاعدته المراقبة</strong></td>
<td><strong>• يمكن أن يكون للمادة علاقة بسيطة بمادة الفيزياء وكذلك مادة الكيمياء (الخلايا الجلفانية) لدى وضع أحماض أو قواعد متفاوتة قوة ومساوية</strong></td>
</tr>
<tr>
<td><strong>Relative</strong></td>
<td><strong>• أن يعرف أنه كلما زادت قوة الحمض ضعفت قوة قاعدته</strong></td>
<td><strong>• توضيع رئيسيين قوية وضعيفة</strong></td>
<td><strong>• شرح الفروق بين نوع هذه</strong></td>
</tr>
</tbody>
</table>
| Strength of acids and bases. | ضعفت قوة حمضه المرافق
> أن يستخلص المعلومات المتعلقة
> بقوة الأحماض وقواعدها المرافية
> من الجداول المناسبة
> • To recognize that as the acidity of an acid increases
>  its conjugate base becomes weaker.
> • To recognize that as the base becomes stronger its
>  conjugate acid becomes weaker.
> • To extract the information related to acid and bases
>  strength for the appropriate tables,
> • Classify acids into
>  strong and weak
>  acids.
> • Explain the
difference between
>  the two types of
>  acids.
> • Give examples
>  supported by
>  ionization
>  equations to
>  explain that if as
>  the acid strength
>  increase its
>  conjugate base
>  decreases. Sand
>  visa versa.
> • Concludes the
>  information related to
>  acids strengths
>  and its conjugate bases from
> • This is related to physics
>  and chemistry (galvanic
cells ) when putting
>  acids and bases with
>  varied strengths and
>  equal concentrations in
>  beakers with rods
>  immersed in it attached
to electric circuit. |
<table>
<thead>
<tr>
<th>C24</th>
<th>تعيين الجهة التي يرجحها الإتزان</th>
<th>Identify the side that a equilibrium will likely take.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>أن يعين الجهة التي يرجحها الإتزان</td>
<td>Explain the reason the why we write the strong acid or base reaction in one way only.</td>
</tr>
<tr>
<td></td>
<td>أن يفسر سبب كتابة معادلة التفاعل للحمض أو القاعدة السوية بالإتجاه الأمامي فقط</td>
<td>• تذكر الطلاب بالاتزان الكيميائي الدينياميك وقاعدة لوتشاليمي والمواد المؤثرة على الإتزان</td>
</tr>
<tr>
<td></td>
<td>• تذكر الطلاب بالاتزان الكيميائي الدينياميك وقاعدة لوتشاليمي والمواد المؤثرة على الإتزان</td>
<td>• إعطاء أمثلة بالإستعانة بالجدول الذي يحدد القوى النسبية للحمض والقواعد لتعيين الجهة التي يحددها الإتزان</td>
</tr>
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<td>• إعطاء أمثلة بالإستعانة بالجدول الذي يحدد القوى النسبية للحمض والقواعد لتعيين الجهة التي يحددها الإتزان</td>
<td>• Remind students of chemical dynamic equilibrium and Le Chatelier’s principle and the factors affecting equilibrium.</td>
</tr>
<tr>
<td></td>
<td>• Remind students of chemical dynamic equilibrium and Le Chatelier’s principle and the factors affecting equilibrium.</td>
<td>• Give examples with the help of tables that identify the relative acid and base strength to identify the side the equilibrium is most likely to take.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C25</th>
<th>تأثير الأيون المشترك The impact of a</th>
<th>مراجعة مبدأ لوتشاليمي لتحديد إتجاه التفاعل لدى حدوث خلل في نظام مترن</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>أن يفسر أثر إضافة أيون مشترك إلى حمض أو قاعدة ضعيفة على موقع الإتزان</td>
<td>لتحديد إتجاه التفاعل لدى حدوث خلل في نظام مترن</td>
</tr>
<tr>
<td></td>
<td>أن يحسب التغيير في قيمة درجة</td>
<td>التعامل مع القسمة والضرب التعامل مع الأسس وجدول اللوغاريمات</td>
</tr>
<tr>
<td></td>
<td>• علاقة بالمواد المحددة للإتزان وقاعدة لوتشاليمي</td>
<td>• علاقة بالمواد المحددة للإتزان وقاعدة لوتشاليمي</td>
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<td></td>
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<td>• علاقة بالمواد المحددة للإتزان وقاعدة لوتشاليمي</td>
</tr>
</tbody>
</table>

