

UNIT LEARNING PACKS

FOCUS IN ACTION

Grade 9 Science In Action

Unit B - Matter and Chemical Change

'Focus in Action' UNIT LEARNING PACKS

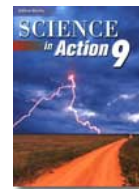
These booklets are designed to provide Grade 9 students with all the resources needed to review or reinforce concepts, covered in the Alberta Science Curriculum, and included in the Grade 9 Science Final Exam in June. There are circumstances in which **an entire unit** may be missed and covering the concepts from that unit (for the final exam) can be difficult. This can happen for a number of reasons:

- Students – new to the school – register throughout the year (from other provinces, school jurisdictions or countries)
- Students may be ill or have surgery and often can miss one or more units
- Students have extended holidays throughout the year
- Transfers from another school, who have completed the units in a different order

For additional support, students are directed to the **Edquest Middle School Science Website** or, Scienceman Resource (http://www.scienceman.com/scienceinaction/pgs/hot_9u2.html)

Unit 1 – Matter and Chemical Change

- **Science Lab Safety (WHMIS)**
- **Safety Test**
- **Section 1 Notes**
- **Section 1 Quiz**
- **Section 2 Notes**
- **Section 2 Quiz**
- **Section 3 Notes**
- **Section 3 Quiz**
- **Section 4 Notes**
- **Section 4 Quiz**
- **Unit Summary**
- **Review Booklet** (Covered in class, prior to the Final Achievement Exam)
- **Unit Test**
- **Answer Key for Section Quizzes and Unit Test**



Additional support will be provided, in the form of practice Achievement Test Questions, during the course review in June. Multiple Choice Questions and Numerical Response Questions will be reviewed, as these are the types that will make up the Science 9 Final Exam

Handouts and other activities, to reinforce the concepts covered in this Unit, will be made available based on need. If you require further information or resources, email Edquest directly: edquest@gmail.com.

Finding Solutions to Problems, instead of Making Excuses

Student Instructions for use of this Learning Pack

The purpose of this Learning Unit Pack is to provide you with the resources that will help you cover the material from the curriculum that will be tested on the Final Exam in June. Follow these steps to successfully complete this Unit Learning Pack:

Step 1 – Read the **Topic Notes**

Step 2 – Use a **highlighter** to identify the key words or phrases in the Topic Notes and reread the material again paying close attention to those words that you highlighted. If necessary, modify your highlights to make sure you understand the material in the notes.

Step 3 – Complete the **Topic Quiz**

Step 4 – Correct the Topic Quiz by **checking the answers** in the back of this Learning Pack.

Step 5 – Using your **textbook** and the **completed quiz**, find the page where the question and correct answer can be found and write it next to the question number in your Learning Pack.

Step 6 – **Repeat Steps 1-5** for each of the other Topics in this Unit.

Step 7 – Look over the **Unit Outline** to review the **Key Concepts** once you have completed all of the Topics.

Step 8 – Complete the **Unit Review**, using your **Learning Pack** and **Textbook**.

Step 9 – **Highlight** those sections of the Review that you had difficulty with and review those sections with your teacher prior to taking the Unit Test.

Step 10 – Take the **Unit Test** and correct it using the answer key provided in the back of the Learning Pack.

Step 11 – You should now be ready to answer any questions on the **Final Exam** related to this Unit.

Anything you still do not understand should be discussed with your teacher. Congratulations on your **Independent Study**, and Good Luck on the Final Exam. I hope you have made good use of this resource. Please provide feedback to your teacher, so that this resource can be improved.

Additional support is available in the form of practice Achievement Test Questions. **Multiple Choice Questions** and **Numerical Response Questions** will be made available on request, as these are the types that will make up the **Alberta Science 9 Achievement Exam**.

Handouts and other activities, to reinforce the concepts covered in this Unit may be acquired by visiting the Edquest Middle School Science Resource Website

<http://www.edquest.ca>

Science Lab Safety Notes

(Internet sites where additional notes and advice can be found)
http://www.sanbenito.k12.tx.us/teachers/Science_safety/Science_Safety.html
<http://homepages.ius.edu/DSPURLOC/c121/week1.htm>
<http://www.epcc.edu/faculty/victors/safety.htm>
http://www.chemistryclasses.com/Lab/lab_safety.htm
http://www.isd196.k12.mn.us/schools/evhs/people/fruincfWeb/lab_safety.html



Before beginning any activity

Know what is expected

Prepare a clear work environment

Wait for permission to start

Whenever special attention is needed in a Lab activity you will see the word **Caution**

(This means that special care must be taken when proceeding with this activity)

