

A Guide to the Periodic Table

Teaching Approach

In this series we discuss the Periodic Table and all the information it can provide. Learners will realise that the periodic table is a useful tool with a vast amount of information. They will understand how and why elements react the way they do, and also be able to predict how elements will behave in certain reactions. The lessons discuss the similarities of physical properties of elements in the same group, as well as their similarities in valency and consequent bonding ability. Trends across periods and down groups in the Periodic Table will help learners to predict how elements react. The link between electronic structure and the position of atoms in the Periodic Table reinforces the work that the learners have done on bonding.

Video Summaries

Some videos have a 'PAUSE' moment, at which point the teacher or learner can choose to pause the video and try to answer the question posed or calculate the answer to the problem under discussion. Once the video starts again, the answer to the question or the right answer to the calculation is given

Mindset suggests a number of ways to use the video lessons. These include:

- Watch or show a lesson as an introduction to a lesson
- Watch or show a lesson after a lesson, as a summary or as a way of adding in some interesting real-life applications or practical aspects
- Design a worksheet or set of questions about one video lesson. Then ask learners to watch a video related to the lesson and to complete the worksheet or questions, either in groups or individually
- Worksheets and questions based on video lessons can be used as short assessments or exercises
- Ask learners to watch a particular video lesson for homework (in the school library or on the website, depending on how the material is available) as preparation for the next day's lesson; if desired, learners can be given specific questions to answer in preparation for the next day's lesson

1. Introduction to the Periodic Table

The development of the Periodic Table is briefly discussed. Its organisation in ascending order of atomic numbers and the relevance to atomic structure is covered. The first 36 elements plus a few others are introduced.

2. Structure of the Periodic Table

In this lesson, groups and periods are defined, and the different groups named. The division into metals and non-metals, and the transition metals are discussed. The relationship between the position of an element on the Periodic Table and its electronic structure is also discussed.

3. Periodicity

The following properties and trends across the periodic table are discussed: atomic radius, density, melting points and boiling points. Learners will understand why these trends exist and will be able to explain them.

4. More on Periodicity

Firstly this lesson focuses on halogens, halides and oxides. The formation of these compounds is explained, and how to write their formulae. Then electron affinity, ionisation energy and electronegativity are defined, and the influence of periodicity on these properties is investigated.

5. Comparison between Groups 1, 2, 17 and 18

The four groups 1, 2, 17 and 18 are discussed. The students are reminded of the names these groups and that the electron arrangements are related to the chemical properties of these groups. Reactivity is defined and the trends in the reactivity of the four groups are described.

Resource Material

1. Introduction to Periodic Table	http://www.ptable.com/	This is a dynamic periodic table.
	http://www.lenntech.com/periodic/history/history-periodic-table.htm	This provides an interesting read into the history of the development of the periodic table
	http://voices.yahoo.com/trivia-fun-interesting-facts-periodic-12241323.html	This is an interesting site providing fun and useful facts about various elements on the periodic table.
2. Structure of the Periodic Table	http://www.chemicalelements.com/groups/alkali.html	This website provides detailed information regarding the alkali metals.
	http://www.chem4kids.com/files/element_alkalineearth.html	A vibrant website on the alkali earth metals
	http://www.bbc.co.uk/schools/gcse/itesize/science/add_ocr_gateway/periodic_table/group7rev1.shtml	A website providing more information on the halogens as well as their uses.
3. Periodicity	http://www.chem.tamu.edu/class/majors/tutorialnotefiles/trends.htm	A very good website explaining the trends across the periodic table.
	http://www.chemguide.co.uk/inorganic/group1/properties.html	A website detailing the atomic and physical properties on group one.
	http://antoine.frostburg.edu/chem/senese/101/periodic/faq/melting-point-trend.shtml	Details the trends in melting points across the periodic table.
4. More on Periodicity	http://www.rsc.org/chemsoc/visualelements/pages/data/intro_groupvii_data.html	Useful website with information regarding the halogens.
	http://chemwiki.ucdavis.edu/Inorganic_Chemistry/Descriptive_Chemistry/Main_Group_Elements/Main_Group_Reactions/Reactions_of_Main_Group_Elements_with_Halogens	This website explains the properties and reactions of the halogens.