relation of equilibrium factors and Le Chatelier’s principle where this can be done as a module to show that if any stimulus affected a balanced system then the system will work to limit the stimulus impact to reach new equilibrium.
<table>
<thead>
<tr>
<th><strong>common ion</strong></th>
<th><strong>Buffer solutions</strong></th>
<th><strong>Relation with limiting factor of equilibrium and Le Chatelier’s principle</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>To explain the impact of adding a common ion to an weak acid or a base on the equilibrium location.</td>
<td>To know what is a buffer solution and to know the importance of the buffer solutions.</td>
<td><strong>Addition and subtraction</strong></td>
</tr>
<tr>
<td>To calculate the change in value of pH as a result of adding a common ion to an ion or a weak base</td>
<td>Explain why the pH value does not change a lot as result of adding little</td>
<td><strong>Exponents and logarithms</strong></td>
</tr>
<tr>
<td><strong>C26</strong></td>
<td>Explain why the pH value does not change a lot as result of adding little</td>
<td><strong>Relation with limiting factor of equilibrium and Le Chatelier’s principle</strong></td>
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<td><strong>Buffer solutions</strong></td>
<td></td>
<td><strong>Common ion</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Biology : how blood pH is kept constant.</strong></td>
</tr>
<tr>
<td>C27</td>
<td>الكواشف Indicators</td>
<td></td>
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<tr>
<td>---</td>
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</tr>
<tr>
<td>An indicator is a substance whose color changes in response to a specific chemical reaction.</td>
<td></td>
<td></td>
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<tr>
<td>To be familiar with indicators and their importance.</td>
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<td></td>
</tr>
<tr>
<td>To know the indicators’ importance and their mechanisms.</td>
<td></td>
<td></td>
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<tr>
<th>amount of acid or base to a buffer solution</th>
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</thead>
<tbody>
<tr>
<td>To calculate the little change that happened in pH value when a little amount of acid or base is added to the buffer solution.</td>
</tr>
<tr>
<td>Review the common ion to explain the buffer solution mechanism.</td>
</tr>
<tr>
<td>Practice solving some problems related to calculate the limited change in the pH value after adding some small amount of acid or base to a buffer solution.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Explain what indictors are</th>
</tr>
</thead>
<tbody>
<tr>
<td>This lesson has a relation with titration.</td>
</tr>
<tr>
<td>This topic has including...</td>
</tr>
</tbody>
</table>
To explain why the increasing of concentration of weak acid from its conjugate base (and vice versa) which leads to the change in color according to the higher concentration substance.

- Relate the indicator color with the pH value of a solution.

- Perform some experiments to neutralization to get to know indicator’s function, kinds, and colors in both acidic and basic mediums.

- Write the equation and explain Le Chatelier’s principle in indicators colors change.

- Explain the reason of using a specific indicator according the strength of the acid and the base.

- Perform some experiments to neutralization to get to know indicator’s function, kinds, and colors in both acidic and basic mediums.

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<tbody>
<tr>
<td>• Show the students the table of standard oxidation voltage.</td>
</tr>
<tr>
<td>• Explain how the values are sequenced downwards on the left side of</td>
</tr>
<tr>
<td>the table and its relation with strength of oxidation factor.</td>
</tr>
<tr>
<td>• Give examples and explain how the reduction values are sequenced</td>
</tr>
<tr>
<td>upwards on the right side of the table and its relation with the</td>
</tr>
<tr>
<td>reduction reaction.</td>
</tr>
<tr>
<td>• Give examples and discuss the idea with the students.</td>
</tr>
</tbody>
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<tr>
<td>• يمكن عمل تجارب كيميائية متعددة</td>
</tr>
<tr>
<td>• May perform many</td>
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<tbody>
<tr>
<td>• حسابات طرح وجمع بسيطة</td>
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<td>• Basic addition and subtraction</td>
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<td>• يتم استخدام جدول جهد الخلية المعياري لحساب جهد الخلية</td>
</tr>
<tr>
<td>• يتم تحليل تفاعلات الأكسدة حسب جهد الخلية</td>
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<td>• An calculator of how to calculate the oxidation voltage should be</td>
</tr>
<tr>
<td>used to calculate the cell potential.</td>
</tr>
<tr>
<td>• تحليل تفاعلات الأكسدة حسب جهد الخلية</td>
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| Identify the Spontaneous oxidation and reduction | Identifying the Spontaneous reaction of oxidation and reduction involves determining whether the reaction occurs naturally. A spontaneous reaction is a reaction that proceeds on its own without external assistance. To identify if a reaction is spontaneous, we can use the standard oxidation-reduction potential. If the standard oxidation-reduction potential is positive, it indicates that the reaction is spontaneous. If the standard oxidation-reduction potential is negative, it indicates that the reaction is not spontaneous.

- Review how to calculate the standard voltage of a cell.
- Conclude that the positive sign of cell standard voltage indicates that it is a spontaneous reaction.
- Conclude that the negative value of the cell standard voltage indicates that the reaction is not spontaneous.

- Chemical exterminates.