General Safety Precautions

- Inform your supervisor of health-related problems, allergies
- Never eat or drink In the Lab area
- Do not attempt Lab activities at home unless told to do so by your teacher, and only under the direct supervision of an adult
- Touch substances only when told to do so
- Smell substances using the proper technique - **wafting** fumes toward you. Chemicals should always be smelled by holding the container in front of your face and slowly (in a circular motion) wafting the vapors toward your nose. Never place the chemical right at your nose and inhale.
- Pour substances properly and safely
- Rinse off substances immediately that come into contact with skin or clothing
- Wash hands after handling substances and before leaving the Lab
- Clean up all spills Immediately
- Dispose of harmful substances by following teacher's directions
- Work quietly and carefully
- Never work alone
- Wear appropriate clothing
- Wear safety equipment



Handling a Heat Source

- Use hot plates that have thermostatic controls.
- Use a beaker of water on a hot plate to heat substances In test tubes.
- Use heat-resistant glass (**Pyrex** or **Kimax**) - **never** use cracked glass.
- Always keep the open end of the test tube pointed away from everyone.
- Never allow any container to boil dry. Use tongs or gloves to pick up hot objects.
- Turn off hot plate when not In use.
- Unplug cords by pulling on the plug, not the cord.
- Report and replace equipment that has frayed or damaged cords.
- Make sure electrical cords are placed properly where no one will trip over them.
- Treat burns using **cold water** or **ice**



Handling an Open Flame

- Locate fire safety equipment before using any open flame (fire blanket, fire extinguishers, fire alarm, first-aid kit)
- Remove all flammable substances from the room before lighting a flame

Know the proper procedures for lighting a **bunsen burner** In the Lab

- Make sure the rubber hoses are firmly attached, both at the gas outlet and at the burner, otherwise, the flame may "strike-back".
- Turn up the gas flow until you hear a gentle flow of gas.
- Light the burner by bringing the match UP from the base toward the burner nozzle.



Follow the proper procedures for heating a substance over an open flame



- Use a test tube holder if the test tube is being heated in an open flame
- Point the open end away from yourself and others
- Gently move the test tube back and forth over the flame so that it is heated evenly

Other Recommendations

Dispose of broken glassware as instructed by your teacher, report broken or damaged equipment immediately (DO NOT USE IT), clean up work area completely when you are finished, wash all glassware thoroughly and place in drying racks, report all accidents to the teacher immediately (no matter how minor)

Workplace Hazardous Materials Information System**Compressed Gas**

This symbol is in class A and is used to inform people of compressed gas. This category includes such things such as propane bottles, butane bottles, and acetylene bottles.

**Poisonous and Infectious**

This symbol belongs to class D-I and is one of the most commonly found symbols in homes across North America. This symbol represents materials that are toxic when ingested. This category includes such common products as bleach, Mr. Clean, and Tide. Most household chemicals and cleaners contain this symbol and has become known as the symbol for poison.

**Oxidizing**

This symbol informs people that this substance produces oxygen when burned. This specific reaction creates a high problem for combustion and has to be stored in special containers and must be transported with extreme care.

**Dangerously Reactive**

This symbol is found on some household products and on a large number of lab chemicals. It means that when certain chemicals are mixed they will react and produce a harmful side effect. Some chemicals that should not be mixed are bleach, drain cleaner, and ammonia because, when combined, they will form a toxic gas.

**Flammable and Combustible**

This symbol is the Flammable and combustible material symbol, which is in class B and tells a person that a certain substance will react with a flame and burn. Some materials that fit into this category are gas and oil. These substances are highly flammable and ignite with little effort.

**Corrosive**

This symbol is the second most common symbol found in homes across North America. This symbol is most commonly found on products such as bleach and battery acid, which are highly corrosive and are able to burn organic matter.

**Toxic / Infectious**

This symbol belongs to class D-2 and is one of the less common symbols found in homes. It is more commonly found in Chemistry Labs. This symbol is somewhat similar to the fourth symbol, but chemicals that fit into this category cause slower effects to the body. Some examples of this are arsenic and nicotine.


**Biohazardous**

This symbol is often found in hospitals and is put on products that have materials that are harmful, such as viruses or bacteria. Examples of bacteria that fall into this category are ebola and the flesh eating disease.

If you think you are ready - Take the [Safety Test @ Edquest.ca](http://www.edquest.ca)

Safety in the Science Lab - Test

When special care is needed with a particular experiment or activity,

CAUTION will appear,  with a note about the special care this activity requires. General Safety Precautions should be followed at all times in the Science Lab.

