

Learning Grids

For Edexcel AS and A Level (Year 1)
Chemistry

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Teacher's Introduction

These learning grids are designed to help your students independently learn content and will help you to assess their knowledge during teaching of each section of the **Edexcel AS / A level Year 1 Chemistry** specification. The concept is that your students are assigned a set of pages to read from the relevant book and are then asked to complete the relevant learning grids, possibly for homework or as a refresher for a topic. These activities are particularly useful for students who need more support, but they also contain some thought-provoking reasoning questions which will stimulate highly engaged students.

This resource is cross-referenced to:

- *Edexcel AS/A level Chemistry 1, Curtis, Murgatroyd and Scott, **Pearson**, 2015, ISBN 978-1-4479-9116-8*
- *Edexcel A Level Chemistry 1, Curtis, Hunt and Hill, **Hodder Education**, 2015, ISBN 978-147-1807466*

Each learning grid is closely linked to the Edexcel 2015 specification and to the approved textbooks. Relevant textbook page numbers are provided on each worksheet, to allow easy cross-referencing.

Each learning grid contains a range of question styles, including:

- **Quick-testing questions** – these may be a phrase, a definition or a numeric response.
- **Labelling questions** – designed to introduce structural and anatomical concepts to the student.
- **Missing-information / Match-terms-to-definitions questions** – test key knowledge quickly.
- **Explain-a-process questions** – encourage students to recognise cause and effect in chemical concepts.
- **Applied knowledge questions** – challenge students to apply knowledge in unfamiliar situations.
- **Core practicals** – ask students to analyse a practical and interpret its results.

Learning grids in this section will on average take 20 – 30 minutes each. However, this resource includes substantial opportunities to develop mathematics skills, and students who find maths challenging may find that these resources take longer to complete.

These resources can be used to engage students and allow those who have missed lessons to catch up quickly. They can be the basis for a homework exercise, and the answer scheme allows them to be easily used in cover lessons. Students could also use the worksheets as an independent learning and revision resource.

All resources can be photocopied in black and white.

We hope you and your students enjoy this resource!

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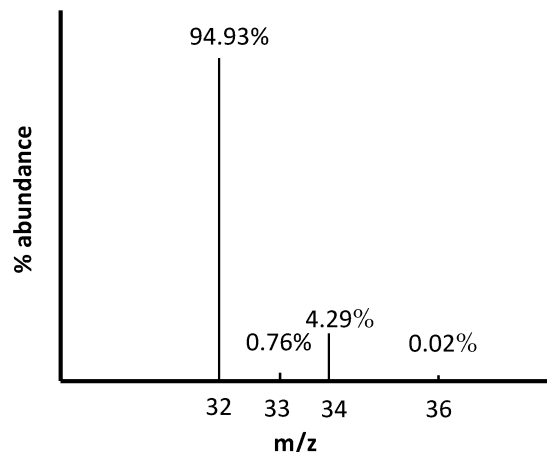
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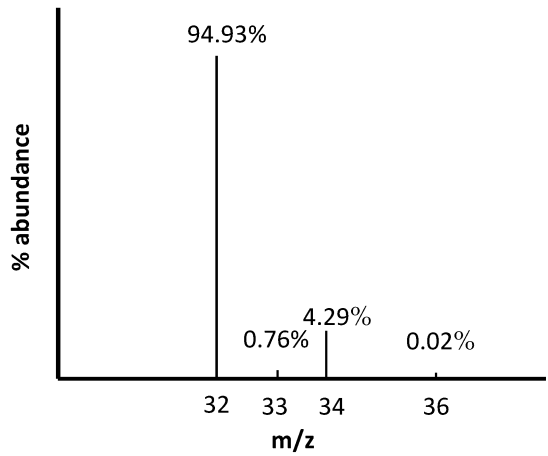
* resulting from minor specification changes, suggestions from teachers and peer reviews, or occasional errors reported by customers

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Selected Question and Answer Pages

For demonstration only, the sample answer pages immediately follow their corresponding question pages

	Question	Answer										
Mass spectrometry and Isotopes	<p>Using the % abundance and the mass-to-charge ratio (position of peak on m/z axis) calculate the relative atomic mass of sulfur. Give your answer to two decimal places.</p>  <table><caption>Mass Spectrum Data for Sulfur</caption><thead><tr><th>m/z</th><th>% abundance</th></tr></thead><tbody><tr><td>32</td><td>94.93%</td></tr><tr><td>33</td><td>0.76%</td></tr><tr><td>34</td><td>4.29%</td></tr><tr><td>36</td><td>0.02%</td></tr></tbody></table>	m/z	% abundance	32	94.93%	33	0.76%	34	4.29%	36	0.02%	
	m/z	% abundance										
	32	94.93%										
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	<p>Describe the mass spectrum of Cl₂, given that the isotopes ³⁵Cl abundance 75 % and ³⁷Cl abundance 25 % are the two main isomers of chlorine.</p>											
	<p>How can a spectrum from a mass spectrometer be used to identify a molecule?</p>											

