



The Periodic Table

2006
26 minutes

Program Synopsis

This program is aimed at Years 11 and 12 Chemistry students; most sections are also relevant for Year 10 students.

It deals with how the modern Periodic Table has evolved from the earliest times to include modern day artificial elements. Animation is used to good advantage to illustrate concepts that are usually hard to grasp. Basic atomic theory is reviewed and used to explain many properties of elements and also trends in periods and groups. Valency, ionisation energy, size of atoms and radioisotopes are dealt with in a clear and logical manner.

Related Programs

- Holding Electrons
- Atom Bond – The Atom with the Golden Electron
- History of the Atom – parts 1 & 2

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Teacher Notes:

Peter Gribben

B. Ed, B. Sc Hon, Post Graduate of Education

Introduction

As early as the 18th century, pioneering work in Chemistry had identified that various elements with similar structural properties share common chemical characteristics. Two and a half centuries later, the Periodic Table is still the starting point for students of Chemistry to gain an understanding of the structure and properties of the chemical elements. This program examines a range of information contained in the Periodic Table, starting with a look at how the Table as we know it today developed with the work of various key scientists, including Lavoisier, Berzelius and Mendeleev. Other areas covered include atomic structure, valency and ionisation, table groups and radioactivity.

Program Rationale

A thorough knowledge of the Periodic Table and periodic properties is essential for any student of Chemistry. Many students do not appreciate the amount of information contained in the Periodic Table and how much an understanding of it can underpin a multitude of other areas in the subject. This program aims to raise awareness of the information contained in the Periodic Table, to provide students with a sound base for further studies in Chemistry and associated science disciplines.

Background Information

The program is designed for students studying Chemistry from Year 9 to 12. It gives a clear and insightful overview of the current Periodic Table and how this affects many branches of Chemistry. Although an existing knowledge of some atomic theory chemistry would be useful, the relevant “basics” are outlined as the program progresses. Many of the concepts covered are difficult to teach using conventional text books and so are dealt with using many animations and graphics. Teachers may wish to view the program as a whole or as series of stages.

These program support notes have a range of activities, including a test of existing knowledge, key words, what to focus on while the program is being viewed and questions on the content and major themes.

Program Timeline

00:00:00	Chapter 1 – The Periodic Table
00:01:56	Chapter 2 – Development of The Periodic Table
00:05:33	Chapter 3 – Atomic structure
00:11:43	Chapter 4 – Valency and Ionisation
00:16:52	Chapter 5 – Table groups
00:21:18	Chapter 6 – Radioactivity
00:25:06	Chapter 7 – Conclusion
00:25:39	Chapter 8 – Credits
00:26:20	End Program

Useful Resources

Books and Other Resources

Most Year 10 Science texts and 11/12 Chemistry text books have a good outline of the Periodic Table.

Internet Resources:

<http://mooni.fccj.org/~ethall/period/period.htm>

<http://www.chemicool.com/>

<http://periodic.lanl.gov/default.htm>

<http://www.chemicalelements.com/>

<http://www.wou.edu/las/phisci/ch412/perhist.htm>

<http://www.chemsoc.org/networks/learnnet/periodictable/pre16/develop/>

Program Worksheet

Before the Program

- 1 What is the Periodic Table?
- 2 What is an element?
- 3 Name the three particles that make up an atom.
- 4 Name two pieces of information that the Periodic Table can tell us about an element.
- 5 Give two common properties of metals.

During the Program

Have a pen/pencil and paper ready. Consider the following terms:

Lavoisier, Berzelius, atomic mass, Mendeleev, period, group, proton, electron, neutron, shell, valence, atomic number, symbol, nucleus, atomic mass units, alkali metal, halogen, noble gas, semi metal, ionisation energy, radioactive, half-life, isotope, transuranium.

As the program plays, jot down a quick thought about these terms or names, as they occur.

1. Lavoisier

2. Berzelius

3. atomic mass

4. Mendeleev

5. period

6. group

7. proton

8. electron

9. neutron

10. shell

11. valence

12. atomic number

13. nucleus

14. atomic mass units

15. alkali metal

16. halogen

17. noble gas

18. semi-metal

19. ionisation energy

20. radioactive

21. half life

22. isotope

23. transuranium

After the Program

After the program has been viewed, complete the sentences using words from the list.

alkali, decreases, groups, increasing, Mendeleev, metalloids, metals, neutrons, noble, one, periods, poor, radioactive, remove, shared, shells, similar, uncombined, unit, uranium, valence

- 1 Lavoisier divided the then known elements into _____ and non-metals.
- 2 _____ created the first Periodic Table
- 3 In the Periodic Table, rows across the Table are called _____ and columns are called _____
- 4 In an atom the electrons are arranged in _____
- 5 Atoms are made up of electrons, protons and _____
- 6 Electrons in the outermost shell of an atom are called _____ electrons.
- 7 Elements in the Periodic Table are arranged in _____ atomic number.
- 8 Hydrogen atoms have _____ proton.
- 9 Atomic mass is measured in atomic mass _____ s.
- 10 Group I metals are also called the _____ metals.
- 11 In chemical bonding, electrons are gained, lost or _____
- 12 Elements in the same group have _____ properties.
- 13 Going left to right across a period, the radius of the atoms _____
- 14 Ionisation energy is the amount of energy required to _____ an electron from an atom.
- 15 The valence shells of _____ gases are full.
- 16 Alkali metals do not occur _____ in nature.
- 17 _____ (semi-metals) have both metallic and non-metallic properties.
- 18 Non-metals are _____ thermal and electrical conductors.
- 19 Elements following _____ in the Periodic Table are called the transuranium elements.
- 20 Some radioisotopes can remain _____ for a very long time.

