GRADE 7

NATURAL SCIENCE: TERM 2 OF 2016

MATTER AND MATERIAL

Topic 1

Physical Properties of materials

The properties or characteristics of a material will determine its suitability for a particular use. Properties include strength, boiling and melting points, flexibility, electrical conductivity and heat conductivity. Factors that also need to be taken into account are cost, colour, texture and mass.

Strength

Strong materials will not bend, break, shatter or deform when subjected to external forces. Examples include security gates.

Activity 1

1. Test the strength of the following materials: Do this activity in groups or the educator can do it by showing students what tears easily. Use shopping bags, aluminium foil, newspaper, (plastic) cling-wrap, white A4 printer paper and wax paper. Apply varied tensions (pull hard, less hard and pull gently).
2. Reproduce and complete the following table in your workbook.

Type of Material	**Amount of Pressure Applied**
Shopping bags	
Newspaper	
Plastic (cling) wrap	

White A4 paper	
Wax / baking paper	
Foil	(6)

3. Order the materials in ascending order. (2)
4. Which material would you choose as wrapping paper?
   Explain your choice. (2)

(10)

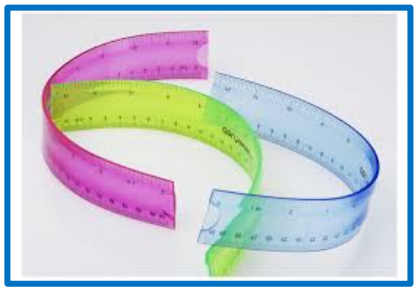
Boiling and Melting Points

Melting occurs when a solid changes into a liquid. A substance's melting point is the temperature at which the substance will start to melt. Boiling occurs when a liquid changes into a gas. A substance's boiling point is the temperature at which the substance will start melting. This is when evaporation occurs. Water boils at 100°C.

	Melting Point (Celsius)	**Boiling Point (C)**
Table salt	801° C	1414° C
Water	0° C	100 °C
Ethanol (ethyl alcohol)	-114 °C	78 ° C
Paraffin	-20 ° C	150° C
Iron	1538 ° C	2862° C
Gold	1064° C	2856° C
Silver	962° C	2162° C
Lead	327° C	1749° C

Flexibility

Materials that are flexible can bend easily without breaking or being damaged. Some types of plastics are flexible, such as a plastic ruler. Plastic lids of aerosol cans, such as deodorant cans, also need to be flexible in order to stretch slightly over the top of the can and stay in position until the lid is removed.

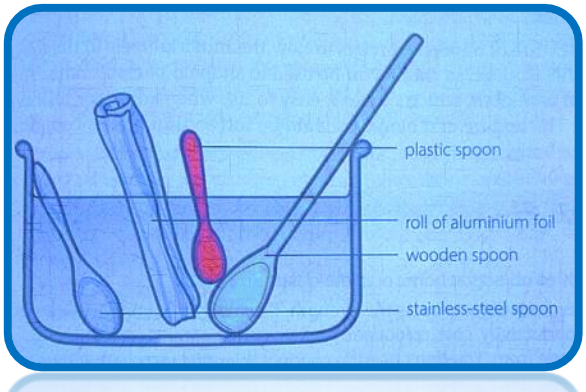


Electrical Conductivity

Electrical conductors are materials that are good at carrying an electrical current (metals). Materials that cannot carry an electric current are called electrical insulators (non-metals). Metals, like copper, are good at conducting a current that travels through a material.

Heat Conductivity

If heat is able to travel through a material easily, then it has good heat / thermal conductivity (metals). Materials that do not carry heat easily are known as thermal insulators (non-metals). The image below shows the heat conductivity of spoons as materials.



Examples of Thermal conductors and insulators: plastic spoon, wooden spoon, stainless-steel spoon.

Other Properties (Factors that need to be considered)

Cost

The immediate and long term cost of a material needs to be taken into account when deciding on its use. For example; a wooden chair may be more expensive but it will last longer than a plastic chair.

Colour

Colour depends on personal taste and may also affect temperature. Darkly coloured materials get hotter in sunlight (absorb light and warmth), whereas lighter colours may be cooler (reflect light and warmth).

