

4. CLASSIFYING IN CHEMISTRY

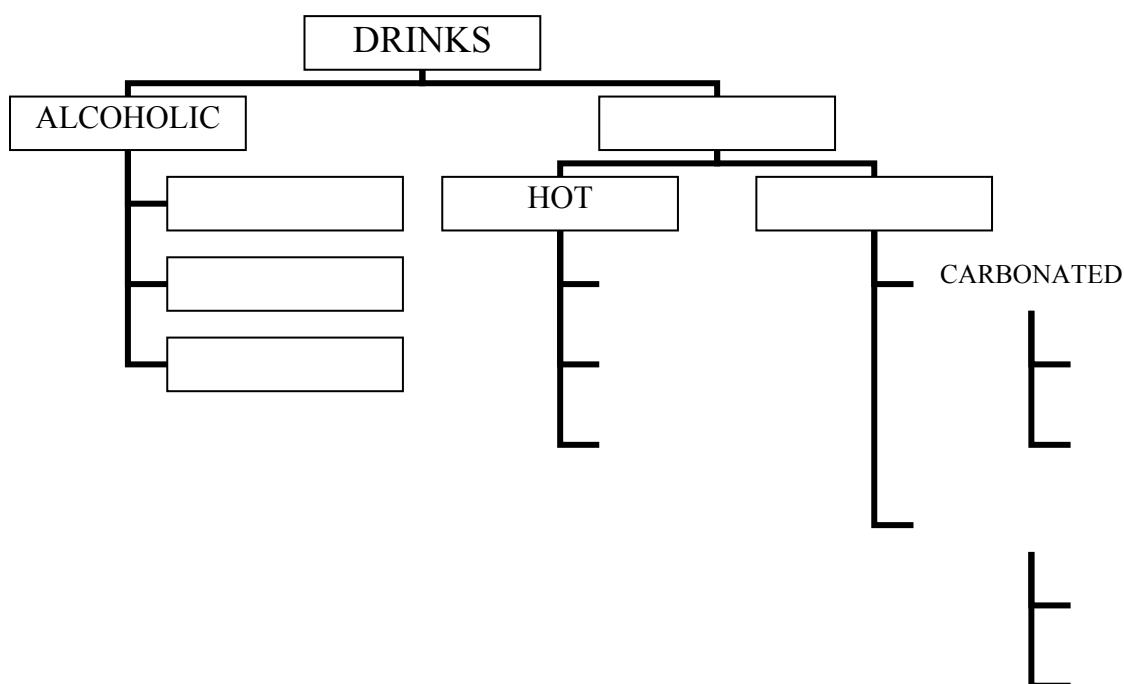
1. Speaking. Work in pairs. Discuss these questions:

- a) What did you drink this morning?
- b) Do you drink tea / coffee every day? Which kind?
- c) What's your favorite drink? How much of it do you drink every day / week?
- d) How often do you go drinking to a pub/tearoom/cafe? What is the best place that you know? Where is it? How often do you go there?
- e) What do you usually like to drink when you go out?
- f) What is your favourite pub? Have you ever left a pub without paying?
- g) What drink do you hate? Why do you hate it?
- h) How many litres of water do you drink every day? Do you prefer tap water or bottled water?
- i) What is a typical drink of your country? What about other countries?
- j) What is the cheapest / the most expensive / the strangest drink that you know?
- k) What drink do you think is the most / least healthy?
- l) Do you prefer carbonated or non-carbonated drinks? (with or without bubbles)¹

2. The following is a list of drinks.

Try to complete the classification diagram below with the following words:

non-alcoholic, coffee, cold, non-carbonated, beer, vodka, tea,
cocoa, tonic, drinking water, juice, wine, coca-cola



3. Speaking. Discussion these points in small groups.

- a) How might you classify students in this class or school? According to ...
- b) What are some ways you could classify foods?
clothes?cars?schools?films?cities?academic subjects?animals?jobs?people in your town or country?music?
- c) A nutritionist might be interested in classifying food according to calories, cholesterol content, sugar content etc. What type of classification might interest a biologist? A meteorologist? A psychologist? A police detective? A football player?
- d) What about a chemist? What can you classify in chemistry? Think about chemistry books. What can we divide into groups / classes / categories?