- Which of the following statements **IS NOT** True?
 - excess noise and carelessness will result in poor results and accidents
 - the baggy look is not in, especially in the science lab
 - it's not cool to wear protective shoes in the science lab
 - long hair, shades and awesome scarves are not the rule in science
- Which of the following statements **IS** True?
 - dazzling, dangling jewelry is OK in the lab, as long as care is taken
 - earphones are acceptable, provided you are careful when doing a lab
 - put your contact lenses in your eyes, as soon as you enter the lab
 - contact lenses should not be worn, especially when working with chemicals
- Laboratory clothing from a safety point of view should follow these guidelines ...**EXCEPT** for ...
 - Finger rings or other tight jewelry, which is not easily removed should be avoided.
 - Where infectious materials are present, lab coats and gloves are essential.
 - Sandals, open-toed shoes, and shoes with woven uppers, can be worn.
 - Find out the recommended clothing to wear for a particular chemical.
- Doing experiments at home **IS** allowed, provided you do this ...
 - Make sure a responsible adult is present
 - Make sure you have safety equipment readily available
 - Know all of the emergency contact numbers
 - Make sure you have read all of the instructions carefully

Identify the **Personal Lab Safety Equipment**  by matching it with its function:

Use these illustrations for your answers



A.



B.



C.



D.

- _____ 5. **Visual protection:** To protect your eyes when mixing strong caustics or acids, it is recommended you wear this.
- _____ 6. **Chemical spill:** If you spill a chemical, you should be wearing these to protect your feet and eyes.
- _____ 7. **Flame retardant:** If you are working with an open flame, you should wear something to protect your clothing
- _____ 8. **Handling hot substances:** If you are handling hot substances you should use these.

WHMIS



Symbols

Identify the Symbols by choosing the letter of the symbol, which corresponds with the description of the classification.

Use these illustrations for your answers



A.



B.



C.



D.

___ 9. Compressed Gas

___ 10. Biohazard Waste

___ 11. Toxic

___ 12. Poisonous

Use these illustrations for your answers



A.



B.



C.



D.

___ 13. Flammable

___ 14. Oxidizing

___ 15. Corrosive

___ 16. Dangerously Reactive

Another Symbol you should be able to recognize is ...



Radioactive Material

But, you won't be exposed to this or tested on it.

Set-Up or Prep Work

17. There are 3 things that need to happen before beginning your activity in the Lab, including all of the following **EXCEPT**
- Make sure you have read and understand all the directions carefully.
 - Get your lab notebook and prepare the data collection table.
 - Prepare a clean work area and assemble safety equipment.
 - Ask your teacher for permission to start the lab.

18. **Illustrate** and **describe** the proper technique for **handling a heat source** ...

19. **WHMIS** stands for ...

W **H** **M** **I** **S**

20. **Lab Procedures and Techniques**

(Illustrate and Explain what to do)

Lighting a Bunsen Burner	Heating Chemicals in a Test Tube

21. **Burns** should be treated by applying _____ or _____ .

Have your teacher go over the test with you, before you go on to this Chemistry Unit

Matter Links: http://www.scienceinaction.com/scienceinaction/pgs/hot_9u2.html*Science in Action Textbook*
(pgs. 88-109)

Unit 2 Matter and Chemical Change

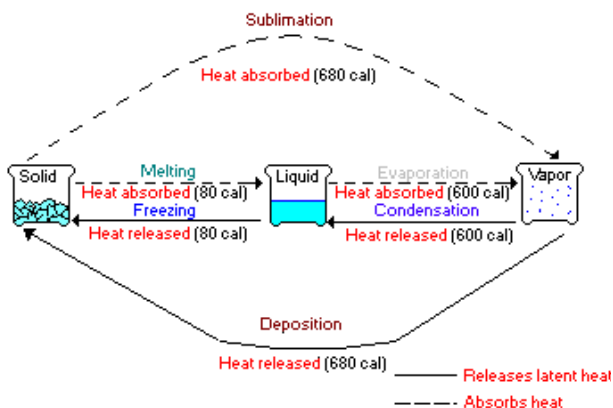
1.0 Matter can be described and organized by its physical and chemical properties.

1.1 Safety in the Science Classroom (Review Safety Notes and Test)

1.2 Organizing Matter

Matter exists in three states: solid, liquid, or gas.

Matter can undergo a change in state when energy is used or released.



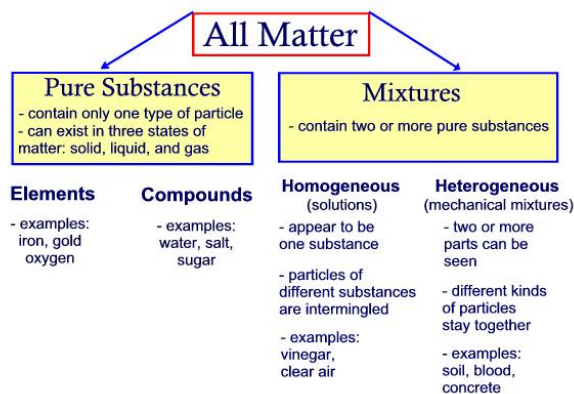
Properties are characteristics that can be used to describe a substance. These properties can be physical or chemical.

Physical properties (see p. 77)

These can include: color, luster, melting point, boiling point, hardness, malleability, ductility, crystal shape, solubility, density and conductivity.

