

**Unit B:
Matter and Chemical Change
Review Package**

Overview: Different materials have different properties. The ability to distinguish between different substances and make sense of their properties, interactions and changes requires the development of ideas about chemical substance.

Key Concepts

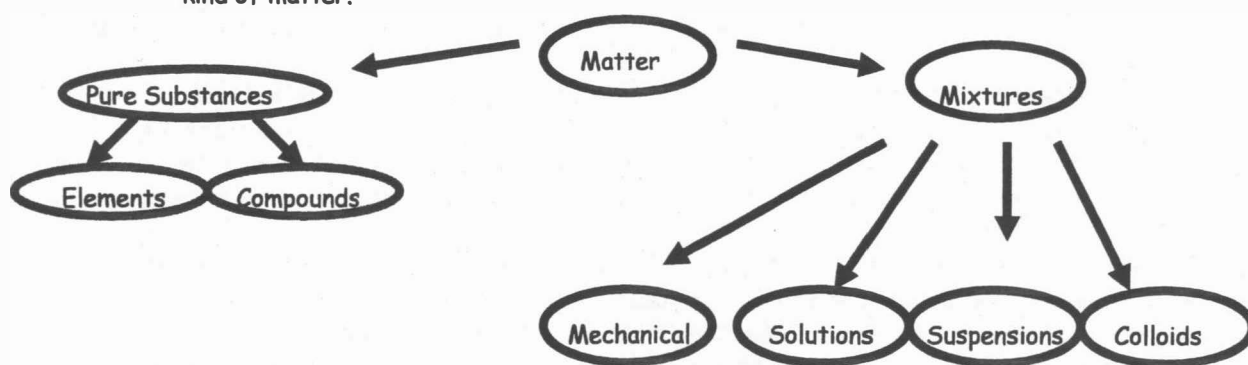
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|--|---|
| <input type="checkbox"/> Workplace Hazardous Materials Information System (WHMIS) and safety | <input type="checkbox"/> factors affecting reaction rates |
| <input type="checkbox"/> substances and properties | <input type="checkbox"/> periodic table |
| <input type="checkbox"/> endothermic and exothermic reactions | <input type="checkbox"/> elements, compounds and atomic theory |
| <input type="checkbox"/> reactants and products | <input type="checkbox"/> chemical nomenclature (introductory treatment) |
| <input type="checkbox"/> conservation of mass | |
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- Investigate materials, and describe them in terms of their physical and chemical properties
 - investigate and describe **properties** of materials (*e.g., investigate and describe the melting point, solubility and conductivity of materials observed*)
 - describe and apply different ways of classifying materials based on their composition and properties, including:
 - distinguishing between pure substances, solutions and mechanical mixtures
 - distinguishing between metals and nonmetals
 - identifying and applying other methods of classification
 - identify conditions under which properties of a material are changed, and critically evaluate if a new substance has been produced. (Physical vs. chemical changes)
 - identify and evaluate dangers of caustic materials and potentially explosive reactions
 - observe and describe evidence of chemical change in reactions between familiar materials, by:
 - describing combustion, corrosion and other reactions involving oxygen
 - observing and inferring evidence of chemical reactions between familiar household materials
 - distinguish between materials that react readily and those that do not (*e.g., compare reactions of different metals to a dilute corrosive solution*)
 - observe and describe patterns of chemical change, by:
 - observing heat generated or absorbed in chemical reactions, and identifying examples of **exothermic** and **endothermic** reactions
 - identifying conditions that affect rates of reactions (*e.g., investigate and describe how factors such as heat, concentration, surface area and electrical energy can affect a chemical reaction*)
 - identifying evidence for conservation of chemical substance (*e.g., identify and apply techniques for comparing the quantity of reactants and products in a chemical reaction*)
 - demonstrate understanding of the origins of the periodic table, and relate patterns in the physical and chemical properties of elements to their positions in the periodic table—focusing on the first 18 elements
 - distinguish between observation and theory, and provide examples of how models and theoretical ideas are used in explaining observations (*e.g., describe how observations of electrical properties of materials led to ideas about electrons and protons; describe how observed differences in the densities of materials are explained, in part, using ideas about the mass of individual atoms*)
 - use the periodic table to identify the number of protons, electrons and other information about each atom; and describe, in general terms, the relationship between the structure of atoms in each