4. CLASSIFYING MATTER.

Reading. Read the following passage aloud. Mind your pronunciation. Then underline the items which are classified and draw a diagram.

Vocabulary:

matter (n) – hmota

solid (n/adj) - pevná látka, pevný

liquid (n/adj) - kapalina, kapalný

gas (n), gaseous /adj.) – plyn, plynný

weight / mass (n) - hmotnost, váha

shape and volume (n) – tvar a objem

movement / motion (n) - pohyb

firm / rigid (adj) – pevný, neohebný, tuhý

definite form (adj+n) – určitá (přesně daná) forma

force (n) – síla

heat the substance (n) – zahřát látku

oxygen (n) – kyslík

iron (n)- železo

sulphur (n) – síra

carbon dioxide (adj+n) - oxid uhličitý

densely packed atoms - hustě natěsnané atomy

loosely structured - ve volné struktuře

arranged in a definite pattern –

uspořádané do určitého vzorce

pour (v) – lít

flow all over the surface - rozlévat se po povrchu

attract each other – přitahovat se navzájem

compress or expand (v) – stlačit se nebo se roztahovat

The Nature of Matter²

1	Everything around us consists of matter : this paper, your body, the air you breathe, and the water you drink. Matter is anything that has weight or mass and takes up space.
2	All matter may be classified as either solid , liquid , or gas . Solids are firm and have a definite form . Rubber, wood, glass, iron , cotton, and sand are all classified as solids . A considerable force would be needed to change the shape or volume of an iron bar, for example, because the atoms or molecules of a solid are densely packed and have very little freedom of movement .
3	Solids may be further divided into two classes: crystalline and amorphous. Rocks, wood, paper, and cotton are crystalline solids . Crystalline solids are made up of atoms arranged in a definite pattern . When these solids are heated , the change to a liquid, known as melting , is sharp and clear. Amorphous substances include rubber, glass, and sulphur . In these substances , the pattern of atoms is not orderly, and when heated , they gradually soften.
4	Liquids , on the other hand, are not rigid . If water, milk, or oil is poured on a table, it will flow all over the surface . The atoms or molecules of liquids attract each other and thereby enable liquids to flow. But these atoms are loosely structured and do not keep their shape . Therefore a liquid will take the shape of any container in which it is poured . However, liquids have a definite volume : a quart of milk cannot fit in a pint container.
5	Gases , such as air, oxygen , and carbon dioxide , have no fixed shape or volume of their own. They diffuse or spread out to fill any container. The atoms or molecules of gases are widely spaced and move very rapidly. They either compress or expand to adapt to any area.
6	Everything we know is made of matter in solid , liquid or gaseous form.

Diagram:



5. Speaking. Work in pairs.
Describe the diagram that you have drawn, using the typical classifying vocabulary:

Matter	is/are may be can be could be	classified grouped divided arranged categorized	into	divisions groups types classes categories classifications
		classified categorized classed grouped	as	solid, liquid, or gas

There are three	types kinds classes categories	of matter
-----------------	---	-----------

Oxygen is	a type a kind a form an example	of gas
-----------	--	--------

Everything	is made up of is composed of consists of	matter.
------------	--	---------

Amorphous substances	include comprise	rubber, glass, and sulphur
----------------------	---------------------	----------------------------

6. Listening.³

Watch the video. Fill in the gaps.