C30 Electro- and Nucleo- philes

| Electro- and Nucleo- philes (Electrophiles) | Identifying the Spontaneous reaction of oxidation and reduction involves determining whether the reaction occurs naturally. A spontaneous reaction is a reaction that proceeds on its own without external assistance. To identify if a reaction is spontaneous, we can use the standard oxidation-reduction potential. If the standard oxidation-reduction potential is positive, it indicates that the reaction is spontaneous. If the standard oxidation-reduction potential is negative, it indicates that the reaction is not spontaneous.

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- Conclude that the negative value of the cell standard voltage indicates that the reaction is not spontaneous.

- Chemical exterminates.
An electrophile is a substance which is rich in electrons. Examples include alkyl halides and hydrogen ions.

A nucleophile is a substance which is poor in electrons. Examples include water and halides.

To know that a double bond is considered as a rich center of electrons, take into consideration the following:

- The ability to undergo addition reactions with the double bond.
- The characteristics of the double bond, especially when hydrogen ions are not symmetrical at both sides of the double bond.

This topic has a relation with explaining why the double bond is a rich center of electrons, and how addition reactions happen in alkyl halides and the reason positive carbon ions and what happens when hydrogen ions are not symmetrical at both sides of the double bond.
|   |   |   | electron Nucleophile and give examples.  
<p>|   |   |   | • Write equations of reaction between alkynes and compounds such hydrogen halides or water  |</p>
<table>
<thead>
<tr>
<th>Code</th>
<th>Topic / concept</th>
<th>Objectives</th>
<th>Strategies</th>
<th>Math skills used/ needed</th>
<th>Application or integration; 1 in the same subject; 2- in other subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>C31</td>
<td><strong>Experimental techniques (measurements)</strong></td>
<td>- Name appropriate apparatus for the measurement of time, temperature, mass and volume, including burettes, pipettes and measuring cylinders - chose which is the most suitable for a certain purpose</td>
<td>- show all apparatus used - Demonstrations in the lab, drawings or through clips/videos. - work sheet and practices should be used to check the understanding of the student.</td>
<td>- add, subtract, multiply and divide - use averages and decimals - draw charts and graphs from given data - interpret charts and graphs - select suitable scales and axes for graphs - recognize and use the relationship between length, surface area and volume and their units on metric scales</td>
<td>- will be used in different parts of the curriculum specially in the preparation of salts (soluble/insoluble)</td>
</tr>
<tr>
<td>C32</td>
<td><strong>Experimental techniques Methods of separation</strong></td>
<td>- describe paper chromatography - interpret simple chromatograms - outline how chromatography techniques can be applied to colourless substances by exposing chromatograms to substances called locating agents</td>
<td>- Demonstrations in the lab, drawings or through clips/videos. - work sheet and practices should be used to check the understanding of the student.</td>
<td>- add, subtract, multiply and divide - draw charts and graphs from given data - interpret charts and graphs - use usual mathematical instruments (ruler)</td>
<td>- understand the importance of purity in substances in everyday life, e.g. foodstuffs and drugs</td>
</tr>
</tbody>
</table>
| C33 | **Experiment techniques**  
Methods of purification | -describe methods of purification by the use of a suitable solvent, filtration, crystallisation, distillation (including use of fractionating column).  
-suggest suitable purification techniques, given information about the substances involved | -to show all apparatus used in separation  
-Demonstrations in the lab for all methods used to separate different types of mixture.  
-to give the students different mixtures and ask which method should be used to separate the components  
-work sheet and practices should be used to check the understanding of the student. | -add, subtract, multiply and divide  
- draw charts and graphs from given data  
-interpret charts and graphs | -the fractional distillation of crude oil and fermented liquor |
|---|---|---|---|---|---|
| C34 | **Atomic structure** | -define proton number and mass number (nucleon number)  
-define isotopes  
-state the two types of isotopes as being radioactive and non-radioactive | -Drawing or figures for the atoms showing all parts of it (protons, neutrons, electrons and the shells)  
-Practice questions to retain the concept  
-work sheet and practices should be used to check the understanding of the student. | -add and subtract  
- draw charts and graphs from given data  
- interpret charts and graphs | -will be used in the periodic table when describing elements  
-state one medical and one industrial use of radioactive isotopes  
-electronic configuration |
| C35 | **Bonding ionic** | -describe the formation of ions by electron loss or gain  
-describe the formation of ionic bonds between metallic and non-metallic elements  
-describe the lattice structure of | -explain why metals tend to lose electron(s) and nonmetals tend to gain electron(s)/ refer electronic structure of noble gases  
-explain the formation of  | -add and subtract  
- draw charts and graphs from given data  
- interpret charts and graphs | -the formation of the bond and structure formed will be used to explain the properties of ionic compounds |
|   | ionic compounds as a regular arrangement of alternating positive and negative ions | cations and anions, by the writing the electronic configuration before and after gaining or losing electrons  
-introduce the topic and relate to electrostatic attraction  
-use drawings and figures  
-deduce the chemical formula from the drawing  
-explain how to binary ionic compounds  
-if technologies is available to show some animations | -think of new uses based on their properties |
|---|---|---|
| C36 | Bonding Simple covalent | -describe the formation of single covalent bonds in H₂, Cl₂, H₂O, CH₄ and HCl as the sharing of pairs of electrons leading to the noble gas configuration  
-describe the electron arrangement in more complex covalent molecules such as N₂, C₂H₄, CH₃OH and CO₂  
-describe the differences in volatility, solubility and electrical conductivity between ionic and covalent compounds  
-explain how two nonmetals share one pair of electron to become stable  
-explain the formation of single, double and triple bonds  
-explain the difference between lone pair and bonding pair of electrons  
-draw molecules for simple covalent compounds  
-if technologies is available to show some animations | -add and subtract  
-draw charts and graphs from given data  
-interpret charts and graphs | -use to explain many properties (physical) in Organic Chemistry or in Halogens. |
| C37 | Bonding | -describe the giant covalent structures of graphite and diamond  
-describe the macromolecular structure of silicon(IV) oxide (silicon dioxide) | animations | -start with carbon and its valence electrons  
-draw the a drawing for diamond showing that each carbon is surrounded with four carbon atoms, and the same graphite but show that each carbon atom is surrounded by three carbon atoms leaving one free moving electron  
-describe the properties of diamond and graphite bases on the structure of each  
-transfer the knowledge to diamond and graphite and apply it to silicon dioxide  
-add and subtract  
-draw charts and graphs from given data  
-interpret charts and graphs | -relate their structures to the use of graphite as a lubricant and of diamond in cutting  
-describe the similarity in properties between diamond and silicon(IV) oxide, related to their structures |
|-----|---------|-------------------------------------------------|--------|----------------------------------------|-----------------------------------------------|
| C38 | Bonding | -describe metallic bonding as a lattice of positive ions in a 'sea of electrons' and use this to | -draw the electronic configuration of a sodium atom, and show that each sodium atom is made out of a valence electron and a cation Na→ Na⁺ + e  
-show that a piece of sodium is made of sodium atoms arranged (solid) | -draw charts and graphs from given data  
-interpret charts and graphs | describe the electrical conductivity and malleability of metals relate to alloys |