- group and the properties of elements in that group
- distinguish between ionic and molecular compounds, and describe the properties of some common examples of each
- Apply simplified chemical nomenclature in describing elements, compounds and chemical reactions
- read and interpret chemical formulas for compounds of two elements, and give the IUPAC name and common name of these compounds (e.g., $\text{NaCl}(s)$ (sodium chloride), $\text{CO}_2(g)$ (carbon dioxide), $\text{MgO}(s)$ (magnesium oxide), $\text{NH}_3(g)$ (nitrogen trihydride or ammonia), $\text{CH}_4(g)$ (carbon tetrahydride or methane), $\text{FeCl}_2(s)$ (iron(II) chloride), $\text{FeCl}_3(s)$ (iron(III) chloride))
- identify/describe chemicals commonly found in the home, and write the chemical symbols (e.g., table salt [$\text{NaCl}(s)$], water [$\text{H}_2\text{O}(l)$], sodium hydroxide [$\text{NaOH}(aq)$] used in household cleaning supplies)
- identify examples of combining ratios/number of atoms per molecule found in some common materials, and use information on ion charges to predict combining ratios in ionic compounds of two elements (e.g., identify the number of atoms per molecule signified by the chemical formulas for $\text{CO}(g)$ and $\text{CO}_2(g)$; predict combining ratios of iron and oxygen based on information on ion charges of iron and oxygen)
- describe familiar chemical reactions, and represent these reactions by using word equations and chemical formulas and by constructing models of reactants and products (e.g., describe combustion reactions, such as: carbon + oxygen . carbon dioxide [$\text{C}(s) + \text{O}_2(g) \rightarrow \text{CO}_2(g)$]; describe corrosion reactions, such as: iron + oxygen . iron(II) oxide [$\text{Fe}(s) + \text{O}_2(g) \rightarrow \text{FeO}(s)$]; describe replacement reactions, such as the following: zinc + copper(II) sulfate . zinc sulfate + copper [$\text{Zn}(s) + \text{CuSO}_4(aq) \rightarrow \text{ZnSO}_4(aq) + \text{Cu}(s)$])
- Analyze qualitative and quantitative data, and develop and assess possible explanations
- calculate theoretical values of a variable (e.g., predict the total mass of the products of a chemical reaction, based on the mass of the reactants used) [Note: In this example, students can apply the law of conservation of mass.]

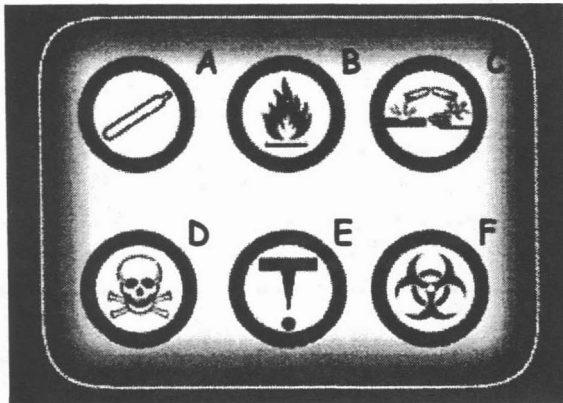
1. There are physical and chemical changes that occur in chemistry. Please list four clues that would tell us that a chemical change is occurring.

1. _____
2. _____
3. _____
4. _____

2. The following is a diagram of the classification of matter. Provide a short description by each kind of matter.



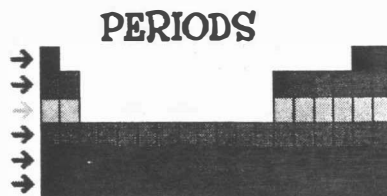
3. WHMIS symbols are very important in the study of chemistry. What do each of the symbols below stand for? You'll need to know these by heart.

