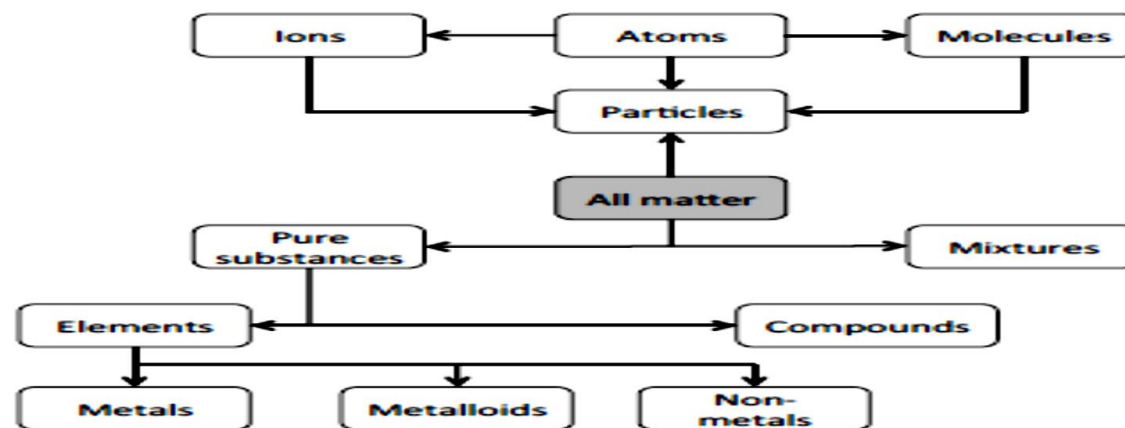




SUBJECT and GRADE	PHYSICAL SCIENCES Grade 10	
TERM 1	Week 1	
TOPIC	Matter and Materials Revision of Matter and Classification	
RESOURCES	Paper based resources	Digital resources
	Learner textbooks: School based <ul style="list-style-type: none">• Answer series – Page 1.1 – 1.9• ScienceClinic – Page 26 - 29	www.wcedportal.co.za https://www.slideshare.net/GLADWELLKAMANGA/grade-10-matter-and-materials
AIMS OF LESSON	At the end of the lesson you must be able to: <ul style="list-style-type: none">• Can distinguish between the different particles that matter consists of• Identify and classify the physical properties of materials• Understand the composition of chemical formulae and be able to write it	
INTRODUCTION	<ul style="list-style-type: none">• This chapter requires you to thoroughly understand matter from previous grades in Natural Sciences.• The earth and everything on earth that has mass and volume, consists of matter.• Matter is formed through constant chemical composition of particles.• The properties of the particles determine the noticeable properties of the matter as well as the reaction of it with other substances.• “Substance” refers to one specific type of matter with a constant composition and specific properties.	
CONCEPTS AND SKILLS	CORE CONCEPTS The material(s) of which an object is composed; Mixtures: heterogeneous and homogeneous; Pure substances: elements and compounds; Names and formulae of substances; Metals, metalloids and non-metals; Electrical conductors, semiconductors and insulators; Thermal conductors and insulators; Magnetic and nonmagnetic	



Pure Substance	A substance that cannot be separated into simpler components by physical methods	Pure copper, O ₂
Element	Pure substance consisting of only one type of atom	Argon, mercury, silicon, gold
Compound	Pure substance consisting of two or more elements chemically bonded in a fixed ratio	Water, carbon dioxide, sodium chloride
Mixture	Consists of different particles mixed together, but not chemically joined.	Milk, air, salt water
Homogenous mixture	A mixture of uniform composition and in which all components are in the same phase	Air, brine, steel
Heterogeneous mixture	A mixture of non-uniform composition and of which the components can be easily identified	Sand and rock mixture, Pizza toppings
Metals	A substance which is normally a shiny solid, a good conductor of heat and electric current. They are malleable and ductile. Some metals have magnetic properties. Metals always form positive ions.	Zn, Cu, Na
Conductors	A substance which has a good ability to move heat through it. A material through which electrons can flow.	Metals
Non-metals	Dull substances which do not conduct electricity or heat. Non-metals are generally liquids and gases or weak solids. Non-metals always form negative ions.	Carbon, oxygen
Insulators	Insulators: A material which allows no or very few electrons to pass through it. The electrons are held very tightly in the atoms.	Wood
Semi-metals (Metalloids)	A class of elements intermediate in properties between metals and non-metals.	Boron and Silicon