	Question	Answer
Mass spectrometry and Isotopes	<p>Using the % abundance and the mass-to-charge ratio (position of peak on m/z axis) calculate the relative atomic mass of sulfur. Give your answer to two decimal places.</p> 	$\frac{(32 \times 94.93) + (33 \times 0.76) + (34 \times 4.29) + (36 \times 0.02)}{100}$ $= 32.09$
	<p>Describe the mass spectrum of Cl₂, given that the isotopes ³⁵Cl abundance 75 % and ³⁷Cl abundance 25 % are the two main isomers of chlorine.</p>	<p>Three peaks at:</p> <p>35 + 35 = 70; Relative intensity: 0.75 × 0.75 = 0.5625</p> <p>35 + 37 = 72; Relative intensity: 0.75 × 0.25 + 0.75 × 0.25 = 0.375</p> <p>37 + 37 = 74; Relative intensity: 0.25 × 0.25 = 0.0625</p>
	<p>How can a spectrum from a mass spectrometer be used to identify a molecule?</p>	<p>The furthest right peak in a mass spectrum is the molecular peak is the same as the mass of the molecule.</p>



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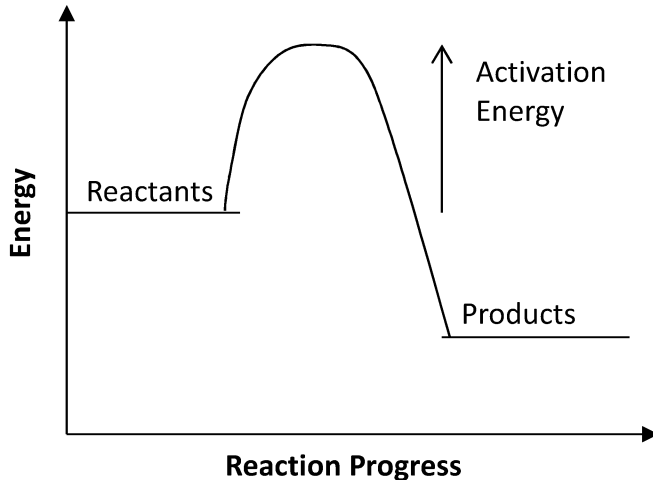
		Question	Answer
Electronegativity		What is 'electronegativity'?	
		What is the most electronegative element?	
		Why are the noble gases not included in the Pauling electronegativity scale?	
		The most electronegative atoms are all _____.	
		The electronegativity of X is greater than H. Show this using partial charges on the molecule.	
		Use the example of H—X to explain where this bond lies on the scale of covalent to ionic.	
		What names are given to this difference in electronegativity?	
		A C=O bond is a polar bond. Why is carbon dioxide not a polar molecule?	
		Name the different types of intermolecular forces.	
		Which of the three types of intermolecular forces is the weakest?	



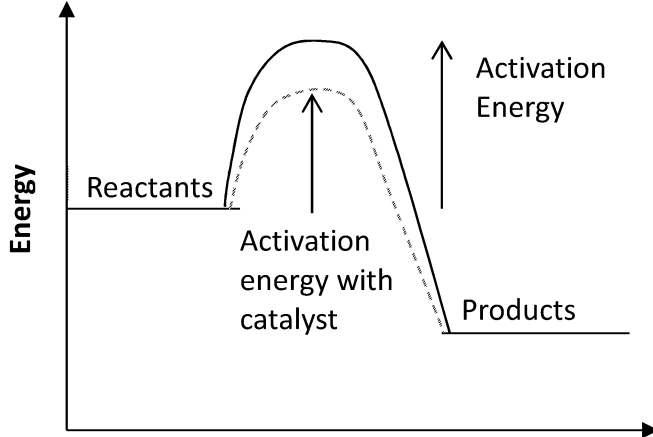
		Question	Answer
Electronegativity		What is 'electronegativity'?	<i>The ability of an atom to attract the bonding pair of electrons in a covalent bond</i>
		What is the most electronegative element?	<i>Fluorine</i>
		Why are the noble gases not included in the Pauling electronegativity scale?	<i>Because noble gases do not form stable compounds/</i>
		The most electronegative atoms are all _____.	<i>Non-metals</i>
		The electronegativity of X is greater than H. Show this using partial charges on the molecule.	$\delta^+ \text{H} - \text{X} \delta^-$
		Use the example of H—X to explain where this bond lies on the scale of covalent to ionic.	<i>In H—X, the electrons are closer to X than to H. This means that it is a covalent bond with some ionic nature/character.</i>
		What names are given to this difference in electronegativity?	<i>Polar bond / permanent dipole.</i>
		A C=O bond is a polar bond. Why is carbon dioxide not a polar molecule?	<i>The dipoles cancel out because the molecule is symmetrical.</i>
		Name the different types of intermolecular forces.	<ul style="list-style-type: none"> Induced dipole-dipole interactions (London Forces) Permanent dipole-dipole interactions Hydrogen bonds
		Which of the three types of intermolecular forces is the weakest?	<i>Induced dipole-dipole interactions (London Forces)</i>