	http://www.alonsoformula.com/inorganic/oxidos_basicos.htm	A website on metal oxides.
6. Comparison between Groups 1, 2, 17 and 18	http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_pre_2011/periodic_table/electronsrev4.shtml	Basic revision on electron configuration.
	http://www.rsc.org/chemsoc/visualelements/pages/data/intro_groupii_data.html	A website detailing group 2 element properties.
	http://www.docbrown.info/page03/Noble_Gases.htm	A website on the properties of Noble gases.

Task

Question 1

Nitrogen and phosphorus are in the same group and have the same number of valence electrons. Give a reason why a phosphorus atom is larger than a nitrogen atom.

Question 2

Define ionisation energy.

Question 3

Which one of the following statements about the trends down group seven is correct?

- a. The atomic size increases
- b. The ionisation energy increases
- c. The non-metallic character increases
- d. The number of valence electrons increases.

Question 4

Consider the following elements: potassium, zinc, phosphorus, antimony and argon. Which of the following statements is true?

- a. All are metals
- b. All are non-metals
- c. All are chemically reactive
- d. One is a metalloid (non-conductor).

Question 5

How does the density of metals change across a period?

Question 6

Which of the following elements would have the highest melting point?

- a. Carbon
- b. Silicon
- c. Lithium
- d. Calcium

Question 7

Which element would have the greater difference between the first ionisation energy and the second ionisation energy?

- a. Calcium
- b. Potassium
- c. Scandium
- d. They should all have the same differences as they are in the same period in the Periodic Table.

Question 8

Which of these elements has the largest atomic radius?

- a. Sodium
- b. Aluminium

- c. Silicon
- d. Chlorine

Question 9

Phosphorous and sulfur are in the same period. Sulfur has one more proton and electron than phosphorous. Explain why the sulfur atom is smaller than the phosphorous atom.

Question 10

What is the product of the reaction between an alkali metal and oxygen?

Question 11

The reaction of alkali earth metals with oxygen is **more/less** volatile than that of alkali metals with oxygen. Give a reason for your answer.

Question 12

What is another name for group seven?

Question 13

The element fluorine has a very high electronegativity value. What is meant by this?

Question 14

The reactivity of the halogens decreases from the top of the group to the bottom. Explain this with the use of the concept of electronegativity.

Task Answers

Question 1

Phosphorous has 15 electrons and its valence electrons are in the third energy level, whereas nitrogen only has 7 electrons and one less energy level. The valence electrons of phosphorous are further from the nucleus than those of nitrogen and more shielded by inner electrons.

Question 2

Ionisation energy is the amount of energy needed to remove an electron from a neutral atom in the gas phase.

Question 3

a. The atomic size increases

Question 4

d. One is a metalloid (non-conductor).

Question 5

The density of metals increases while the density of non-metals decreases.

Question 6

a. Carbon

Question 7

Potassium

Question 8

a. Sodium

Question 9

Sulfur has a higher nuclear charge than phosphorous and therefore its nucleus attracts the electrons more strongly, therefore it is slightly smaller.

Question 10

Hydrogen

Question 11

Less. Alkali earth metals are to the right of the alkali metals in a period and therefore have higher ionisation energy. More energy is needed to remove an electron and therefore to allow a reaction to take place.

Question 12

Halogens

Question 13

The electronegativity of an atom shows how strongly an atom in a compound will attract a shared pair of electrons towards it. Therefore, if fluorine has a high electronegativity it means that it has a very strong force of attraction on the valence electrons of neighbouring atoms and will attract these electrons towards itself.

Question 14

The electronegativity decreases from top to bottom, which means that the force of attraction on shared pairs of electrons will decrease, thus the elements are less likely to attract the electrons of other atoms and it is less likely that reactions will occur

Acknowledgements

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