Chemical properties describe how a substance interacts with other substances. Chemical properties include: reaction with acids, ability to burn, reaction with water, behaviour in air and reaction to heat. A **chemical change** always results in the formation of a different substance, which has its own unique 'different' physical properties.

Pure Substance or Mixture?



Physical and chemical properties show us whether a substance is 'pure' or a 'mixture'.

A pure substance is made up of only one kind of matter and has its own unique set of physical properties.

Types of Pure Substances

- **element**
- cannot be broken down into any simpler substance
- **compound**
- is a combination of two or more elements in fixed proportions

A mixture is a combination of pure substances

Types of Mixtures

- **mechanical (*heterogenous*)**
- each substance in the mixture is visible
- **solution (*homogeneous*)**
- each substance is not clearly visible (A substance dissolved in water is called an aqueous solution)
- **suspension**
- is a cloudy mixture in which tiny particles are held (suspended) with another substance, and can be filtered out
- **colloid**
- is also a cloudy mixture, but the particles are so small that they cannot be filtered out easily

1.3 Observing Changes in Matter

Matter can change from one form to another, or create new materials.

A **physical change** occurs when a material changes state.

A **chemical change** occurs when two or more substances react and create a new substance.

Evidence that a chemical change has occurred includes:

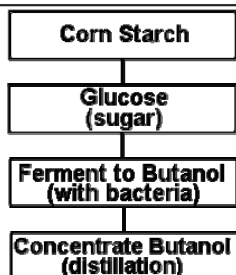
- Change in color
- Change in odor
- Formation of a gas
- Release or absorption of energy (heat)

Controlling Changes In Matter To Meet Human Needs

Freeze-drying allows food to be processed by removing the water (by freezing and sublimation) and then packaged to be **ready to eat** just by adding hot water. Biologists, to study plant cells and tissue, also use the freeze-drying method. It has also benefited scientists who need to restore ancient relics or documents that have been damaged by water.

From Corn To Nail Polish Remover and Plastic Wrap?

Butanol From Corn



Scientists are able to change other common materials into useful products.

Corn - makes soda pop bottles, removes paint or nail polish and **fuels some cars**.

These refined products are more environmentally friendly.

Section 1

Properties of Matter

1. Aluminum foam is used to create lighter, safer cars. The reason that a lighter car is a safer car is because aluminum foam is ...

- A. less rigid
- B. much cheaper than aluminum
- C. unable to be dented
- D. able to absorb more impact energy

2.



This symbol means ...

- A. flammable
- B. corrosive
- C. dangerously reactive
- D. biohazardous

3.

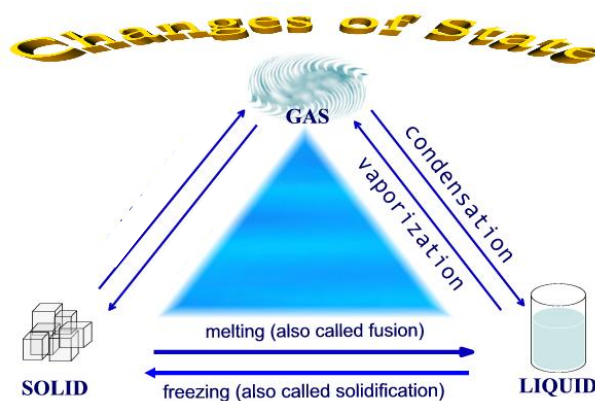


This symbol means ...

- A. caution
- B. warning
- C. danger
- D. special care

4. When a substance undergoes a change of state it can use energy or give off energy. The change that occurs when a substance changes from a gas to a solid is referred to as ...

