CHEMICAL REACTIONS

2^ ITT – Gardascuola

CLIL Module

Physical and Chemical Changes

Unit 1

Lesson objectives

- to get familiar with the most common physical and chemical changes occurring in matter
- to be able to tell apart a chemical from a physical change
- to know the clues to identify a chemical reaction

Task 1

- Before we start the lesson, assess your knowledge of the key vocabulary you should already know, by filling the blanks with the correct word from the list below. Note that there are words which you do not need to use.

pure substances - reversible / irreversible - phase change (or phase transition) - states of aggregation - freezing / melting - condensation / vaporization - molecules - deposition / sublimation - mass - forces - mixtures - distillation - heat - physical changes

Change: physical vs. chemical

Physical

No new substance is created during a physical change, although the matter takes a different form. Size, shape and sometimes colour of matter may change.

- Phase changes are physical changes. Mixing is a physical change when the mixed substances do not chemically react.
- Physical changes are reversible (though not always easy to reverse).

Chemical

A chemical change produces new substances: one or more substances are transformed into one or more new and different substances.

- A chemical change, also known as a chemical reaction, involves the rearrangement of atoms to form new substances.
- Most chemical changes are irreversible, except via another chemical reaction.

Task 2

- Discuss and classify the following actions (changes), by using the T-chart on your worksheet:
  A. Breaking a glass
  B. Producing wine from grapes
  C. Mixing sugar and coffee
  D. Cutting ham into slices
  E. Cooking an egg
  F. Baking a cake

Physical changes: examples

Illustration: Hugo Lin, © ThoughtCo., 2018

Physical changes: further examples

- Melting an ice cube
- Breaking a bottle
- Chopping an apple
- Boiling water
- Dissolving sugar in water
- Mixing water and oil
- Evaporating alcohol
- Shredding paper
- Sublimation of dry ice into carbon dioxide vapor
- Crumpling a paper bag
- Casting silver in a mold
- Mixing salt and sand
- Filling a candy bowl with different candies

Chemical changes: examples

Illustration: Hugo Lin, © ThoughtCo., 2018

Chemical changes: further examples

- Cooking an egg
- Milk going sour
- Mixing vinegard and baking soda
- Heating sugar to form caramel
- Baking a cake
- Burning a candle
- Grilling a hamburger
- Rusting of iron (oxidation)
- Pouring peroxide on a wound
- The metabolism of food in the body (digestion)
- Electroplating a metal
- Using a chemical battery
- The explosion of fireworks
- Rotting bananas
- Photosynthesis
- Making cheese
- Making wine

How to recognize a chemical change?

- Releasing gas (bubbles)
- Absorbing or releasing energy (heat, light, …)
- Changing colour
- Releasing an odour
- Disappearance of a solid
- Precipitation of a solid from a liquid solution
- Inability to reverse the change
- Change in the chemical properties of the sample (e.g., flammability, oxidation state)

Task 3

- Light a match and observe while it is burning. Use the binary key pattern on your worksheet to determine the nature of the change.
- When finished, write down a few sentences where you explain how you reached your conclusion (chemical or physical change).

Task 4

- Record 3-6 new English words you have learned today.
- Ask your peer to translate or make a sentence out of them.

Chemical Reaction

Unit 2

Elements, Compounds & Chemical Equation

Lesson 1

Chemical Reaction

Unit 2

Task 1

- Match the opposites:

to release	to be inert
to light	base
to react	to absorb
to heat	condensation
empty	to put out
pure substance	freezing
acid	full
vaporisation	decomposition
melting	to cool
synthesis	mixture

Elements …

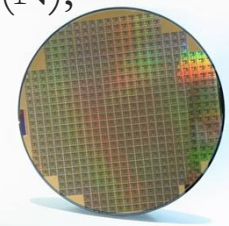
Element

An element is a substance consisting of only one type of atom, which:

- cannot be broken down into two or more new substances,
- cannot be changed into another element using chemical means.