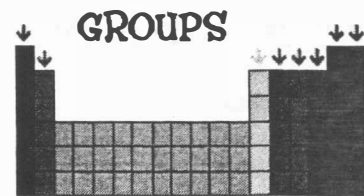


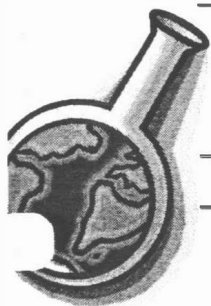
4. Explain what the elements of a period have in common with each other. What do the elements of a group or family have in common with each other?

5. What is the difference between the Alkali Metals and the Halogens? In your answer include the group number they are in and the characteristics that they have.

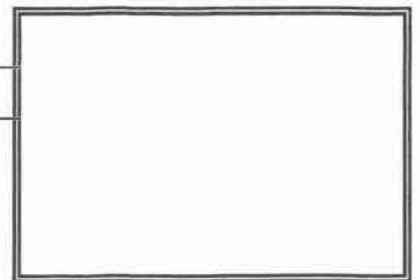
6. The bottom diagrams represent the periods and groups in the periodic table. Under each write the significance between periods and groups. Include ALL points.







7. Explain Aristotle's view of matter. Include a diagram.



8. Who was Niels Bohr?

9. Define the following:

A. Electron shell

B. Proton

C. Neutron

D. Electron

E. Atom

F. Atomic number

G. Atomic

H. Metals

I. Non-metals

J. Metalloids

10. For each element use your periodic table to (1/2 a mark each):

a. Give the element's symbol

b. Draw the Bohr model in the box.

c. Give the number of protons.

d. Give the number of neutrons.

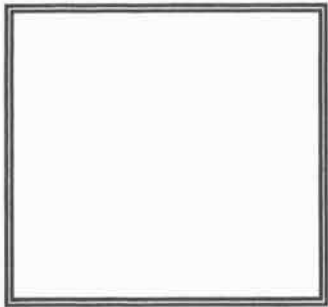
e. Give the period number.

f. Give the group number.

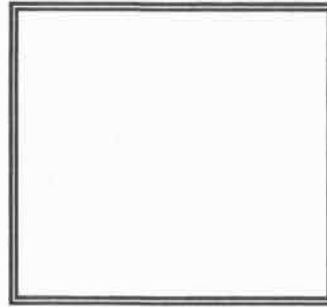
g. The number of electrons on their outer shell

1) Aluminum :

Flourine :



- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____
- g. _____



- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____
- g. _____

11. Various combinations of four substances (W, X, Y, and Z) were observed and the results were recorded in a chart.

Combination of substances	Observations after mixing
X with Y	Produced a strong odour
X with W	Fizzing occurred
W with Z	Colour became a lighter red
Y with Z	Both melted

Write out which of the combinations are physical changes and which are chemical changes.

12. Read the list of tasks. After each one, write if a chemical, physical or no change occurred. Please include reasoning for your choice.

- Task A bringing a cup of water to a boil
Task B adding salt to a cup of water
Task C mixing sugar and flour
Task D adding yeast to make the bread dough rise
Task E melting wax
Task F burning paper
Task G cut up a piece of wire
Task H adding a magnesium strip to HCl acid

13. Match the following

- proposed the atomic theory of matter (1808)
- described the atom using the "raisin bun model" (1897)
- proposed that electrons orbit the nucleus in shells (1922)
- discovered that the nucleus contains protons and neutrons (1935)

- _____ Bohr
- _____ Chadwick
- _____ Dalton
- _____ Thomson

Naming Chemical Compounds

15. Fill in the following table:

Chemical Formula	Elements	N. of atoms of each	Total number of Atoms
NaCl			
Mg ₃ N ₂			
HF			
Sc ₂ S ₃			
HgCl ₂			

Naming IONIC Compounds

The following are the three rules for naming IONIC COMPOUNDS

- 1) Check whether the formula has a **polyatomic ion**. (Their name does not change) See top of periodic table.
- 2) Check whether the **metal ion** is one that has a double charge. (They are denoted by a Roman numeral behind the metal's name.)
 - if so, to figure out the charge start with the anion (negative non-metal) and find out it's overall charge. (e.g. for Fe₂O₃ the anion O has an overall charge of -6.... 3O's at a -2 charge = 3x-2 = -6)
 - Figure out the charge of the cation (metal or positive ion) that will make the compound neutral. (e.g. to have neutral compound Fe has to be +6. So..... there are two Fe's and the charge has to be +6. In order for that to happen the charge has to be +3.
 - Denote the charge that you figured out in the name by putting it behind the cation (metal or positive ion). (e.g. Iron (III) Oxide)
- 3) Otherwise name using the two main rules. 1. Metal goes first 2. Non-metal ends in *-ide*.