- A. fusion
- B. deposition
- C. sublimation
- D. condensation



5. A substance's ability to resist being scratched is the physical property of matter known as ...

- A. ductility
- B. malleability
- C. hardness
- D. conductivity

6. An obvious chemical property of pancakes is ...

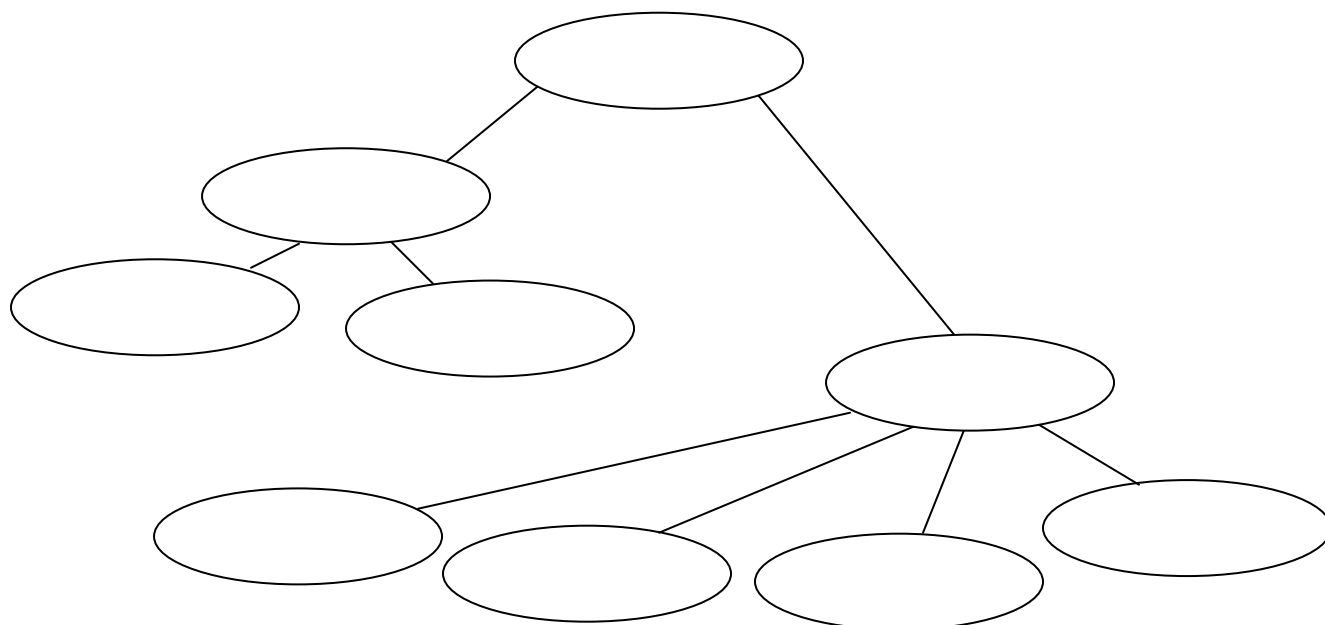
- A. ability to combine ingredients easily
- B. the positive reversibility of the process
- C. the heat it gives off
- D. the new substance that appears to form

7. The difference between an element and a compound is that an element ...

- A. is a pure substance and a compound is a mixture
- B. has only one substance, while a compound has more than one substance
- C. can be made into a mixture, but a compound cannot
- D. Can be a pure substance, while a compound cannot be a pure substance

8. Use the following words to complete a visual organizer, showing the relationships between and among the words provided. Use each word only once.

Pure Substances, Colloids, Matter, Solutions, Compounds, Mixtures, Mechanical Mixtures, Suspensions, Elements



9. A cloudy mixture in which the particles of the suspended substance are so small they cannot be easily separated out is called a ...
- mechanical mixture**
 - suspension**
 - colloid**
 - solution**
10. Physical or chemical change can be identified by evidence. When a substance undergoes a chemical change the pieces of evidence used include all of the following, **EXCEPT** ...
- colour**
 - odour**
 - state**
 - formation of a gas**
11. Freeze-drying is a technique used to preserve food for long periods of time. In the freeze-drying method the first step is to ...
- add hot water**
 - put it in a pressure chamber**
 - freeze the water, in the food**
 - refrigerate the food**
12. MRE's are especially useful for astronauts, soldiers and mountain climbers. They are heated in a special package called a 'flameless ration heater'. MRE stands for ...
- Military Ration Envelope**
 - Mission Ration Envelope**
 - Meal, Ready to Eat**
 - Meals Requiring Energy**

2.0 An understanding of the nature of matter has developed through observations over time.

2.1 Evolving Theories of Matter (pgs. 113-120)

Timeline of Achievement <http://www.chemheritage.org/explore/ancients-time.html>

Year	Evolving Theory of Matter	3D Model
8000 B.C.	<i>(Stone Age) Matter was made up of solid material, which could be fashioned into tools.</i>	Stone implements
6000-1000 B.C.	<i>Chemists investigated the properties of only those materials that were of high value to humans. (gold and copper)</i>	Metals
4500 B.C.	<i>(Bronze Age) The effect of heat on copper, led to the creation of a strong material (bronze) for use as tools.</i>	Bronze tools
1200 B.C.	<i>(Iron Age) Iron combined with carbon to make steel, for even stronger tools.</i>	Steel
350 B.C.	<i>Everything was made out of Air – Water - Earth – Fire (atomos particles)</i>	Earth/Wind/Fire/Ice
1500	<i>Theory of Matter was based more on experimentation. (History of Alchemy)</i>	States of Matter
1660	<i>Particles can be compressed. (Boyle)</i>	Particles
1770	<i>System for the naming of chemicals was developed. (Lavoisier)</i>	Molecule
1780	<i>Air is necessary for combustion to occur.</i>	Molecules
1808	<i>Observation principles during experimentation.</i>	Dalton Model
1897	<i>Raisin bun model with charged particles.</i>	Raisin bun
1904	<i>Negatively charged particles orbiting around nucleus.</i>	Rutherford
1922	<i>Electrons rotate randomly around the nucleus.</i>	Bohr






Today the 'quantum model' describes the atom as a cloud of electrons around a nucleus

2.2 Organizing the Elements (p. 122-125)

Finding a pattern in an unknown helps scientists to organize ideas and information. It also helps scientists to interpret what the information means and explain these ideas, based on what they have learned.







