Unit 4: PERIODIC TABLE OF THE ELEMENTS (by courtesy of A.Rozkošná)

Useful website: www.webelements.com

1. For one minute try to write down as many elements in English as you can.

2. Listening. Listen to the song of the elements by Tom Lehrer and fill in the gaps.
(e.g. http://www.youtube.com/watch?v=zGM-wSKFBpo)

There's antimony, arsenic, aluminum, selenium, And hydrogen and _____ and nitrogen and rhenium. And nickel, neodymium, neptunium, germanium, And_____, americium, ruthenium, uranium, Europium, zirconium, lutetium, vanadium, And lanthanum and osmium and astatine and _____ . And gold, protactinium and indium and gallium, And _____ and thorium and thulium and thallium.	There's holmium and helium and hafnium and erbium, And _____ and francium and fluorine and terbium. And manganese and mercury, molybdenum,_____ Dysprosium and scandium and cerium and cesium, And lead, praseodymium, and platinum, plutonium, Palladium, promethium, _____, polonium, Tantalum, technetium, titanium, tellurium, And cadmium and _____ and chromium and curium.
There's yttrium, ytterbium, actinium, _____. And boron, gadolinium, niobium, iridium. And strontium and _____ and silver and samarium, And bismuth, bromine, lithium, beryllium and barium.	There's sulfur, californium and fermium, berkelium, And also mendelevium, einsteinium and nobelium. And argon, _____, neon, radon, xenon, zinc and rhodium, And chlorine, carbon, cobalt, copper, Tungsten, tin and _____.
	These are the only ones of which the news has come to Harvard, And there may be many others but they haven't been discovered.

3. Practice reading from phonetic transcription.

/ˊæl yəˈmɪn i əm/	/ˈɒz mi əm/	/ˈmɜr kyə ri/
/ˈkæl si əm/	/ruˈbɪd i əm/	/ˈni ɒn/
/ˈkɑr bən/	/ˈsoʊ di əm/	/ɪˈtɜr bi əm/
/ˈaɪ ərn/	/tɪn/	/ˈnɪk əl/
/lɛd/	/yʊˈreɪ ni əm/	/zɪŋk/

http://dictionary.reference.com/help/luna/IPA_pron_key.html

4. Speaking. Work in small groups. Try to answer these questions:

a) Which element makes more than 90 % of the universe?
b) What is the lightest element? What is the heaviest element?
c) What elements are present in the air? Do you know the percentages?
d) Which element is used as rocket fuel and as alternative fuel for cars?
e) What elements are present in the human body?
f) What are the three forms of carbon? What are their uses?
g) What is an isotope? Do you know any isotopes? Which ones?
h) Do you know any alloys (combinations of metals)? Which ones? What metals are they made of?
i) Which elements can be dangerous? How are they dangerous?

5. What do you know about arsenic?

Listening / Watching. ARSENIC. Watch the video and note down the uses of arsenic.
(http://www.youtube.com/watch?v=a2AbKwAvyos)

Vocabulary:

sample (n)
mould (n)
volatile (adj)
poisonous (adj)
common (adj)
high-profile (adj)
dispose of (v+prep)
feed livestock (v)
powder (n)

Uses of arsenic:

6. Reading: ARSENIC[2]

Study the words below and then read the text about Arsenic. After you have read the text complete the table with suitable information