To write the formula from the name:

1. Write the two ions with their charges. (e.g. Cadmium Chloride is made up of Cd²⁺ and Cl⁻)
2. Combine the two ions so the charges cancel each other out and you have a neutral atom. (e.g. Cd²⁺ = +2 Cl⁻ = -1 in order to make it neutral we will need two Cl ions to make a -2 charge)
3. Bring them together denoting all multiple ions with a subscript. (When brought together there is a subscript to denote the 2 Cl⁻'s. So we have CdCl₂)

Polyatomic Ions

OH⁻ - hydroxide
 SO₄²⁻ - sulfate
 NO₃⁻ - nitrate
 ClO₃⁻ - chlorate
 PO₄³⁻ - phosphate

Roman Numerals

1 = I 6 = VI
 2 = II 7 = VII
 3 = III 8 = VIII
 4 = IV 9 = IX
 5 = V 10 = X

There are more polyatomic ions at the top of your periodic table.

16. Fill in the following table:

Ionic Compound	List the elements in the chemical name and include their charges		Chemical Formula
Nickel (III) oxide			
			AgNO ₃
	Cu ⁺	S ²⁻	
Sodium phosphide			
			MnO ₂
	Pb ⁴⁺	O ²⁻	
Magnesium bromide			
Potassium Chlorate			

20. What is the chemical formula for the following compounds?

Chemical Name	Chemical formula
Calcium Bromide	
Mercury Oxide	
Iron (III) Oxide	
Potassium Sulfate	
Chromium (III) Oxide	

21. What are the names of the following compounds?

Chemical Formula	Chemical Name
CaF_2	
SnO_2	
CaSO_4	
LiNO_3	
MnO_2	

22. Fill in the table below (5 marks)

Name of element	symbol	Atomic mass	What period is it in?	What group or family is it in?
Sodium				
Antimony				
Helium				
Gold				
Mercury				

Naming Molecular Compounds

When naming molecular compounds it is similar to ionic compounds in the sense that the second compound ends in *-ide*. As well a prefix is added to tell how many of each element is in the compound.

Prefixes

1= mono 2 = di 3= tri 4= tetra 5=penta 6=hexa 7=hepta 8=octa 9=nona

For example : H_2O is commonly know as water. It's chemical name would be **dihydrogen oxide**.

Note : If the **first** element only has one **mono** is **not added**. (e.g. CO is carbon monoxide)

Molecular Compounds

17. Write the chemical formula for the following molecular compounds:

- | | |
|--------------------------|-------|
| a. Nitrogen dioxide | _____ |
| b. Carbon tetrachloride | _____ |
| c. Phosphorus trihydride | _____ |
| d. Diboron decaoxide | _____ |
| e. Oxygen diflouride | _____ |

18. Write the molecular compounds for the following chemical formulas:

- | | |
|-------------|-------|
| a. SF_6 | _____ |
| b. ICl | _____ |
| c. PCl_4 | _____ |
| d. O_2N_2 | _____ |
| e. O_3H | _____ |

19. Name three common household chemicals and give their chemical formula.

Common Name	Chemical Name	Chemical Formula

23. List three properties of ionic compounds. (3 marks)

A. _____

B. _____

C. _____

24. How is an ion Formed?

25. List three properties of a molecular compound.

A. _____

B. _____

C. _____

26. What is the difference between an endothermic reaction and an exothermic reaction?

27. Define the following chemical changes involving Oxygen.

A. **Combustion**

B. **Corrosion**

C. **Cellular Respiration**

28. What is the difference between a closed system and an open system?

29. What are the four factors that can affect the rate of a chemical reaction. (2 marks)

A. _____

B. _____

C. _____

D. _____

30. What does the Law of Conservation of Mass state? (1 mark)