Looking for Patterns

Early chemists used [symbols](#) of the sun and the planets to identify the metallic elements known to them.

Metal	gold	silver	iron	mercury	tin	copper	lead
Symbol							
Celestial Body	Sun	Moon	Mars	Mercury	Jupiter	Venus	Saturn

This later became a problem, when more elements were discovered, because they ran out of planets. (**History of Chemical Symbols** - <http://www.seps.org/cvoracle/faq/catalase.html>).

John Dalton developed a new set of symbols in the early 1800's to improve communication between chemists.

Symbol						
Element	hydrogen	oxygen	carbon	gold	silver	mercury

Berzelius later revised **Dalton's** symbols by replacing them with letters, instead of pictures. He represented the elements by their first letter (capitalized), or their first two letters (first one capitalized and the second letter was lower case).

An Order for the Elements

Elements were listed in order of their atomic mass. **Atomic mass** is the mass of one atom of an element. It is represented in **atomic mass units (amu)**. John Newland's "**law of octaves**" identified the pattern in which the properties of the elements seemed to repeat at regular intervals, similar to the octave scale in music. Demitri Mendeleev later revised it in 1869.

Finding a Pattern

Mendeleev collected the 63 elements known at the time and arranged them according to their properties (which he wrote on a file card). He arranged the cards into a 'solitaire-like' table. By sorting and arranging the elements in this way, Mendeleev was able to identify gaps where elements, not yet discovered, would be able to fit.

			Ti=50	Zr=90	?[2]=180
			V=51	Nb=94	Ta=182
			Cr=52	Mo=96	W=186
			Mn=55	Rh=104,4[3]	Pt=197,4[4]
			Fe=56	Ru=104,4	Ir=198
			Ni=Co=59	Pd=106,6	Os=199
			Cu=63,4	Ag=108	Hg=200
	Be=9,4	Mg=24	Zn=65,2	Cd=112	
	B=11	Al=27,4	?[6]=68	Ur=116[7]	Au=197?
	C=12	Si=28	?[8]=70	Sn=118	
	N=14	P=31	As=75	Sb=122	Bi=210?
	O=16	S=32	Se=79,4	Te=128?	
	F=19	Cl=35,5	Br=80	J=127[9]	
Li=7	Na=23	K=39	Rb=85,4	Cs=133	Tl=204
		Ca=40	Sr=87,6	Ba=137	Pb=207
		?[10]=45	Ce=92[11]		
		?Er=56	La=94		
		?Yt=60	Di=95		
		?In=75,6	Th=118?		

2.3 The Periodic Table Today

About 112 elements are known today. They are organized into what is called '**The Periodic Table of Elements**'. In 1875 gallium was discovered and proved that Mendeleev's organization of the elements worked, because it fit in where he had placed a (?). The next (?) was not replaced until 1939 when francium was discovered.

Understanding the Periodic Table

Web Elements.com <http://www.webelements.com/>

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Horizontal rows are called **periods** (numbered 1-7)

Vertical columns form a **group**, or **family** of elements (numbered 1-18)

[Different versions] <http://chemlab.pc.maricopa.edu/periodic/foldedtable.html>

Los Alamos Periodic Table <http://pearl1.lanl.gov/periodic/default.htm>

Visual Elements (Flash Version) http://www.chemsoc.org/viselements/pages/periodic_table.html

Useful Information On Each Element

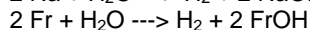
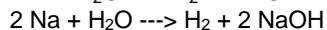
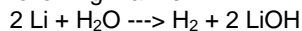
Atomic Number	3	2	Ion charge
Element Symbol	Li	1	
Element Name	Lithium		
Atomic Mass	6.941		

Patterns of Information in The Periodic Table

All the elements in a **group** (or column) are called **families**.
Metals, Non-metals and metalloids
Groups
Periods

Alkali metals

(Group 1): **The Alkali Earth Metals**, all react with water in the following manner





Halogens

(Group 8): **The Noble Gases**, don't react with other elements.

Other Interesting Patterns

Section 2

Nature of Matter Over Time – Periodic Table

- The first chemists lived before 8000 B.C. Because metals had not been discovered, humans used only simple tools made from these ...
 - rocks, scissors and paper
 - wood pulp and ink
 - stones and bones
 - plants and animal remains
- This is derived from “khemeia” (a Greek word) ...
 - Caustic
 - Chemistry
 - Copper
 - Copernicus
- ‘alkimiya’ (an Arabic word) translates as ...
 - Alchemy
 - Alkali
 - Apostle
 - The Chemist
- The scientist who developed the ‘billiard ball’ model of the atom was ...
 - Lavoisier
 - Boyle
 - Libeu
 - Dalton
- Most models of the atom include the sub-atomic particles, called electrons, orbiting the nucleus. The quantum model of the atom has these electrons in ...
 - a charged cloud
 - fixed orbits
 - random patterns
 - scattered orbits
-  This ancient element symbol means ...
 - copper
 - silver
 - gold
 - tin
-  This element symbol means ...
 - oxygen
 - hydrogen
 - silver
 - carbon
- Demitri Mendeleev wanted to find a pattern that would allow him to predict the properties of elements not yet discovered. By using information cards he charted the pattern that seemed to work. The characteristic that showed that the properties of elements vary periodically was the ...
 - color
 - atomic number
 - atomic mass
 - symbol

8.