ARSENIC

Adapted from Wikipedia

Arsenic is the chemical element that has the symbol **As**, atomic number 33 and atomic mass 74.92. Arsenic was first documented by Albertus Magnus in 1250. The element is a steel grey, very brittle, crystalline solid.	**1**
Arsenic is a poisonous element that occurs in the earth's crust. It is metalloid with many allotropic forms, including a yellow (molecular non-metallic) and several black and grey forms (metalloids). Three metalloidal forms of arsenic, each with a different crystal structure, are found free in nature. The most stable of arsenic's isomers is 68mAs with a half-life of 111.	**2**
In the environment, arsenic is combined with oxygen, chlorine, and sulphur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds. The most common oxidation states for arsenic are −3 (arsenides: usually alloy-like intermetallic compounds), +3 (arsenates(III) or arsenites, and most organoarsenic compounds), and +5 (arsenates: the most stable inorganic arsenic oxycompounds. Arsenic and its compounds are used as pesticides, herbicides, insecticides and in various alloys.	**3**
Arsenic is made on an industrial scale by heating appropriate minerals in the absence of air. The arsenic is condensed out as a solid. FeAsS (700°C) → FeS + As(g) → As(s)	**4**
Upon heating arsenic sublimes (transfers from the solid to the gaseous state, without passing through the liquid state).	
You may be exposed to arsenic by: Taking in small amounts in food, water or air / Burning smoke from arsenic-treated wood / Living in an area with high levels of arsenic in rock / Working in a job where arsenic is made or used	**5**
Exposure to arsenic can cause many health problems. Being exposed to low levels for a long time can change the colour of your skin. Exposure to high levels of arsenic can cause death. (adapted from Wikipedia.org)	**6** **7**

Symbol	
Atomic number	
Atomic mass	
Properties	
Occurrence (Where is it found?)	
Forms	

Half-life	
Oxidation states	
Compounds	
Uses	
Production / lab preparation	
Ways of Exposure	
Effects of Exposure	

7. Now read the text again and complete the second chart with words needed for a description of an element.

Nouns	Verbs	Adjectives
symbol	***occurs***	***crystalline***

8. Speaking. Work in pairs. Without looking at the text, try to summarize all the facts that you have learnt about arsenic according to the tables in exercise 6 and 7.

9. Speaking. Work in pairs. Each student should choose 2-3 elements from the periodic table. Try to describe the position in the table, properties, occurrence, forms, compounds, uses, reactions etc. Use the standard phrases, structures and vocabulary. The other one has to guess which element it is.
You can use these phrases:
This element combines with …. to form … ***It is used as / in ...*** ***It is made by …***

10. Reading. Complete the gaps in the text with suitable words.

Development of the periodic table

On the evening of February 17, 1869, at the University of St. Petersburg in Russia, a 35-year-old professor of general chemistry – Dmitri Ivanovich Mendeleev (1834-1907) – was writing a chapter of his soon-to-be-famous textbook on chemistry. He had the properties of each element written on cards, with a separate card for each element. While he was shuffling the cards trying to gather his thoughts before writing his manuscript, Mendeleev _____ that if the elements were arranged in the order of their atomic weights, there was a trend in properties that repeated itself several times. He arranged the elements into groups that had similar properties and used the resulting periodic chart to predict the properties and places in the chart of as yet undiscovered elements.

Thus, the periodic law and the periodic table were born, although only 63 elements had been discovered by 1869 (for example, the noble gases were not discovered until after 1893), and the clarifying concept of the atomic number was not _____ until 1913.

Mendeleev´s idea and textbook achieved great success, and he rose to a position of prestige and fame while he continued to teach at the University of St. Petersburg.

Mendeleev aided the discovery of new elements by predicting their properties with remarkable accuracy, and he even _____ the geographical regions in which minerals containing the elements could be found. The properties of a missing element were predicted by consideration of the properties of its neighbouring elements in the table. For example, for the element we now know as germanium, which falls below silicon in the modern periodic table, Mendeleev predicted a grey element of atomic weight 72 with a density of 5.5g/cm3. Germanium, once discovered, _____ to be a grey element of atomic weight 72.59 with a density of 5.36g/cm3.

The empty spaces in the table and Mendeleev´s predictions of the properties of missing elements stimulated a flurry of prospecting for elements in 1870s and 1880s and eight more were discovered by 1886.

Mendeleev found that a few elements did not _____ under other elements with similar chemical properties when arranged according to increasing atomic weight. Eventually it was found that the atomic weight is *not* the property that _____ the similarities and differences among the elements. This was discovered in 1913 by H.G.J. Moseley (1885-1915), a young scientist working with Ernest Rutherford. Moseley found that the wavelengths of X-rays emitted by a particular element are _____ in a precise way to the atomic number of that element. He quickly realised that that other atomic properties may be similarly related to atomic number and not, as Mendeleev had believed, to atomic weight.