Texture

Texture refers to how a material feels when you touch it. Some materials need to be rough (sandpaper) and others need to be smooth (spoon).

Activity 2

Homework activity: Use any three objects from home.

1. Assess the strength, flexibility, heat conductivity, electrical conductivity, cost, colour and texture of each material. Base your assessment on what you observe.
2. Relate the properties of each material to the use of the object. For example, a pot has a plastic handle, making it a good heat insulator and a metal base to assist in heat conductivity.
   Use this table to plot the properties of each of your three objects:

Property	Item One:	Item Two	Item Three:
Strength			
Flexibility			

Heat conductivity			
Electrical conductivity			
Cost			
Colour			
Texture			

Topic 2
Impact on the Environment

Many materials are available from the Earth and may be processed to produce other materials (wood processed into paper). However, there is a cost to the environment when these materials are extracted, processed, transported and used.

Environmental Impact of mining metals

Metals like gold need to be mined. Mining is very important but may lead to many environmental problems, such as:

- Chemicals used can cause water pollution.
- Harmful to the health of humans (dust).
- Creation of mine dumps (affects civil developments like housing)
- Air pollution (global warming).
- Soil fertility (soil is no longer suitable or safe to grow vegetation).
- Disrupts the natural habitat of many animal species.

Natural habitats are in danger

To limit these impacts, the mining industry has implemented EIA (Environment Impact Assessments) to limit the amount of impact that these factors have on the environments. Mining companies also have the responsibility to rehabilitate these areas when the mining project is complete.

Environmental Impact of Plastics

Plastic bags are one example of a type of plastic that we use every day. They are very useful because they are light, strong and inexpensive. However, they have a very negative impact on the natural environment:

- Contribute to the decline of non-renewable resources (polyethylene comes from a natural gas that cannot be remade).
- Pollution (air, ground and water).
- Blocks drains, causing flooding.
- Affects animal and human health (choking hazard).
- Non bio-degradable (can take up to 1000 years to break down).
- Poisonous (although dumped onto land fill sites, they contaminate the soil and affect animal health).

Plastics release harmful toxins into the environment

Less plastic needs to be used. Solutions include the re-use of plastic materials as well as recycling.

Environmental Impact of Fuels

Coal, oil and natural gas are very important sources of energy but have a significant impact on the environment. Many fuels need to be mined and the same concerns about mining metals apply to fuels as well. Fossil fuels also impact on the environment, not only in the mining process, but also in their uses. They contribute directly to:

- Air pollution (fuel in cars).
- Oil spills (in the ocean)
- Oil spills (can kill animals and their natural habitats)
  As a result from damaged pipes, oil tanker accidents and human error.

Air pollution contributes to Global Warming

Activity 3

Answer these questions, in your books, and a peer will mark it. Complete corrections if required.

1. Name five ways in which gold mining is harmful to the environment. (5)
2. Name three problems that occur from plastic litter. (3)
3. Someone says to you, “plastic won’t harm the environment, as long as I throw it into a dustbin”, you then reply to him/her; “….. (2)
4. How can you reduce the amount of plastic that you use? (3)
5. Name the impact that the use of fossil fuels has on the environment. (2)

Total: 15

Topic 3
Methods of physical separation of mixtures

What are mixtures?

A **mixture** is an impure substance made up of two or more substances that have different physical properties (salt and rice).

A **pure substance** has uniform composition and consists of particles of only one kind (salt).

A **solution** is a homogeneous mixture which means that two substances are mixed together to create a mixture that is in a single phase, i.e. liquid. For example, when you mix salt and water together, the salt will dissolve into the water thereby turning both into a liquid (only one liquid is visible). A solution contains 2 or more substances that mix uniformly to make it look as though it is only 1 substance. The substances in a mixture are different and can be separated:

Separation by hand sorting

This involves using your senses of sight and touch to separate two or more substances (separating different types of rocks from one another).