Physical Properties of materials

Strength: the ability of a material to resist stress and strain

Thermal conductivity: the ability of material to conduct heat

Electrical conductivity: the ability of a material to conduct electricity

Brittle: hard but likely to break

Malleable: Ability to be hammered or pressed into shape without breaking or cracking

Ductile: the ability to be stretched into a wire

Magnetic: a material which can be attracted or repelled by a magnet (its domains are aligned)

Non-magnetic: a material which is not attracted or repelled by a magnet (its domains are misaligned)

Density: the mass per unit volume of a substance

Melting point: The temperature at which a solid becomes a liquid.

Boiling point: the temperature of a liquid at which its vapour pressure equals the external (atmospheric) pressure

WRITING OF CHEMICAL FORMULAE

NOTE 1

1. Write symbol for the positive ion first, then for the negative ion. The ions can be monoatomic or polyatomic ions.

2. Write the ionic charges on top of the symbols to the right using numbers.

Monoatomic ion → the ion of a single element, where you can use the periodic table to determine its charge

Polyatomic ion → these charges you have to memorise.

NOTE 2

3. "Cross multiply" the numbers so that the total charge of the compound is equal to 0.

4. Write the final compound – if it ends in –ide → monoatomic ion e.g. Hydrogen sulphide is H_2S . The name will end in –ate or –ite if it includes oxygen.

5. Roman numbers (II) → indicate ionic charge of the metal

NOTE 3

When potassium (K) bonds with oxygen (O), it takes place in the following ratio:

Potassium (K) has a valency of 1, oxygen has a valency of 2.

Cross multiply the valencies to get the correct ratio.

Valency will correspond with the ion charge of the atom.

NOTE 4

EXAMPLE:

K_2O

NOTE 5

EXAMPLE:

Aluminium Al^{3+} Oksied O^{2-}

("cross multiply the numbers")

Al_2O_3
(the total charge should be equal to 0)

$2 \times (3+) + 3 \times (2-) = 0$
 $+6 + -6 = 0$

NOTE 6

The compound's name will always contain the names of the element that it consists of. In a compound, the element that occurs on the left hand side of the Periodic table, will be said first.

The symbols of the elements are used to represent the compounds. They are called chemical formulae.

A compound may contain ions (an ion is an atom that either gained or lost electrons). These ions can be single (consist of only one element) or polyatomic (consist of more than one element).

TABLE OF COMMON CATIONS AND ANIONS

SINGLE CHARGE		DOUBLE CHARGE		TRIPLE CHARGE	
ANIONS (NEGATIVE IONS)					
All Group 7		All Group 6		All Group 5	
OH^-	Hydroxide ion	SO_4^{2-}	Sulphate ion	PO_4^{3-}	Phosphate ion
NO_3^-	Nitrate ion	SO_3^{2-}	Sulfite ion		
NO_2^-	Nitrite ion	CO_3^{2-}	Carbonate ion		
MnO_4^-	Permanganate ion	CrO_4^{2-}	Chromate ion		
ClO_3^-	Chlorate ion	$Cr_2O_4^{2-}$	Dichromate ion		
ClO^-	Hypochlorite ion	O_2^{2-}	Peroxide ion		
HCO_3^-	Hydrogen carbonate ion				
HSO_3^-	Hydrogen sulphate ion				
HSO_4^-	Hydrogen sulfite ion				
$H_2PO_4^-$	Dihydrogen phosphate ion				
CH_3COO^-	Acetate ion				
CATIONS (POSITIVE IONS)					
All Group 1		All Group 2		All Group 3	
NH_4^+	Ammonium ion				
H_3O^+	Hydronium ion				

ACTIVITY

Complete the activity below to consolidate the work covered above.

1. Refer to the table of information shown below, and answer the questions that follow.

Material	Magnetic	Electrical conductor	Thermal conductor	Thermal insulator	Element	Compound
Steel	yes	yes	yes	no	no	no
Glass fibre	no	no	no	yes	no	yes
Wood	no	no	no	yes	no	yes
Air	no	no	no	yes	yes	no
Copper	no	yes	yes	no	yes	no

1.1 Select a material which is suitable to use as ceiling insulation that keeps a home cool in summer and warm in winter.