By building on the work of Mendeleev and others, and by using the concept of the atomic number, we are now able to _____ the modern ***periodic law****: When the elements are arranged in the order of their atomic numbers, their chemical and physical properties show repeatable, or _____ trends.*

(adapted from Joesten, Castellion, Hogg: *The World of Chemistry.* Thomson Brooks/Cole, 2007)

Lesson 4 – Vocabulary – Periodic Table of the Elements	
magnify under a microscope	zvětšovat pod mikroskopem
transmit radio signals	přenášet rádiové signály
process vast amounts of data	zpracovat velké množství dat
convert energy (v+n)	přeměnit energii
renewable energy sources	obnovitelné zdroje energie
rotate (v)	otáčet se
fluid (n)	tekutina
compounds (n) mixtures (n)	sloučeniny a směsi
boiling / melting point (adj+n)	bod varu / tání
point of condensation (n+prep+n)	bod kondenzace
freezing point (adj+n)	bod mrazu
evaporate (v) / evaporation (n)	vypařovat se / vypařování
condense (v) / condensation (n)	kondenzovat / kondenzace
liquefy (v) / liquefaction (n)	zkapalnit / zkapalnění
melt (v) / melting (n)	tát / tání
solidify (v) / solidification (n)	tuhnout / tuhnutí
sublimate (v) / sublimation (n)	sublimovat / sublimace
desublimate (v) / desublimation (n)	desublimovat / desublimace
alkali metals (adj+n)	alkalické kovy
alkaline earth metals (adj+n)	kovy alkalických zemin

halogens (n)	halogeny
chalcogens (n)	chalkogeny
noble gases (adj+n)	vzácné plyny
chemical symbol (adj+n)	chemická značka
atomic number (adj+n)	protonové číslo
half-life (n)	poločas rozpadu
relative atomic mass (adj+adj+n)	relativní atomová hmotnost
poisonous (adj)	jedovatý
occur (v)	vyskytovat se
metal (n) / metalloid (n) / non-metal (n)	kov / polokov / nekov
alloy (n)	slitina
amount (n)	množství
stable isotope (adj+n)	stabilní izotop
common (adj)	obvyklý
environment (n)	životní prostředí
combines with … to form	reaguje s … a vytvoří…
be exposed to (v+prep) / exposure (n)	být vystaven (chemikálii)/ vystavení se
treat (v)	zacházet s něčím, jednat s někým, ošetřit
cause (v)	způsobit
high/low levels (adj+n)	vysoké / nízké hladiny
sample (n)	vzorek
volatile (adj)	těkavý
dispose of (v+prep)	zbavit se
powder (n)	prášek

HOMEWORK: Circle synonyms (=words that mean the same):

1. Chemists study the composition of natural *substances*.
a. materials b. machines
2. Plastic products are hard to dispose of because they are almost *indestructible*.
a. unable to be destroyed b. unable to be constructed
3. Silicon is a nonmetallic element that is inexpensive because it is so *abundant* in minerals and rocks.
a. rare b. plentiful
4. When exposed to air and moisture, iron will *corrode*.
a. rust b. shine
5. After the fire, the police investigated the cause of the *combustion*.
a. burning b. excitement
6. Gasoline should be stored carefully because it is *flammable*.
a. fireproof b. able to catch fire easily
7. Heat can *convert* a solid to a liquid.
a. condense b. change
8. The ammonia was *diluted* in water to make it weaker.
a. thinned b. thickened
9. A *catalyst* speeds up a chemical reaction.
a. chemical additive b. chemical agent
10. To obtain aluminum, metallurgists must *extract* it from bauxite.
a. remove b. replace
11. The temperature on a Fahrenheit fever thermometer *ranges* from 94° to 108°.
a. extends b. contract