Useful vocabulary:

assume the shape - přebírat tvar

particles collide with each other (n) – částice se srážejí

separated (adj) oddělený

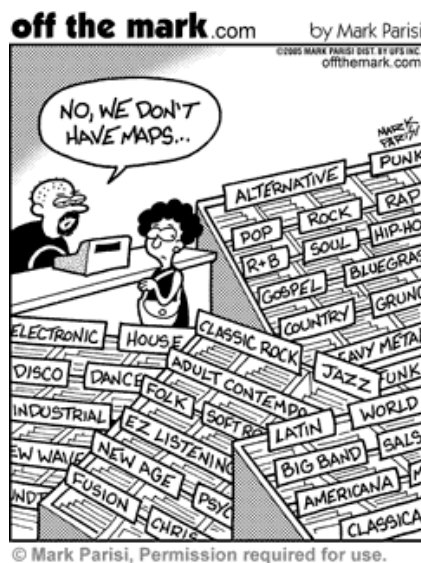
in a completely random manner - zcela náhodně

slip past (v) – míjet

The states of are gas, liquid and solid. Gasses assume the shape and of their container. Particles of a gas are separated from each other, move in straight lines, and in a completely random manner. They change direction only when they collide with each other or the

Liquids have a volume, and assume the shape of their containers. The particles of a liquid are closely spaced, and so their motion is still random, but much more The particles slip past, and collide with, near-neighbors.

Solids have a definite and volume. Particles of solids are in positions, and collide only with near-neighbors.



7. Presentations. Work in small groups.

Each group will get a text describing something from the area of chemistry.
Read the text and underline all the things that are classified.
Then draw your diagram on a poster.

In the end of the lesson, present your poster to the others.
To describe the poster, use the vocabulary that you have learnt today.
(e.g. *may be divided into four parts, can be classified as...*)

You can enrich your presentation with these phrases:

I would like to talk about...

First of all... Finally...

That's all. Thank you for your attention.

Texts for Presentations:

A)

Matter is anything with mass and volume. It can be divided into pure substances (matter with constant composition) and mixtures (matter with variable composition). Substances can be further subdivided into elements (substances made up of only one type of atom) and compounds (two or more elements that are chemically combined). Examples of elements are gold, silver, carbon, oxygen and hydrogen. Compounds include water, carbon dioxide, sodium bicarbonate, carbon monoxide. There are two basic types of mixtures. Heterogeneous mixtures are mixtures that are made up of more than one phase, such as sand or soil. Homogeneous mixtures, also called solutions, are mixtures that are made up of only one phase, for instance salt water, pure air or metal alloys.

Available at <http://www.fordhamprep.org/gcurran/sho/sho/lessons/lesson14.htm>

B) Substances can be classified as acids, bases and salts. An acid is a substance that gives H^+ ions when dissolved in water. Acids are usually compounds of non metals with hydrogen and sometimes oxygen. Sulphuric, hydrochloric and nitric acids are inorganic. There are also organic acids, such as the acetic acid (found in vinegar) Many acids only show acidic properties when water is present. Acids are corrosive and can burn flesh and dissolve metal. A base is a substance that gives OH^- ions when dissolved in water. Bases are usually metal hydroxides. Examples include sodium hydroxide, $NaOH$, calcium hydroxide, $Ca(OH)_2$. Alkalis have a soapy feel and can corrode. The solution of a base in water is called an alkali. A salt results when an acid reacts with a base. Both are neutralised. The H^+ and OH^- ions combine to form water. The non metallic ions of the acid and the metal ions of the base form the salt. Examples of salts are $NaCl$ (sodium chloride, or common salt) or $CaSO_4$ (Calcium Sulphate).

Available at <http://www.krysstal.com/acidbase.html>

C) Matter is frequently classified according to its electrical conductivity as a conductor, nonconductor, or semiconductor. Conductors have many electrons that are free to move and are useful in carrying, or conducting, electric current. All metals, particularly silver, copper, gold, and aluminum, are good conductors. Substances with few free electrons are called nonconductors, or insulators, because they do not carry electric charge and can be used to prevent electricity from flowing where it is not wanted. Air, wood, glass, and plastic are insulators. A few substances, like carbon, silicon, and germanium, do not fall into either of these categories. They are classed as semiconductors and are used in such electronic devices as transistor radios.