| Metallic bonding | -draw the electronic configuration of a sodium atom, and show that each sodium atom is made out of a valence electron and a cation Na→ Na⁺ + e  
-show that a piece of sodium is made of sodium atoms arranged (solid) | -draw charts and graphs from given data  
-interpret charts and graphs | describe the electrical conductivity and malleability of metals relate to alloys |
-make the students define the metallic bonding based on the drawn structure.
-explain the properties of metals based on the structure of sodium.
-compare between the m.p. of Sodium, Magnesium and Aluminium to highlight the effect of the number of valence electrons on the strength of metallic binding.

| C39 | Stoichiometry | -use the symbols of the elements and write the formulae of simple compounds
-construct word equations and simple balanced chemical equations
-define the mole and the Avogadro constant
-calculate stoichiometric reacting masses and volumes of gases and solutions, solution concentrations expressed in g/dm³ and mol/dm³.
(Calculations involving the idea of limiting reactants may be set.
-calculate empirical formulae and molecular formulae

|   |   | -start by defining Avogadro’s number
-relate the mole to Avogadro’s number
-describe the concept of relative molecular and formula mass, and relate them to the mole.

-the best way to deliver the mole concept is to move slowly between the formulae with many examples

|   |   | -add, subtract, multiply and divide
-use averages, decimals, fractions, percentages, ratios and reciprocals
-recognise and use standard notation
-use direct and inverse proportion;