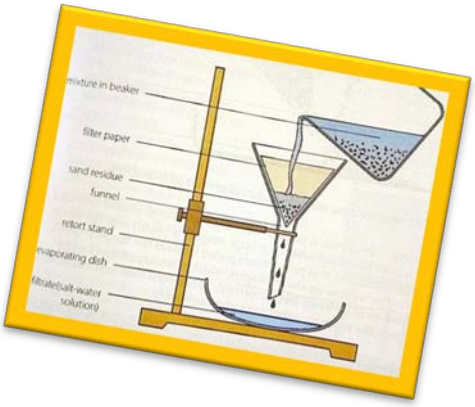
These gemstones can be sorted by hand, by looking at the colours

Separation by sieving or filtration

This method will be used when the grains of one substance are larger than the other. For example, one can place rice in flour and through the use of a sieve, separate the rice from the flour with ease.

Solutions such as salt in water are more difficult to separate via filtration.

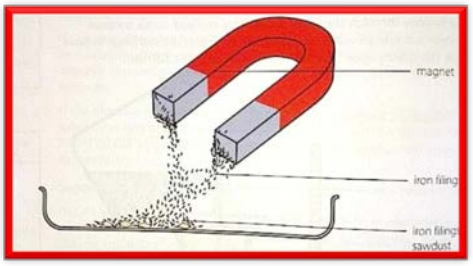
Sand can be separated from water by filtration.



Separation with the use of a magnet

If one substance is magnetic and the other is not, a magnet may be used to separate the mixture. Many industries used electromagnets, which can be switched on or off and are very useful in the separation of mixtures.

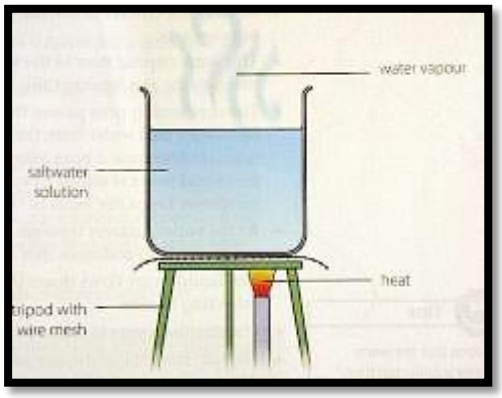
Magnets will collect only the iron fillings, leaving the sawdust behind.



Separation by evaporation

A solution (salt and water) is made up of a solvent (water) which is a liquid and a solute (salt) which is the substance added to the solvent. A solution is mixed in such a way that the solvent and the solute mix evenly and cannot be separated by filtration (salt water).

However a solution can be separated by evaporation, which involves heating the solution until the solvent (water) evaporates and only the solute (salt) is left behind.

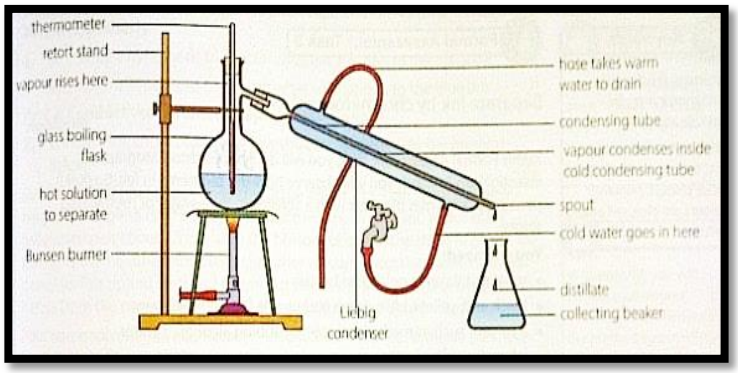


Evaporation is used to get rid of the water, leaving only the salt behind.

Separation by distillation

During evaporation, the solute (salt) is collected but the solvent is lost (water). If one needs to collect the solvent (water) instead, then distillation would be the correct method. By following the same method as evaporation, the solution is heated until boiling and vapour (water) is released. Instead of escaping into the air, the vapour is collected by a special piece of apparatus called a Liebig condenser. In our example of the salt water, the salt does not evaporate as it does not come close to its boiling point (water boils at 100ºC and salt only boils at 1413ºC).