True or false response

Decide whether the following statements are true or false.

- 21 Lithium, sodium and potassium atoms all have one electron in the outer shell _____
- 22 Mendeleev's Periodic Table shows all of the naturally occurring elements. _____
- 23 Atoms of more than one element can have the same atomic structure." _____
- 24 The symbols of all elements come from their name in English _____
- 25 Hydrogen is the first element in the Periodic Table. _____
- 26 Protons and neutrons are located in the nucleus of an atom. _____
- 27 The isotope carbon-12 is used to define atomic mass. _____
- 28 Transition metals are located in group III _____
- 29 In a period, moving from left to right, the atomic number increases. _____
- 30 Valence electrons are involved in chemical bonding. _____
- 31 The reactivity decreases going down a group of metals. _____
- 32 Group I metals have low ionisation energies _____
- 33 Metals are malleable and ductile _____
- 34 Non metals are always solids under normal conditions _____
- 35 Some elements are radioactive _____
- 36 All radioactive elements have been synthesised _____

NOTE TO TEACHERS

The synthetic elements

Many students are fascinated by the idea that "new" elements can be synthesised, i.e. made by scientists in laboratories. Whilst it is outside the scope of this program to go too deeply into this area, it is often a worthwhile exercise to consider these synthetic elements. Basically, all elements after uranium have been made by bombarding heavy nuclei with high energy particles. (Note that neptunium and plutonium do occur in microscopic amounts in nature.) Because these elements have unstable nuclei, they are radioactive. The Periodic Table can be used to predict many of the properties of these (sometimes very short-lived) elements. It can be useful to set an assignment on this topic.

Suggested Student Responses

Before Viewing the Program

1. What is the Periodic Table?
A table listing elements in order of increasing atomic number.
2. What is an element?
Substance that contains only one type of atom.
3. Name the three particles that make up an atom.
Proton, neutron and electron.
4. Name two pieces of information that the Periodic Table can tell us about an element.
E.g. symbol, atomic mass, atomic number, number of electrons and Group.
5. Give two common properties of metals.
E.g. malleable, ductile, good thermal and electrical conductors and opaque.

After the Program

1. Lavoisier divided the then known elements into **metals** and non–metals.
2. **Mendeleyev** created the first Periodic Table.
3. In the Periodic Table, rows across the Table are called **periods** and columns are called **groups**.
4. In an atom the electrons are arranged in **shells**.
5. Atoms are made up of electrons, protons and **neutrons**.
6. Electrons in the outermost shell of an atom are called **valence** electrons.
7. Elements in the Periodic table are arranged in **increasing** atomic number.
8. Hydrogen atoms have **one** proton.
9. Atomic mass is measured in atomic mass **units**.
10. Group I metals are also called the **alkali** metals.
11. In chemical bonding, electrons are gained, lost or **shared**.
12. Elements in the same Group have **similar** properties.
13. Going left to right across a period, the radius of the atoms **decreases**.
14. Ionisation energy is the amount of energy required to **remove** an electron from an atom.
15. The valence shells of **noble** gases are full.
16. Alkali metals do not occur **uncombined** in nature.
17. **Metalloids** (semi metals) have both metallic and non–metallic properties.
18. Non–metals are **poor** thermal and electrical conductors.
19. Elements following **uranium** in the Periodic Table are called the transuranium elements.
20. Some radioisotopes can remain **radioactive** for a very long time.

True or false response

Decide whether the following statements are true or false.

21. Lithium, sodium and potassium atoms all have one electron in the outer shell.
True
22. Mendeleyev's Periodic Table shows all of the naturally occurring elements.
False
23. Atoms of more than one element can have the same atomic structure."
False

The Periodic Table

24. The symbols of all elements come from their name in English.
False
25. Hydrogen is the first element in the Periodic Table.
True
26. Protons and neutrons are located in the nucleus of an atom.
True
27. The isotope carbon-12 is used to define atomic mass.
True
28. Transition metals are located in group III.
False
29. In a Period, moving from left to right, the atomic number increases.
True
30. Valence electrons are involved in chemical bonding.
True
31. The reactivity decreases going down a group of metals.
False
32. Group I metals have low ionisation energies.
True
33. Metals are malleable and ductile.
True
34. Non metals are always solids under normal conditions.
False
35. Some elements are radioactive.
True
36. All radioactive elements have been synthesised.
False