|   |   | -to be able to balance chemical equations in industry
-to be able to calculate the amount of reactants and products in any question or even in industrial applications.
-rate of reactions, calculating moles and amount of products such as the volume of a gas
<table>
<thead>
<tr>
<th></th>
<th></th>
<th>-calculate % yield and % purity</th>
<th>-define the term electrolysis, electrolyte and electrodes</th>
<th>-add and subtract and divide</th>
<th>-to know the applications of electrolysis (such as: electroplating, purifying copper, extraction of some metals; especially aluminium)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C40</strong></td>
<td><strong>Electrolysis</strong></td>
<td>-to be able to predict the products of electrolysis for molten and aqueous electrolyte</td>
<td>-show the students the different types of electrodes</td>
<td>-draw charts and graphs from given data</td>
<td>-high light the importance of salts as fuels</td>
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<td>-to show demonstrations and to test for the products formed on each electrode for molten and aqueous electrolytes</td>
<td>-interpret charts and graphs</td>
<td>-antacid as insoluble bases</td>
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<td>-to electroplate</td>
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<td>-uses of acids</td>
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<td>-testing for the acidity of soil</td>
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<td>-add and subtract</td>
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<td><strong>C41</strong></td>
<td><strong>Acids, bases and salts</strong></td>
<td>-preparation of soluble and insoluble salts</td>
<td>-describe the methods for the preparation of soluble salts by writing general equations: Acid + metal → salt + hydrogen</td>
<td>-draw charts and graphs</td>
<td>-suggest suitable</td>
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<td>-describe the following tests to identify: <strong>aqueous cations:</strong> aluminium, ammonium, calcium, copper(II), iron(II), iron(III) and zinc (Using aqueous sodium hydroxide and aqueous ammonia as appropriate). <strong>aqueous anions:</strong> carbonate (by reaction with dilute acid and then limewater), chloride (by reaction under acidic conditions with aqueous silver nitrate), iodide (by reaction under acidic conditions with aqueous lead(II) nitrate),</td>
<td>Acid + base → salt + water</td>
<td>-interpret charts and graphs</td>
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<td>-give example on each by doing a demonstration on each example</td>
<td>Acid + carbonate → salt + water + carbon dioxide</td>
<td>-draw conclusions from information given</td>
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<td></td>
<td>-describe the method for preparing insoluble salts by writing general equation :</td>
<td>Acid + alkali → salt + water</td>
<td>-interpret and evaluate observations and experimental data</td>
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<td>-describe tests for gases and ions, and/or draw conclusions from such tests</td>
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<td>-identify sources of error and suggest possible improvements in procedures</td>
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<td>-suggest suitable</td>
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<td>C42</td>
<td>Reactivity series</td>
<td>Extraction of iron</td>
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<td>-describe the ease in obtaining metals from their ores by relating the elements to the reactivity series -describe the essential reactions in the extraction of iron from hematite</td>
<td>-describe the position of the metal in the reactivity series -show that there are mainly three methods used to extract the metal from its ores bases on their position in the reactivity series (electrolysis, thermal</td>
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<td>- draw charts and graphs -interpret charts and graphs;</td>
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<td>-describe the idea of changing the properties of iron by the controlled use of additives to form steel alloys -name the uses of mild steel (car bodies and machinery) and</td>
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</tbody>
</table>

nitrate (by reduction with aluminium), sulphate (by reaction under acidic conditions with aqueous barium ions)

gases:
Ammonia (using damp red litmus paper), carbon dioxide (using limewater), chlorine (using damp litmus paper), hydrogen (using lighted splint), oxygen (using a glowing splint).

(Soluble salt +soluble salt $\rightarrow$ soluble salt + insoluble salt)
-show a demonstration for the preparation of the insoluble salt -give the students different salts and ask them which method could/should be used to prepare that steps, name the chemicals required and the steps needed -show all tests that should be done for the cations, anions and gases -then take different unknowns and start testing them with different reagents and ask them which ion does it contain
| C43 | **Organic chemistry polymers** | reduction and simple methods for purification (for native elements)  
-define the term reactivity series  
-show technologies to show both of the extraction of iron (blast furnace) and the electrolysis for aluminium from its ore. | stainless steel (chemical plant and cutlery)  
-describe methods of rust prevention, specifically paint and other coatings to exclude oxygen |

|   |   | -describe macromolecules in terms of large molecules built up from small units (monomers), different macromolecules having different units and/or different linkages  
-describe the formation of nylon (a polyamide) and Terylene (a polyester) by condensation polymerisation, the structure of nylon being represented as:  
and the structure of Terylene as: | -draw on the board or use the interactive white board  
-describe the polymer, by showing it is made out from repeating units known as monomers  
-show the students how the water molecules are formed when some hydrogen atoms and (OH) are broken from the monomers to form the polymer  
-highlight the different types of linkage (ester and amide linkage) give example on each and ask them to draw the polymer made of certain monomers  
-ask the students to  
-add, subtract, multiply and divide;  
-draw charts and graphs (for different types of organic molecules including polymers)  
-interpret charts and graphs |

|   |   | -describe the pollution problems caused by non-biodegradable plastics  
-name some typical uses of plastics and of man-made fibres  
-name proteins, fats and carbohydrates as the main constituents of food  
-describe proteins as possessing the same (amide) linkages as nylon but with different units  
-describe the hydrolysis of proteins to amino |
search for uses of any polymers and also to search to the disadvantage of monomers

 acids (structures and names not required)
 -describe fats as esters possessing the same linkage as Terylene but with different units