19	2
K	8
<u>Potassium</u>	8
39.0983	1

 In this element – **Potassium** – **19** refers to the ...
9.

19	2
K	8
<u>Potassium</u>	8
39.0983	1

 In this element – **Potassium** – **39.0983** refers to the ...
- A. mass
B. reactivity
C. number
D. Ion charge
- A. mass
B. reactivity
C. number
D. Ion charge

Use this periodic table information to answer the next two questions

1.0 H 1																4.0 He 2	
6.9 Li 3	9.0 Be 4											10.8 B 5	12.0 C 6	14.0 N 7	16.0 O 8	19.0 F 9	20.2 Ne 10
23.0 Na 11	24.3 Mg 12											27.0 Al 13	28.1 Si 14	31.0 P 15	32.1 S 16	35.5 Cl 17	39.9 Ar 18
39.1 K 19	40.1 Ca 20	45.0 Sc 21	47.9 Ti 22	50.9 V 23	52.0 Cr 24	54.9 Mn 25	55.8 Fe 26	58.9 Co 27	58.7 Ni 28	63.5 Cu 29	65.4 Zn 30	69.7 Ga 31	72.6 Ge 32	74.9 As 33	79.0 Se 34	79.9 Br 35	83.8 Kr 36
85.5 Rb 37	87.6 Sr 38	88.9 Y 39	91.2 Zr 40	92.9 Nb 41	95.9 Mo 42	(99) Tc 43	101.1 Ru 44	102.1 Rh 45	106.4 Pd 46	107.9 Ag 47	112.4 Cd 48	114.8 In 49	118.7 Sn 50	121.8 Sb 51	127.6 Te 52	126.9 I 53	131.3 Xe 54
132.9 Cs 55	137.3 Ba 56	138.9 La 57	178.1 Hf 72	181.0 Ta 73	183.0 W 74	186.2 Re 75	190.2 Os 76	192.2 Ir 77	195.1 Pt 78	197.0 Au 79	200.6 Hg 80	204.4 Tl 81	207.2 Pb 82	209.0 Bi 83	(210) Po 84	(210) At 85	(222) Rn 86

10. In the table above the following elements would be described as the Noble Gases.
- A. He, Ne, Ar, Kr, Xe, Rn
B. Li, Na, K, Rb, Cs, Fr
C. Be, Mg, Ca, Sr, Ba, Ra
D. Rf, Db, Sg, Bh, Hs, Mt, Uun
11. How many neutrons does Potassium have?
- A. 15
B. 17
C. 19
D. 20
12. As you move across the periodic table the properties of the elements change. The most reactive metals include ...
- A. sodium and lithium
B. iron and copper
C. aluminum and carbon
D. lead and zinc
13. The periodic table is organized by the patterns of the properties of the elements. The rows in the periodic table vary with the amount of elements they contain. These rows are called ...
- A. groups
B. families
C. periods
D. metals

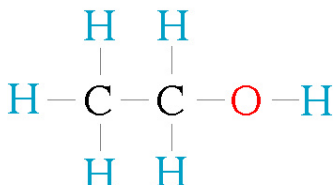
3.0 Compounds form according to a set of rules.

3.1 Naming Compounds (pgs. 139-142)

As you learned in the last section (*The Periodic Table*), each element has a chemical name. The combination of elements to form **compounds** has a **chemical name** and a **chemical formula**. The formula identifies which elements and how many of each are in the compound.

For example:

ethanol (C_2H_6O) has **2** carbon atoms, **6** hydrogen atoms and **1** oxygen atom



To determine the name, a standardized chemical naming system, or **nomenclature**, is used. Guyton de Morveau in France developed it in 1787. The metal name is always first. Since 1920, the **IUPAC** (*International Union of Pure and Applied Chemistry*) is responsible for determining the appropriate name for each compound.

Interpreting Chemical Names and Formulas From Compounds

If you know the formula for a compound you can determine its chemical name – if you know its name, you can determine its formula.

Write the **chemical formula** as determined by the **name** of the compound.