Source: Zimmerman, Fran. *English for Science*. New Jersey 1989.

D)

The periodic table is divided into three groups.

Most elements are metals. They are typically shiny, good conductors of heat and electricity, have a high density, and only melt at high temperatures. Metals are ductile and malleable, so their shape can be easily changed into thin wires or sheets. Metals will corrode, gradually wearing away like rusting iron. Examples of metals include mercury, silver and gold.

Nonmetals, on the right side of the periodic table, are very different from metals. Their surface is dull and they are poor conductor of heat and electricity. As compared to metals, they have low density and will melt at low temperatures. The shape of a nonmetal cannot be changed easily as they tend to be brittle and will break. Nonmetals include hydrogen, carbon and oxygen. Elements that have properties of both metals and nonmetals are called metalloids. They can be shiny or dull and their shape is easily changed. Metalloids typically conduct heat and electricity better than nonmetals but not as well as metals. Examples of metalloids are silicon, germanium and arsenic.

Available at <http://www.windows.ucar.edu/tour/link=/earth/geology/metals.html&edu=high>

E)

Oxides are compounds containing oxygen combined with a single element. Oxides can be acidic, basic or neutral. Acidic oxides react with water to form an acid. Sulphur trioxide (SO_3) reacts with water to form Sulphuric Acid: $\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$. Other acidic oxides include SO_2 , CO_2 , NO and NO_2 . Basic Oxides react with water to form an alkali.

Most metal oxides are basic. Ammonia (NH_3) behaves like a basic oxide when it reacts with water to form a weak alkali, Ammonium Hydroxide (NH_4OH).

Neutral Oxides are either insoluble in water or do not form acids or alkalis when dissolved. Carbon Monoxide (CO), Dinitrogen Oxide (N_2O) and water are neutral.

Acidic Oxides and Basic Oxides react together to form a Salt:

Acidic Oxide + Basic Oxide \rightarrow Salt

In the example below, Sulphur Trioxide combines with Sodium Oxide to form the salt, Sodium Sulphate: $\text{SO}_3 + \text{Na}_2\text{O} \rightarrow \text{Na}_2\text{SO}_4$

Available at <http://www.krysstal.com/acidbase.html>

F)

Chemical compounds are formed by the joining of two or more atoms by chemical bonds.

Covalent chemical bonds involve the sharing of a pair of valence electrons by two atoms, in contrast to the transfer of electrons in ionic bonds. Covalent bonds in which the sharing of the electron pair is unequal, with the electrons spending more time around the more nonmetallic atom, are called polar covalent bonds.

In ionic bonding, electrons are completely transferred from one atom to another. In the process of either losing or gaining negatively charged electrons, the reacting atoms form ions. Typical of ionic bonds are those in the alkali halides such as sodium chloride, NaCl .

Another type is metallic bonding. The properties of metals suggest that their atoms possess strong bonds, yet the ease of conduction of heat and electricity suggest that electrons can move freely in all directions in a metal.

Hydrogen bonding differs from other uses of the word "bond" since it is a force of attraction between a hydrogen atom in one molecule and a small atom of high electronegativity in another molecule.