### Subject: Chemistry

**Grades: 11,12 SL**

<table>
<thead>
<tr>
<th>Code</th>
<th>Topic/Concept</th>
<th>Objectives</th>
<th>Strategies</th>
<th>Math skills used/needed.</th>
<th>Application or integration.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C44</td>
<td>Quantitative chemistry</td>
<td>-determining the limiting reactant and the reactant in excess.</td>
<td>- Virtual experiments can be used here. Solve problems involving theoretical, experimental and percentage yield.</td>
<td>-Division. -Subtraction. -Multiplication.</td>
<td>-The internal combustion engine, gasoline, when hydrocarbons are burnt in a limited supply of oxygen (incomplete combustion when produces carbon, carbon monoxide</td>
</tr>
</tbody>
</table>
### Quantitative Chemistry

**Mass and gaseous volume relationships in chemical reactions.**

| C45 | Solve problems using the Ideal gas equation PV = nRT | -Apply Avogadro’s law to calculate reacting volumes of gases.  
- Apply the concept of molar volume at standard temperature and pressure in calculations.  
The molar volume of an ideal gas under standard conditions is $2.24 \times 10^{-2}$ m$^3$ mol$^{-1}$ (22.4 dm$^3$ mol$^{-1}$).  
-Solve problems involving the relationship between temperature, pressure and volume for a fixed mass of an ideal gas.  
-Simulations can be used to demonstrate this.  
- Solve problems using the ideal gas equation, $PV = nRT$  
 T.O.K: The distinction between the Celsius and Kelvin scales as an example of an artificial and natural scale could be discussed.  
-Analyze graphs relating | -Multiplication.  
-Division.  
- The study of common gasses under different conditions.  
-To correlate the four macroscopic properties of gasses (P,V,T and the no of moles ). |
| C46 | Atomic structure  
Electron arrangement | - Explain the lines in the emission spectrum of the Hydrogen are related to electron energy levels.  
- Explain how the lines in the emission spectrum of hydrogen are related to electron energy levels.  
- Students should be able to draw an energy level diagram,  
- show transitions between different energy levels and recognize that the lines in a line spectrum are directly related to these differences.  
- An understanding of convergence is expected. Series should be considered in the ultraviolet, visible and infrared regions of the spectrum.  
- Calculations, knowledge of quantum numbers and historical references will not be assessed.  
- Interactive simulations modelling the behaviour of electrons in the  
<p>| - To explain the presence of energy levels in atoms and relate this to the colors of some metal ion compounds and fire works. |</p>
<table>
<thead>
<tr>
<th>C47</th>
<th><strong>Periodicity</strong></th>
<th>- Describe and explain the trends in atomic radii, ionic radii, first ionization energies and electro negativities for elements across period 3.</th>
<th>- Describe and explain the trends in atomic radii, ionic radii, first ionization energies and electro negativities for elements across period 3. - Databases and simulations can be used here.</th>
<th>- Relate this to strength of ionic and covalent compounds and its relation to solubility of compounds in different solvents. (Electro negativity and polarity of compounds).</th>
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<tbody>
<tr>
<td></td>
<td><strong>Physical properties</strong></td>
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<td></td>
<td><strong>Chemical properties</strong></td>
<td>Discuss the changes in nature, from ionic to covalent and from basic to acidic, of the oxides across period 3.</td>
<td>Discuss the changes in nature, from ionic to covalent and from basic to acidic, of the oxides across period 3. 3 Equations are required for the reactions of Na₂O, MgO, P₄O₁₀ and SO₃ with water.</td>
<td>- Relate the nature of oxides to to pollution (acidic rain) - The use of the basic oxides in neutralizing acidic soils.</td>
</tr>
<tr>
<td>C48</td>
<td><strong>Periodicity</strong></td>
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<td></td>
<td><strong>Chemical properties</strong></td>
<td>Discuss the changes in nature, from ionic to covalent and from basic to acidic, of the oxides across period 3.</td>
<td>Discuss the changes in nature, from ionic to covalent and from basic to acidic, of the oxides across period 3. 3 Equations are required for the reactions of Na₂O, MgO, P₄O₁₀ and SO₃ with water.</td>
<td>- Relate the nature of oxides to to pollution (acidic rain) - The use of the basic oxides in neutralizing acidic soils.</td>
</tr>
</tbody>
</table>
| C49 | **Energetics:**  
**Hess’s law** | - Determine the enthalpy change of a reaction that is the sum of two or three reactions with known enthalpy changes. Students should be able to use simple enthalpy cycles and enthalpy level diagrams and to manipulate equations. | - Determine the enthalpy change of a reaction that is the sum of two or three reactions with known enthalpy changes.  
- Students should be able to use simple enthalpy cycles and enthalpy level diagrams and to manipulate equations.  
- Students will not be required to state Hess’s law.  
TOK: As an example of the conservation of energy, this illustrates the unification of ideas from different areas of science. | - Multiplication.  
- Division.  
- Subtraction. | - Calculate the enthalpy change of reactions that cannot be measured directly or for reactions that cannot take place or isolated easily. |
<table>
<thead>
<tr>
<th>C50</th>
<th><strong>Oxidation and reduction</strong></th>
<th>Deduce redox equations using half equations.</th>
<th>H+ and H2O should be used where necessary to balance half-equations in acid solution. The balancing of equations for reactions in alkaline solution will not be assessed.</th>
<th>Adding and Subtracting negative and positive numbers. Multiplication. Division.</th>
<th>- To facilitate balancing equations and use this in determining the amount of oxidizing agents needed for certain reactions.</th>
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<tbody>
<tr>
<td></td>
<td><strong>Redox equations</strong></td>
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<tr>
<td>C51</td>
<td><strong>Organic chemistry</strong></td>