Fractional distillation can be used if two liquids have different boiling points for example, ethanol mixed with water. Ethanol boils at 78ºC and water boils at 100ºC.



A Liebig Condenser collects the substance that is being evaporated

Activity 4

Answer the questions from the Informal Assessment, in your books. Hand it in for marking. Once marked, do corrections, in pencil.

1. How would you separate the following mixtures (explain):

a. steel pins and plastic beads (1)

b. sugar and rice (1)

c. paper and plastic items from a bin (1)

d. Sand, iron filings, salt, ethanol and water (Explain this step by step) (5)

2. If we heat a salt water solution to 100ºC, the _____ will evaporate and the _____ will remain in the beaker. (2)
3. What is the purpose of a Liebig Condenser? (1)
4. Is there a method that can be used to make sea water drinkable? Explain your answer. (2)
5. Explain how a mixture of ethanol and water can be separated. (2)

Total: 15

Topic 4
Sorting and recycling waste materials

Everyone has the responsibility to dispose of waste properly. Consideration should be given to re-use and recycling.

Recycling

Recycling involves putting waste material through a process to create new products. Examples include paper, glass, metal, plastics and even electronic equipment. Separating waste into categories in this process is very important.

The Recycle Symbol

This process can save money as well as precious natural resources when conducted correctly. Recycling bins are a great way of sorting and recycling.

The role of local authorities in waste management

Local authorities help manage waste generated by residents. This is done by sorting and disposal methods. Waste is dumped on a land fill site where it may be dumped or incinerated (burnt), then covered by sand to help aid decomposition.

Negative consequences of poor waste management

- Pollution of water, soil and the environment
- Health hazards and diseases
- Blockage of sewerage and water drainage systems
- Waste of land that is used for landfills
- Wastage of valuable materials that could be recycled

Careers in waste management, Chemistry & Mining

Waste management

This involves the management of waste water, recycling and landfill management.

Chemistry

Chemical engineers process raw materials into valuable products and may work in food processing, water purification and plastic manufacturing.

Mining

Mine managers plan operations and insure that work is done safely.

Activity 5

Do this activity in your book. A peer must mark it and then you need to complete corrections as required.

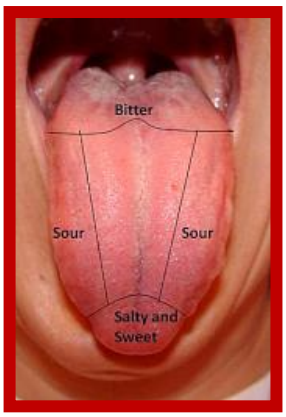
1. What is recycling? (2)
2. How is waste managed at a landfill site? (2)
3. Is it the responsibility of local authorities to dispose of waste properly? True or False. Explain your answer. (1)

Total: 5

Topic 5
Taste of substances

The human tongue is the organ used for taste. Taste buds are used to receive sensory information about taste which is interpreted by the brain. Most taste buds are situated on the top surface of the tongue but can also be found underneath and to the sides of the tongue. Your tongue contains different groups of taste buds; each responsible for tasting either salt, sour, bitter or sweet. This helps you to distinguish between pleasant, unpleasant and even toxic foods.

You can use your sense of taste to determine whether a substance is an acid or base. Acids are normally sour whereas bases normally taste bitter.



The tongue has taste buds that can help us determine pleasant and unpleasant food