Available at <http://hyperphysics.phy-astr.gsu.edu/>

8. HOMEWORK Word-formation (Slovotvorba – změna slovních druhů):⁴

SUFFIXES (Přípony):

Nouns (n -podstatná jména): - ment, - ness, - tion, - - ity, - ance, - ist, -er
(replacement, richness, formation, flexibility, assistance, chemist, fighter)

Adjectives (adj - přídavná jména) - able, -ible, -ine, - ous, - ic, -ing, -ed
(countable, flexible, saline, famous, toxic, interesting, prepared)

Verbs (v - slovesa): - ify, - ize, - ate, - en
(intensify, minimize, activate, frighten)

Adverbs (adv - příslovce): - ly, - ally
(quickly, technically)

Ovšem často jsou změny složitější: např. long (adj) – length (n)

Někdy u určitého slovního druhu není žádná přípona – např. profitable (adj) - profit (n)

Někdy nemá příponu žádný slovní druh (tzv. konverze - stejné slovo pro více slovních druhů)

Např. a stone bridge – a bridge stone – to stone somebody

stone – adj / n / v

EXERCISES:

a) Which of these words is a noun / adjective / verb / adverb?

Write them into the right column.

frustrated, department, organize, university, chemically, probable, calculate, famous, purify, soften, quickly, cosmic, softness, electronically, biologist, hardly

Noun	Adjective	Verb	Adverb
<i>physicist</i>	<i>exciting</i>	<i>analyze</i>	<i>simply</i>

b) Choose the right word: chemist (n) – chemistry (n) – chemical (adj)

- Chemistry* is a branch of science.
- Intensive study is necessary for becoming a or an expert in
- At present more than a hundred elements are known.
- The famous French Lavoisier established the Law of Conservation in Mass.
- The law says that no change occurs in the mass of substances present in a reaction.
- This was the birth of as an exact science.

c) Fill in the table with the right words describing changing states of matter

Changing state of matter	Verb	Noun
1. liquid to gas	to evaporate	evaporation
2. gas to liquid		
3.		melting / liquefaction
4.		solidification
5.	to sublimate	
6. gas to solid		

WEEK 3 – VOCABULARY – CLASSIFYING IN CHEMISTRY	
matter (n)	hmota
state of matter	skupenství
solid (n/adj)	pevná látka, pevný
liquid (n/adj)	kapalina, kapalný
gas (n)	plyn
gaseous (adj)	plynný
weight / mass (n)	hmotnost, váha
volume (n)	objem
keep shape (n)	držet tvar
movement (n)	pohyb
firm / rigid (adj)	pevný, neohebný, tuhý
definite form (adj+n)	určitá (přesně daná) forma
take up space (v+n)	zabírat prostor
force (n)	síla
melting (n)	tání
oxygen (n)	kyslík
element (n)	prvek
compound (n)	sloučenina
mixture (n)	směs
acid (n)	kyselina
base (n)	zásada
solution (n)	roztok
conductor of heat and electricity	vodič tepla a elektřiny
iron (n)	železo
sulphur (n)	síra
carbon dioxide (adj+n)	oxid uhličitý
Atoms are densely packed.	Atomy jsou hustě natěsnané.
Atoms are loosely structured.	Atomy jsou ve volné struktuře.
Atoms are arranged in a definite pattern	Atomy jsou uspořádané do určitého vzorce.
heat the substance (v+n)	zahřát látku
crystalline and amorphous solids	krystalické a amorfní látky
pour (v)	lít, nalívat
flow all over the surface	rozlévat se po povrchu
attract each other	přitahovat se navzájem
diffuse / spread out (v)	rozpínat se
compress or expand (v)	stlačit se nebo se roztahovat
... may be classified / divided / arranged / grouped / categorized into... as ... according to ...	mohou být klasifikovány / rozděleny / uspořádány / seřazeny / kategorizovány do ... jako ... podle ...
There three types / kinds / classes / categories of	Jsou tři typy / druhy / třídy / kategorie ...
particles (n)	částice
collide with each other	srazit se navzájem

Based on: ¹ *Conversation questions for the ESL Classroom.* Available at <http://iteslj.org/questions/>

² Zimmerman, Fran. *English for Science.* New Jersey 1989.

³ Available at http://highered.mcgraw-hill.com/sites/0072396814/student_view0/animations_center.html#

⁴ Alžběta Oreská et al. *English for Chemistry.* Bratislava: STU, 2006.