<td>Explain the reactions of methane and ethane with chlorine and bromine in terms of free radical mechanisms.</td>
<td>Reference should be made to hemolytic fission and the reaction steps of initiation, propagation and termination. The use of the half-arrow to represent the movement of a single electron is not required. The formulas of free radicals should include the radical symbol, for example, Cl•.</td>
<td>- To explain certain products of organic reactions.</td>
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<td><strong>Alkanes</strong></td>
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<td></td>
<td><strong>Free radical mechanisms</strong></td>
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<tr>
<td>C52</td>
<td>Measurements and data processing: uncertainties</td>
<td>-Determine and calculating uncertainties in results</td>
<td>Only a simple treatment is required. For functions such as addition and subtraction, absolute uncertainties can be added. For multiplication, division and powers, percentage uncertainties can be added. If one uncertainty is much larger than others, the approximate uncertainty in the calculated result can be taken as due to that quantity alone</td>
<td>Addition Subtraction Multiplication And Division</td>
<td>-To analyze errors and to relate this to the deviation and to errors and improvements. -To evaluate the experiment through the results and the error analysis.</td>
</tr>
<tr>
<td>Code</td>
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<tr>
<td>C53</td>
<td>Atomic structure</td>
<td>-Apply the Aufbau principle, Hund’s rule and the Pauli exclusion principle to write electron configurations for atoms and ions up to $Z = 54$.</td>
<td>-For $Z = 23$, the full electron configuration is $1s^22s^22p^63s^23p^64s^23d^3$ and the abbreviated electron configuration is $[\text{Ar}]4s^23d^3$ or $[\text{Ar}]3d^34s^2$. Exceptions to the principle for copper and chromium should be known. -Students should be familiar with the $\uparrow$-representation of the spinning electron in an orbital as an arrow in a box.</td>
<td>Addition. Subtraction.</td>
<td>1-In the same subject 2-In other subjects -Displaying the electronic configuration of certain atoms and relate this to colors of compounds and the catalytic activity of transition metals.</td>
</tr>
<tr>
<td>C54 a</td>
<td><strong>Periodicity:</strong> First row d-block elements</td>
<td>Describe and explain the formation of complexes of d-block elements.</td>
<td>Include [Fe(H2O)6]3+, [Fe(CN)6]3–, [CuCl4]2– and [Ag(NH3)2]2+. Only monodentate ligands are required.</td>
<td>Application in complex metric titration used in industry as means of estimating metal ion concentrations such as in determining the hardness of water, pigments and the study of light spectrum.</td>
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<td>C54 b</td>
<td>Explain why some complexes of d-block elements are coloured.</td>
<td>Students need only know that, in complexes, the d sub-level splits into two sets of orbitals of different energy and the electronic transitions that take place between them are responsible for their colours.</td>
<td></td>
<td>Dyes Pigments Fireworks Food dyes</td>
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<tr>
<td>C55</td>
<td><strong>Bonding</strong> Shapes of molecules and ions</td>
<td>Predict the shape and bond angles for species with five and six negative charge centres using the VSEPR theory.</td>
<td>Examples should include PCl5, SF6, XeF4 and PF6. <strong>Aim 7:</strong> Interactive simulations are available to illustrate this.</td>
<td>Geometry. Angles and Bond angles. Shapes and drawing shapes in space. Three dimensional shapes. To show how two or more atoms may link by sharing electron pairs in covalent bonds and represent the electronic structure of the resulting compound or ion. This is related to polarity of</td>
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<tr>
<td>C56</td>
<td><strong>Bonding</strong>&lt;br&gt;Hybridization</td>
<td>Explain hybridization in terms of the mixing of atomic orbitals to form new orbitals for bonding.&lt;br&gt;Identify and explain the relationships between Lewis structures, molecular shapes and types of hybridization (sp, sp2 and sp3).</td>
<td>Students should consider sp, sp2 and sp3 hybridization, and the shapes and orientation of these orbitals. <strong>TOK:</strong> Is hybridization a real process or a mathematical device?&lt;br&gt;Students should consider examples from inorganic as well as organic chemistry.</td>
<td>To explain the arrangement of atoms in molecules and relate this to the bonding in compounds especially carbon compounds of multiple bonds.</td>
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<td>C57</td>
<td><strong>Energetics:</strong> Born-Haber cycle</td>
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<td>- Construct a Born–Haber cycle for group 1 and 2 oxides and chlorides, and use it to calculate an enthalpy change.</td>
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<td>- Discuss the difference between theoretical and experimental lattice enthalpy values of ionic compounds in terms of their covalent character</td>
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<td>- A significant difference between the two values indicates covalent character.</td>
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<td>- Addition</td>
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<td>- Subtraction</td>
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<td>- Division</td>
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<td>- Multiplication</td>
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<thead>
<tr>
<th>C58</th>
<th><strong>Energetics spontaneity</strong></th>
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<tbody>
<tr>
<td></td>
<td>- Predict the effect of a change in temperature on the spontaneity of a reaction using standard entropy and enthalpy changes.</td>
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<td>- Predict whether a chemical reaction will take place or not by calculating the value of Gibbs free energy.</td>
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</tbody>
</table>

