AS CHEMISTRY SUMMER TASKS 2018

Bideford College

- Abstract
- This booklet contains a set of tasks based on GCSE content. These concepts are still important at A Level and you need to return in September with a good knowledge of all of your GCSE Chemistry

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AS and A LEVEL

CHEMISTRY A AND CHEMISTRY B (SALTERS)
Learner Activity

Oxford Cambridge and RSA

Enthalpy changes

Learner Activity

Exothermic reactions

1. Write a definition of an exothermic reaction.

2. Draw an enthalpy profile diagram for an exothermic reaction.

   Label the axes, ΔH and the activation energy.

3. Give an example of an exothermic reaction.

Endothermic reactions

4. Write a definition of an endothermic reaction.

5. Draw an enthalpy profile diagram for an endothermic reaction.

   Label the axes, ΔH and the activation energy.

6. Give an example of an endothermic reaction.

Bond enthalpy

7. Write a definition of bond enthalpy. (You might know this term as ‘bond energy’.)

8. In a chemical reaction, bonds in the reactants are broken, and new bonds are formed to make the products. Complete the following sentences.

Energy is [ ] to break bonds.

Energy is [ ] when bonds are formed.

The overall energy change of a reaction is the

[ ]

Calculations

Remember:

enthalpy change = energy required to break bonds – energy released in making bonds

or

$\Delta_r H = \Sigma$(bond enthalpies in reactants) – Σ(bond enthalpies in products)

9. Use bond enthalpies to calculate the enthalpy change for the following reaction.

$H_2(g) + Br_2(g) \rightarrow 2HBr(g)$

Bond	H–H	Br–Br	H–Br
Bond enthalpy / kJ mol^{-1}	438	193	366

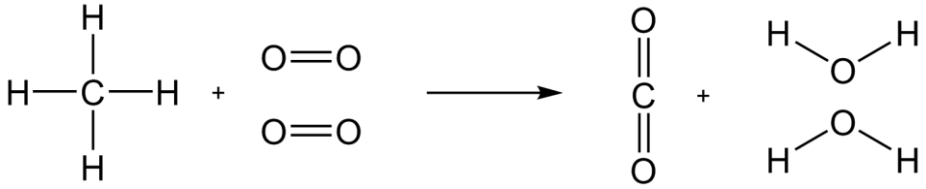
Energy required to break bonds:

Energy released in forming new bonds:

Enthalpy change:

10. Use bond enthalpies to calculate the enthalpy change for the combustion of methane.

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$



Bond	C–H	C–C	O–H	C=O	O=O
Bond enthalpy / kJ mol^{-1}	413	347	464	805	498

Energy required to break bonds:

Energy released in forming new bonds:

Enthalpy change:

11.

Bond	C–H	C–C	H–H	C=C
Bond enthalpy / kJ mol^{-1}	413	347	436	612

Use the bond energies above to calculate

a) the enthalpy change for the hydrogenation of ethene

$H_2C{=}CH_2(g) + H_2(g) \rightarrow CH_3CH_3(g)$

b) the enthalpy change for the cracking of decane

$C_{10}H_{22}(g) \rightarrow H_2C{=}CH_2(g) + C_8H_{18}(g)$

12. Explain in terms of bond breaking and bond formation why combustion reactions are exothermic but cracking reactions are endothermic.

Bonding and structure

Student Activity

Introduction

In your study of Bonding and Structure at A Level, you will be building a lot on ideas that you have already covered previously. Because bonding is a complex subject that is often simplified at GCSE, many learners can have unclear ideas or misconceptions about the topic. This activity will encourage you to explore what you already understand about chemical bonding, and to identify those areas that you still struggle with or require refinement at A Level.

Task 1

Here are twenty statements about chemical bonding. Each is “Always True” or “Normally True”. Decide which is which!

Task 2

For the statements that you think are not always true, try to think up some exceptions to the rule. You could use an equation or example element or compound to illustrate the ‘exception to the rule’. Feel free to consult textbooks or other resources to help you with this.

Extension

If you have confidently identified all of the ‘rules of thumb’ and provided each with an exception to the rule, now see if you can think of any other parts of chemistry where we use ‘rules of thumb’, analogies or simplifications that are not strictly true. Some topics you could think about include atomic structure, reactivity, solubility, or acid–base theory.