1.2 Select a material that is suitable for making magnets for an electric motor.

1.3 Steel is neither an element nor a compound. What type of material is it? Explain your answer.

1.4 Select the material which lies between the two panes of glass in double glazed windows.

1.5 Select a material which would be suitable to make electrical wiring. Explain your answer.

1.6 Explain why wood is a thermal insulator.

1.7 Explain why steel is such an important material in today's world and give three instances where steel is used.

2. Tabulate three differences between a mixture and a compound.

3.1 What is meant by the density of a material?

3.2 Why do metals generally have high densities?

4. Which of the following is/are heterogeneous mixtures?

4.1 Iodine and water

4.2 Iodine and ethanol

4.3 Sugar and water

5. How would you identify a heterogeneous mixture?
6. Describe how you would test a material for each of the following properties?
- 6.1 Electrical conductivity
 - 6.2 Thermal conductivity
 - 6.3 Whether it is magnetic
7. What happens to the electrical conductivity of each of the following materials as its temperature increases?
- 7.1 Metals
 - 7.2 Metalloids

Answers

- 1.1 Glass fibre is often used as thermal insulator above the ceilings in buildings. The structure of glass fibre is such that there are lots of pockets of air within the material and this serves to make it a good insulator.
- 1.2 Steel is the only material that is magnetic. It makes strong magnets.
- 1.3 Steel is an alloy of a number of metals, it can be an alloy of iron, vanadium, and other metals, depending on the type of steel. Metals do not react chemically with each other. They form a mixture called an alloy.
- 1.4 Air. The outside layer of glass, which is in contact with the air outside is cold. The layer of glass on the inside is in contact with the warm air indoors and is at the same temperature. The air that is in contact with this second pane, is a good insulator and prevents energy from the inside from passing to the outer pane, thus retaining warm air.
- 1.5 Copper. Besides being a very good electrical conductor, copper is also ductile i.e. it can be drawn out into thin wire.
- 1.6 The structure of wood is such that there is a lot of air trapped in the structure. Air is a good thermal insulator.
- 1.7 Steel is strong and can be shaped into many different types of material such as thin sheets and car panels. It also does not corrode easily. Steel is used in structural engineering such as buildings, bridges, cranes etc. It is also used in making panels for car bodies. It can be used for making specialised tools which require hardness and durability.

2.

PROPERTIES			
Mixture	Contains two or more materials in any ratio. ✓	Contains two or more materials that do not combine chemically. ✓	Mixtures can be separated by physical means. ✓
Compound	Contains two or more elements combined in specific ratios. ✓	Contains two or more elements that combine chemically. ✓	Compounds can only be separated into their elements by chemical means. ✓

3.1 The density of a material is the mass per unit volume.

3.2 Metals have atoms that are packed very closely together. This means that there is a large amount of Matter packed in every unit of volume.

4.1 Only iodine and water. Iodine crystals sink to the bottom of a test tube of water and are clearly visible.

4.2 Iodine dissolves in ethanol to form a homogeneous solution which is pinkish in color.

4.3 Sugar dissolves in water to form a clear homogeneous solution.

5. A heterogeneous mixture is one in which two phases of matter can be clearly observed.

6.1 Set up an electric circuit with a battery, two leads connected to the terminals of the battery and a light bulb. Connect the free ends of the leads to either end of a piece of the material to be tested. If the light bulb glows, the substance is an electric conductor.

6.2 Take a long narrow piece of the substance to be tested. Smear molten candle wax on one end and let the wax cool so that it is solid. Heat the other end gently with a candle flame. The quicker the wax melts, the better the substance serves as a thermal conductor. If the wax doesn't melt, it is a thermal insulator.

6.3 If the material is attracted to a permanent magnet it is magnetic. If not, it is nonmagnetic.

7.1 Metals become poorer conductors the warmer they get.

7.2 Metalloids become better conductors as their temperature increases.

CONSOLIDATION	<p>By the end of this lesson you should be able to:</p> <ul style="list-style-type: none">• Define the different concepts covered.• Write chemical formulae.• Content learned apply in everyday contexts
VALUES	<ul style="list-style-type: none">• Realize the importance of accurate descriptions in the applying the classification of matter.• Realize the importance of the memorizing of tables containing positive and negative ions in the writing of chemical formulae.