Properties of Acids, Bases and Neutrals

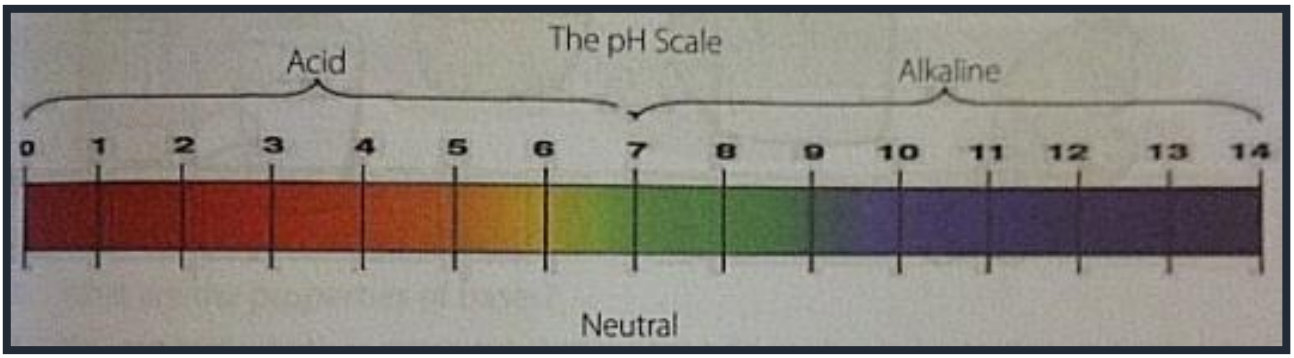
If a substance is neither an acid nor a base, it is a neutral.

Neutral Substances

Substances like water, salt water solution, sugar water solution and oil are all neutrals.

The pH Scale

The pH scale measures how strong an acid or base is. A substance that ranges from 0 to just less than 7 is classified as an acid. The lower the PH value, the stronger the acid is. A substance that ranges from just above 7 to 14 is classified as a base. The higher the PH value, the stronger the base is. A substance with a PH of 7 is neutral.



The pH scale

Properties of Acids

Examples of household acids include lemon juice, fruit juice, vinegar and swimming pool acid. When you put an acid between your fingers and rub them together, it will feel rough and will not slide smoothly.

Properties of acids include;

- Sour taste
- Rough feel
- Many acids are dangerous because they are corrosive (burn)

Properties of Bases

Examples of household bases include bicarbonate, washing powder, toothpaste, most soaps and bleach. Bases feel slippery between the fingers.

Properties of bases include:

- Bitter taste
- Feel slippery

Many bases are dangerous because they can be corrosive. Bases that are alkali are soluble in water.

Activity 6

1. What is a neutral substance? Give two examples. (3)
2. What are the properties of an acid? (1)
3. What are the properties of a base? (1)
4. Why can't the technique of tasting and feeling to distinguish between acids and bases be used for all substances? (2)

Using Acid-Base indicators

There are substances that can be used to test whether a substance is an acid or base. They are called indicators. They change colour when they come into contact with acids and bases. Red and blue litmus paper can be used. The substance will need to be in liquid form before being tested.

	Red Litmus Paper	**Blue Litmus Paper**
Acid	Stays red	Turns red
Base	Turns blue	Stays blue
Neutral	Stays red	Stays blue

It is important to use both red and blue litmus paper when testing a substance because red litmus will stay red when in contact with an acid as well as when in contact with a neutral.

An acid turns blue litmus paper red

A base turns red litmus paper blue

Activity 7

Using both taste and feel, determine whether the following substances are an acid, base or neutral:

Substance	Taste	Feel	Acid, Base or Neutral?
Lemon Juice			
Milk			
Vinegar			
Shampoo			
Salt			
Water			

If you have blue and red litmus paper, draw up a new table

Topic 6
The Arrangement of Elements on the Periodic Table

The Origins of the Periodic Table

The periodic table is a classification system that categorises all elements that make up matter and materials in the world. Oxygen, Nitrogen and Gold are examples of elements whereas water is an example of a compound. Compounds are made up of two or more elements. Water is made up of Hydrogen and Oxygen.

The Periodic Table was developed by Dimitri Mendeleev in 1869. He organised the elements into rows and columns based on their properties.

Metals, Semi-metals and Non-metals

The elements in the Periodic Table are arranged into three main categories; metals, semi-metals and non-metals. Look at the Periodic Table below. The metals are coloured in blue on the left hand side. The non-metals are coloured in pink on the right hand side (Hydrogen being the only exception on the left). The stepped line divides metals from non-metals, where semi-metals appear on either side of this line in yellow.