OCR
Oxford Cambridge and RSA

Statements for use in activity

A. The atoms of Group 2 elements have two electrons in their outer shell.	**B. Noble gases do not form any types of bonds because they have full outer shells.**
C. Ionic substances have higher melting points than covalent substances.	**D. Oppositely charged ions attract.**
E. Delocalised electrons are more stable than electrons in fixed atomic orbitals.	**F. Energy is released when ionic bonds form.**
G. In an ionic compound, ions are combined in proportions which balance out the electrical charges.	**H. Energy is needed to break covalent bonds.**
I. Energy is required to form positive ions from atoms.	**J. Energy is released when negative ions are formed from atoms.**

CHEMISTRY A AND CHEMISTRY B (SALTERS)
Learner Activity

Statements for use in activity

K. Bonding within compounds is either ionic or covalent.	**L. Electrons shared between atoms (in molecular orbitals) are more stable than electrons in atomic orbitals.**
M. Electrons that are closer to the nucleus experience less shielding and are more strongly attracted than electrons further away.	**N. A covalent bond is formed from a shared pair of electrons; one electron comes from each atom within the bond.**
O. Compounds are more stable than elements.	**P. Elements always react to form ions with noble gas electron configurations.**
Q. Ionic compounds are formed when metals react with non-metals.	**R. Covalent compounds are formed when non-metals react with other non-metals.**
S. Hydrogen atoms form ions by losing one electron and becoming H^+.	**T. Within a covalent compound, all elements except hydrogen have eight electrons in their outer shells.**

Supporting/further information

If you would like to go further, the Royal Society of Chemistry has produced some excellent classroom resources to help identify and address learner misconceptions about bonding and ion formation; the three resources most pertinent to the checkpoint task are given below.

Stability and reactivity:

http://www.rsc.org/learn-chemistry/resource/res00001103/stability-and-reactivity

This resource gets learners to think in further detail about the relative stability of atoms and ions as well as elements vs compounds.

Why do atoms form ions?:

http://www.rsc.org/learn-chemistry/resource/res00000111/afl-why-do-atoms-form-ions

This ties in very well with the resource above and can help learners think about ion formation and ionic bond formation in the context of energy changes and electrostatic attractions.

Ionisation energy:

http://www.rsc.org/learn-chemistry/resource/res00001101/ionisation-energy

This is a fairly challenging true/false exercise which learners can use to test their understanding of ion formation, again in terms of energy changes and electrostatic attractions rather than the octet rule.

Amount of substance

Student Activity

Introduction

Often learners have very different levels of understanding when it comes to chemical calculations and the mole. This activity will probe your understanding of the words used to describe chemical quantities and amounts, and how they relate to the symbols (balanced equations), calculations and observations that happen in chemical reactions. You may find that your ideas change and evolve as you discuss the activity, so don't be concerned if you find some of the concepts difficult.

Task 1

Read through each of the ten statements below. Decide whether you think each statement is true or false and make a note of your answers.

1. The total number and type of atoms present are the same at the start and end of a reaction.

2. The amount of substance, measured in moles, is the same at the start and end of a reaction.

3. The total mass of reactants is equal to the total mass of products for any reaction.

4. The total volume of gas is the same at the start and the end of a reaction.

5. The amount in moles is proportional to the number of particles for that substance.

6. One mole of methane molecules (CH_4) contains 1/5 mole of carbon atoms and 4/5 mole of hydrogen atoms.

7. One mole of methane molecules (CH_4) contains 1 mole of carbon atoms and 4 moles of hydrogen atoms.

8. 100 cm^3 of methane gas contains the same number of molecules as 100 cm^3 hydrogen gas at room temperature and pressure.

9. 100 cm^3 of methane gas at room temperature and pressure has the same mass as 100 cm^3 of hydrogen gas under the same conditions.

10. If 0.1 mol of magnesium atoms reacts with a solution containing 0.1 mol of hydrochloric acid, 0.1 mol of hydrogen molecules will be produced. (Hint – you may need to look up or work out the balanced equation for this reaction.)

Task 2

Now for the difficult bit! For each of the statements you will need to justify your true/false answer with an explanation or an example. If you have decided that a statement is true, try to give an explanation using the chemical concepts and definitions you know. If you have decided that a statement is false, you could find an example of a chemical process, reaction or balanced equation where it is not the case. You are free to look up information using whatever resources you have available to assist you with your explanations.

Extension

Read through the statements again and imagine you are trying to teach the concept of 'amount of substance' to a class of younger pupils who are having difficulty understanding. What practical demonstrations / activities / everyday examples can you think of that will help them understand?

Structure and bonding

Learner Activity

Covalent bonding

Explain how a covalent bond forms and what a covalent bond is.

Explain why Carbon Dioxide is a gas at room temperature and pressure whereas Silicon Dioxide is a high melting solid. (Note, Si and C are both in group 4)

Explain why diamond is an insulator but graphite is a conductor.

Ionic bonding

Describe how magnesium reacts with chlorine. Use diagrams to show what happens during the reaction.

Describe the arrangement of ions in an ionic solid.

Discuss the conductivity of ionic substances as solids, solutions and liquids.

Metallic bonding

Use words and a diagram to describe metallic bonding. Explain how metals conduct electricity and heat.