		Question	Answer
Catalysts		How does a catalyst affect the rate of reaction?	
		The diagram opposite shows the position of the activation energy for a reaction. Draw a line on the diagram to show the activation energy for this reaction if a catalyst is used.	
		How would a fully labelled Boltzmann distribution graph be altered by the use of a catalyst?	
		What is a heterogeneous catalyst?	
		How does a solid catalyst work in a reaction where the reactants are gases?	
		Why is the use of a catalyst considered economically beneficial?	



	Question	Answer
Catalysts	How does a catalyst affect the rate of reaction?	Catalysts provide an alternative route of reaction with a lower activation energy. A lower activation energy will mean more collisions occur with enough energy to react, thus increasing the rate of the reaction.
	The diagram opposite shows the position of the activation energy for a reaction. Draw a line on the diagram to show the activation energy for this reaction if a catalyst is used.	<p>When a catalyst is used, the activation energy is lowered. The line drawn should appear below the line showing the activation energy (without a catalyst).</p> 
	How would a fully labelled Boltzmann distribution graph be altered by the use of a catalyst?	The graph would stay the same shape, only the position of the activation energy would move to the left. This shows an increase in the number of molecules with sufficient energy to react as a catalyst lowers the required energy to react.
	What is a heterogeneous catalyst?	A catalyst that is in a different physical state to the reactants.
	How does a solid catalyst work in a reaction where the reactants are gases?	Molecules of the reactants in the gas adsorb on the surface of the catalyst, providing a surface for the reaction to take place.
	Why is the use of a catalyst considered economically beneficial?	Using a catalyst lowers the heat and pressure required for a reaction to take place, so the reaction can take place at a lower temperature and pressure, reducing the cost of the process.



Additional Selected Question Pages



		Question	Answer
Burning alkanes		What is the general formula for an alkane?	
		Complete the following:	Alkanes are saturated hydrocarbons, so contain only _____ carbon-carbon and _____ hydrogen bonds.
		Describe the processes used in isolating useful alkanes from crude oil.	
		What pollutants can be formed during combustion of alkane fuels?	
		What products are formed during incomplete combustion of alkanes?	
		Poorly maintained household boilers can leak products of incomplete combustion. Why does this pose a health hazard?	
		What problems are associated with nitrous oxide and sulfurous oxide?	
		What process is carried out by a catalytic converter?	

	Question	Answer
Burning alkanes (continued)	Why are biofuels such as biodiesel and bioalcohols considered to be 'carbon-neutral'?	
	Describe two advantages and disadvantages of biofuels compared to natural gas.	



Pearson: Pages 184–185
Hodder: Pages 173–174

	Question	Answer
Reactions of alkanes	What is homolytic fission?	
	Represent the product of homolytic fission of Cl_2 .	
	Write the balanced equation for the complete combustion of pentane.	
	Alkanes can react with halogens such as chlorine to create a chloro-alkane. Name the mechanism for this type of reaction.	
	Name the three stages that take place in this mechanism.	

	Question	Answer
Reactions of alkanes (continued)	Using Cl_2 as a starting material, describe the conditions required for the initiation stage of the free radical substitution reaction.	
	Give two equations to show the main stages of the reaction using ethane as the organic molecule.	
	The final stages of the reaction involve radicals reacting with radicals. Write three equations to show this happening for this reaction mechanism.	
	Why is this type of mechanism difficult to control?	
	Why are free radical substitution reactions often not suitable for synthesis of organic molecules?	



	Question	Answer
Electrophilic reactions of alkenes	Give the general formula for alkenes.	
	Why are alkenes referred to as 'unsaturated hydrocarbons'?	
	What type of orbital overlap forms a double bond? What name is given to this type of bond? Draw a diagram to illustrate.	
	What is an electrophile?	
	Why can alkenes be attacked by electrophiles?	
	Draw a molecule of hydrogen bromide showing how it can act as an electrophile.	
	A chemist wants to convert an alkene to an alkane. Give the name of the process. What is required to carry out this conversion?	
	Which industrial process relies on this reaction? What are the starting materials?	