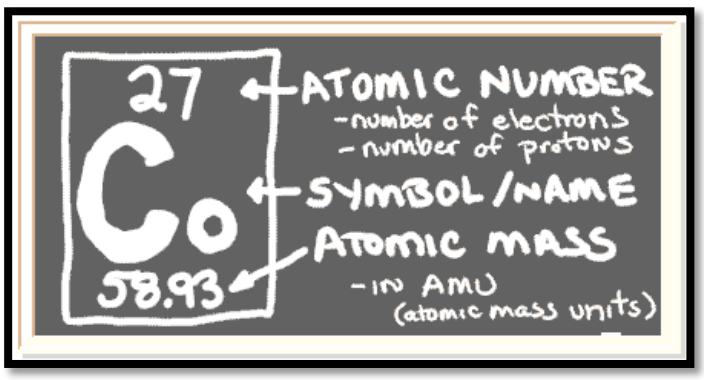
Periodic Table of the Elements

I	II											III	IV	V	VI	VII	VIII
1	2											13	14	15	16	17	18
1 H 1.008																	2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180
11 Na 22.990	12 Mg 24.305	3	4	5	6	7	8	9	10	11	12	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.066	17 Cl 35.453	18 Ar 39.948
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.88	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.69	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.906	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 In 114.82	50 Sn 118.710	51 Sb 121.757	52 Te 127.60	53 I 126.905	54 Xe 131.29
55 Cs 132.905	56 Ba 137.327	71 Lu 174.967	72 Hf 178.49	73 Ta 180.948	74 W 183.85	75 Re 186.207	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.967	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.025	103 Lr (260)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (268)	110 (269)	111 (272)							

57 La 138.906	58 Ce 140.115	59 Pr 140.908	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.965	64 Gd 157.25	65 Tb 158.925	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.934	70 Yb 173.04
89 Ac 227.028	90 Th 232.038	91 Pa 231.036	92 U 238.029	93 Np 237.048	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)

Examples of Elements

Each element has its own name and symbol. Each element also has an atomic number, starting from one, which is Hydrogen and becomes greater from left to right and from top to bottom.



Below, is a list of the first twenty elements

Atomic Number	Symbol	Element	Atomic Number	Symbol	Element
1	H	Hydrogen	11	Na	Sodium
2	He	Helium	12	Mg	Magnesium
3	Li	Lithium	13	Al	Aluminium
4	Be	Beryllium	14	Si	Silicon
5	B	Boron	15	P	Phosphorus
6	C	Carbon	16	S	Sulfur
7	N	Nitrogen	17	Cl	Chlorine
8	O	Oxygen	18	Ar	Argon
9	F	Fluorine	19	K	Potassium
10	Ne	Neon	20	Ca	Calcium

Uses of Elements

Without knowing it, you have been using these elements your entire life. The air you breathe contains Oxygen and Nitrogen. Argon is a gas that is used to preserve food. Lithium is used in rechargeable batteries. Boron is used in washing powders. Platinum, Gold, Silver, Copper and Bronze are all precious metals that are used in jewellery and the money we use every day. Copper is a good conductor of electricity so it is commonly used in wiring and many electrical devices. Many fizzy drinks have cans made from Aluminium. Matches require both Sulphur and Phosphorus.

Activity 8

1. What are the names of the following elements;
   a. Na = _____
   b. K = _____
   c. Mg = _____
   d. Cl = _____
2. Name three semi-metals, three metals and three non-metals from the Periodic Table?

3. List at least one use for the following elements;

a. Lithium

b. Gold

c. Argon

d. Copper

e. Aluminium

4. Name an element that you use every day and explain how you use it. Identify an element that has not yet been discussed, e.g. Oxygen

Properties of Metals, Semi-metals and Non-metals

Properties of Metals

Metals have the following properties:

- Shiny
- Ductile (can be stretched into wires)
- Malleable (can be hammered into sheets)
- They are all solid at room temperature (Except for Mercury which is naturally liquid)
- They all have high melting and boiling points
- Good electrical and heat conductivity

Gold and silver are shiny

Properties of Semi-metals and Non-metals

Non-metals have the following properties:

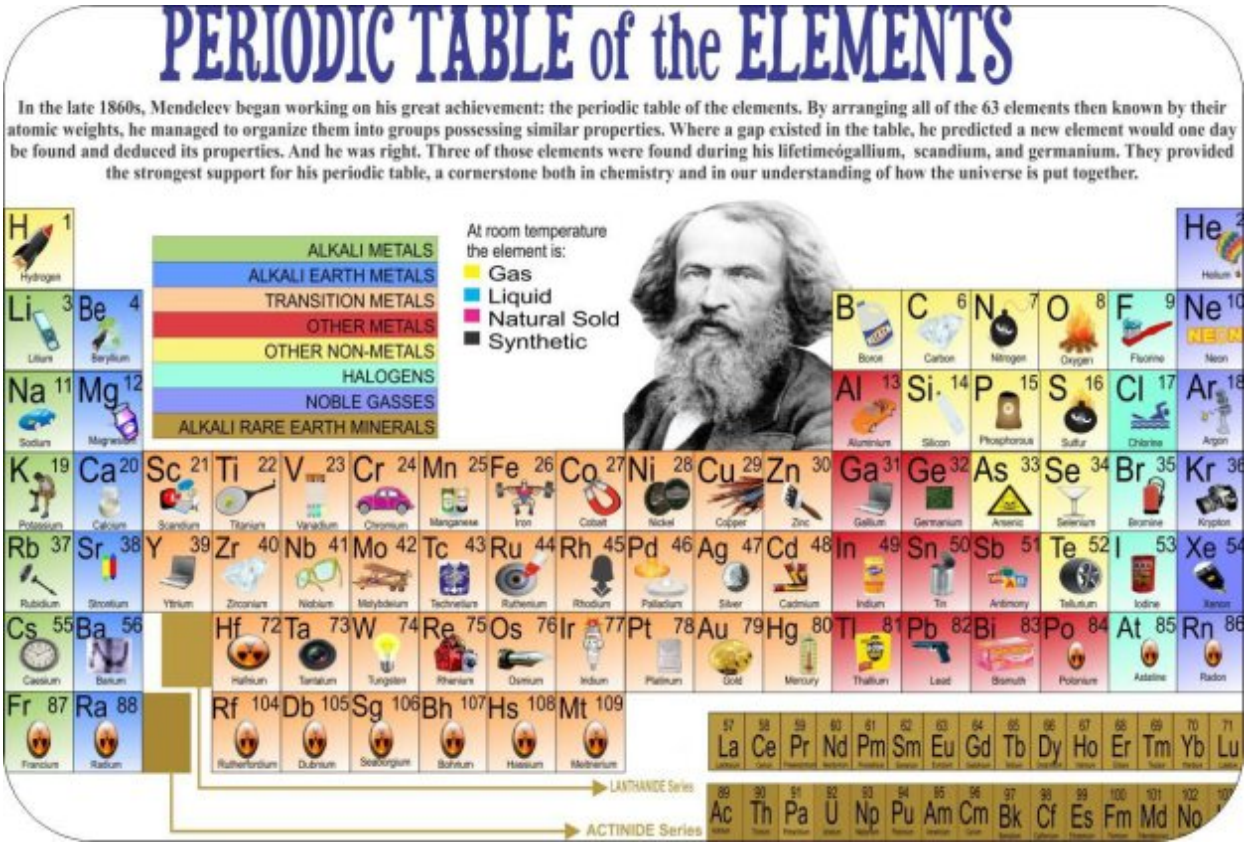
- Dull
- Weak
- Brittle
- Bad electrical and heat conductivity
- They are all gasses at room temperature
- Non- metals are dull

Semi-metals are solids and contain properties from both metals and non-metals.

Activity 9

Use the Periodic Table to identify and write down the name of each of the following elements:

1. The only metal that is naturally liquid at room temperature.
2. The semi-metal element that lies to the left of Phosphorus.
3. The metal that lies below Boron.
4. The gas that can be used as a preservative.
5. The gas with the atomic number 7.
6. The metal with the atomic number 19.
7. Table salt is a compound and is made up of Na and _____?



Visit the following website for a complete list of the elements and their properties: http://www.science.co.il/PTelements.asp