- To measure enthalpy changes of certain chemical reactions.  
- To measure electron affinities of certain atoms.  
- To conclude whether a compound is purely ionic or partially ionic.
<table>
<thead>
<tr>
<th>C59</th>
<th>Kinetics</th>
<th>Reaction mechanisms</th>
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</thead>
</table>
|     | - Explain that reactions can occur by more than one step and that the slowest step determines the rate of reaction (rate-determining step).
|     | - Describe the relationship between reaction mechanism, order of reaction and rate-determining step. |
|     | - Only examples with one- or two-step reactions where the mechanism is given will be assessed. |
|     | **TOK:** Agreement between rate equation and a suggested mechanism only provides evidence to support a reaction mechanism. Disagreement disproves the mechanism. |
|     | - Account for the photochemical smog.(air pollution). - Also to account for the order of a chemical reaction. |

<table>
<thead>
<tr>
<th>C60</th>
<th>Kinetics</th>
<th>Activation energy</th>
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<tbody>
<tr>
<td></td>
<td>- Describe qualitatively the relationship between the rate constant (k) and temperature.-----Determine activation energy (E_a) values from the Arrhenius equation by a graphical method. (T).</td>
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<td>- The Arrhenius equation and its logarithmic form are provided in the <em>Chemistry data booklet</em>. The use of simultaneous equations will not be assessed.</td>
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<td>- Dealing with powers. - Logs and Lens values - Graphs and calculating slopes from graphs. - Identifying intersections of x and y axis.</td>
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<td>- To show the effect of temperature on the rate of a chemical reaction. - To calculate the activation energy of a chemical industrial reaction and to be able to know the specific temperature needed to work out a chemical reaction.</td>
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<tr>
<td>C61</td>
<td>Acids and bases</td>
<td>-Describe the composition of a buffer solution and explain its action. Solve problems involving the composition and pH of a specified buffer system.</td>
</tr>
<tr>
<td>C62</td>
<td>Organic chemistry</td>
<td>-Describe stereoisomers as compounds with the same structural formula but with different arrangements of atoms in space. -Describe and explain geometrical isomerism in non-cyclic alkenes. -Describe and explain geometrical isomerism in C3 and C4 cycloalkanes</td>
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<td>Explain the difference in the physical and chemical properties of geometrical isomers.</td>
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<td>-Describe and explain optical isomerism in simple organic molecules.</td>
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<tr>
<td>-Include <em>cis</em>- and <em>trans</em>- 1,2- dichloroethylene as examples with different boiling points, and <em>cis</em>- and <em>trans</em>- but-2-ene-1,4-dioic acid as examples that react differently when heated.</td>
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<tr>
<td>Include examples such as butan-2-ol and 2-bromobutane. The term asymmetric can be used to describe a carbon atom joined to four different atoms or groups. The term chiral can be used to describe a carbon atom joined to four different atoms or groups, and also as a description of the molecule itself. Include the meanings of the terms enantiomer and racemic mixture. <strong>TOK:</strong> The existence of optical isomers provided indirect evidence of a</td>
<td>-Polarity of certain isomers and the solubility in polar and non polar solvents</td>
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</tbody>
</table>
tetrahedrally bonded carbon atom. This is an example of the power of reasoning in allowing us access to the molecular scale. Do we know or believe those carbon atoms are Tetrahedrally coordinated? The use of conventions in representing three-dimensional molecules in two dimensions could also be discussed.