- There are 118 known elements, 94 of which are known to occur naturally on Earth. The others are called synthetic elements.
- Elements are the basic chemical building blocks of matter: oxygen (O), iron (Fe), silicon (Si), carbon (C), hydrogen (H), nitrogen (N), Al (aluminum), Ca (calcium), etc

Periodic Table of Elements



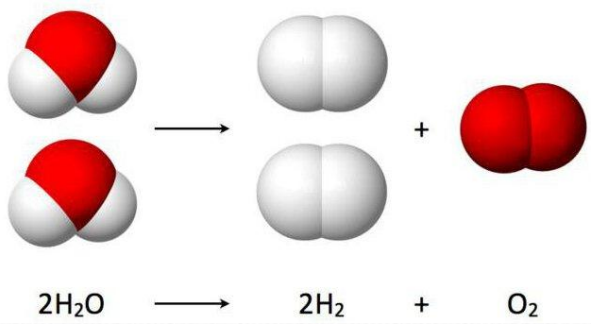
… and compounds

Compound

A compound is a substance made up of two or more elements.

- Examples: H_2O (water), NaCl (sodium chloride)
- It can broken down into their constituent elements by a chemical reaction (decomposition reaction). For example:

water → hydrogen + oxygen

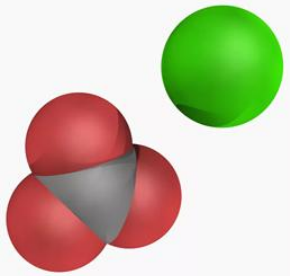


Atoms and molecules

Atom

An atom is the smallest particle of an element.

- It cannot be broken by any chemical reaction.
- It has the chemical properties of that element.



Molecule

A molecule consists of two or more atoms chemically bonded with each other.

- If the atoms (→ elements) are different from each other, the molecule represents the smallest particle of a compound: H_2O, CaO (calcium oxide), $C_6H_{12}O_6$ (glucose), …
- Sometimes the bonded atoms are the same: N_2, O_2, O_3 (ozone), Cl_2 (chlorine), …

Task 2

- On your worksheet, complete the multiple-choice quiz.

Chemical equation

- A chemical equation is the symbolic representation of a chemical reaction, where the *REACTANTS* (starting substances used to obtain the reaction, also called reagents) are on the left side of an arrow and the *PRODUCTS* (the ending substances thus obtained) are on the right side.
- Examples:
  a. methane + oxygen → carbon dioxide + water
  b. hydrogen + oxygen → water
  c. sucrose → carbon + water

Chemical equation

- A special notation, called *CHEMICAL FORMULA*, consisting of letters and numbers, is used to represent the substances (elements or compounds) that take part in a reaction.
- Numbers put before the formulas are used to represent the ratios of reactants and products to produce the reaction. They are called *COEFFICIENTS*.
- Arrows point to the direction a reaction occurs, i.e. from reactants to products.

a. methane + oxygen → carbon dioxide + water

$$CH_4 + 2\,O_2 \rightarrow CO_2 + 2\,H_2O$$

c. sucrose → carbon + water

$$C_{12}H_{22}O_{11} \rightarrow 12\,C + 11\,H_2O$$

Chemical equation

- It's also common to indicate the state of matter in a chemical equation by including parentheses and an abbreviation right after a chemical formula.

  $CH_{4\,(g)} + 2\,O_{2\,(g)} \rightarrow CO_{2\,(g)} + 2\,H_2O_{\,(l)}$

  $C_{12}H_{22}O_{11\,(s)} \rightarrow 12\,C_{\,(s)} + 11\,H_2O_{\,(l)}$

  (g) means the substance is a gas, (l) a liquid, (s) a solid.

- Another symbol you may see is (aq), which means the chemical species is in water (aqueous solution). For example: $HCl_{\,(aq)}$, $AgNO_{3\,(aq)}$
- Another symbol you may see is "↓",which means a solid is formed from a liquid solution as a result of a precipitation reaction. For example: AgCl↓

Task 3

- Skim through the questions on your worksheet, then watch the video. When it is over, discuss and agree with your group mates upon the possible answers to the questions. Write them down.

https://www.khanacademy.org/science/biology/chemistry--of-life/chemical-bonds-and-reactions/v/chemical-reactions-introduction