(If a poly atomic ion is part of the formula, keep the poly-atomic ion intact)

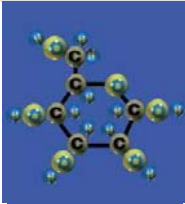
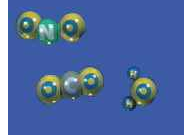
Aluminum oxide	2 - Al	3 - O	Al_2O_3
Calcium nitrite	1 - Ca	2 - NO_2	$Ca(NO_2)_2$
Sodium Chloride	1 - Na	2 - Cl_2	NaCl

If the compound contains a metal the compound is ionic.

If the compound does not contain a metal, it is molecular.

Write the **name** of the compound as determined by the **chemical formula**.

Al_2O_3	2 - Al	3 - O	Aluminum oxide
$Ca(NO_2)_2$	1 - Ca	2 - NO_2	Calcium nitrite
NaCl	1 - Na	2 - Cl_2	Sodium Chloride

Chemical Name & Physical State	Atomic model	Chemical Formula
Glucose (s) - solid		$C_6H_{12}O_6$ The chemical formula for glucose tells us that each molecule is made of 6 carbon atoms, 12 hydrogen atoms, and 6 oxygen atoms.
Nitrogen dioxide (g) - gas		NO_2
Carbon dioxide (g) - gas		CO_2
Water (l) – liquid		H_2O

(aq) – **aqueous solution** This is used when substances are dissolved in water.
A saltwater solution would be **NaCl** (aq)

3.2 Ionic Compounds (pgs. 144-148)

Sodium Chloride (table salt) – **NaCl** – is an **ionic compound**. Ionic compounds are pure substances formed as a result of the attraction between particles of opposite charges, called **ions**.

Properties of ionic compounds

- High melting point
- Good electrical conductivity
- Distinct crystal shape
- Solid at room temperature

When the ionic compound is dissolved in water, the metal (**Na**) and nonmetal (**Cl₂**) form an aqueous solution of ions. An ion is an atom or group of atoms that has become electrically charged through **a loss or gain of electrons**. (see Table sia p. 146)

Ion Charges

A superscript (**+**) or a (**-**) are used to indicate the charge. **Na⁺** and **Cl⁻**

Some ions can also form when certain atoms of elements combine. These ions are called **polyatomic ions** (*poly* meaning “many”). Polyatomic atoms are a group of atoms acting as one.

Example:

1 carbon atom reacting with 3 oxygen atoms produces
1 carbonate group of atoms, which act as one. **CO₃²⁻**

Then, when carbonate ions react with calcium atoms they produce calcium carbonate, or limestone. **Ca CO₃²⁻**

Naming Ionic Compounds

Two rules:

1. The chemical name of the metal or positive ion goes first, followed by the name of the non-metal or negative ion.
2. The name of the non-metal negative ion changes its ending to **ide**.

NB: one exception – Where negative ions are polyatomic ions, the name remains unchanged. Some elements with *more than one ion charge* use a roman numeral in its chemical name to clearly show which ion is being used. **Cu(II)SO₄** (Copper II Sulfate)

Using Ion Charges and Chemical Names To Write Formulas

Step 1 – Print the metal element's name, symbol and ion charge, then the non-metals name, symbol and ion charge

Step 2 – Balance the ion charges (the positive ion must balance with the negative ion)

Step 3 – Write the formula by indicating how many atoms of each element are in it.

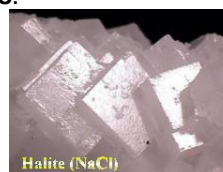
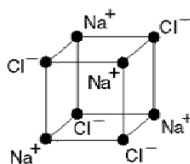
Ca ²⁺	Cl ¹⁻
Ca ²⁺	Cl ¹⁻ Cl ¹⁻
CaCl ₂	

Ion Charges and the Periodic Table

Patterns:	ion charge
Alkali metals	1+
Halogens	1 -

Elements in a group have the same ion charge (most consistency at either end of the table)

All ionic compounds model **distinct** (different) **crystal shapes**.



3.3 Molecular Compounds (pgs. 150-153)

When **non-metals** combine, they produce a pure substance called a **molecule**, or **molecular compound**. They can be solids, liquids, or gases at room temperature.

Examples: sugar ($C_{12}H_{22}O_{11(s)}$)
acetylene, water

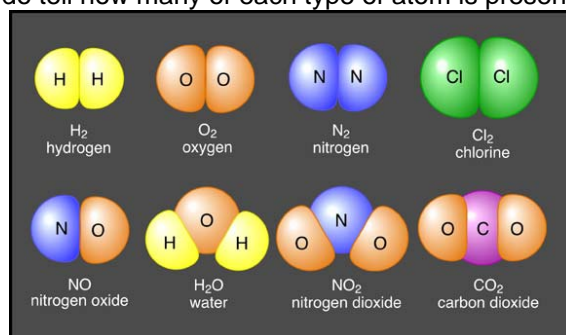
Properties of molecular compounds

- Low melting point
- Low boiling point
- Good insulators
- Poor conductors
- Distinct crystal shape

Of the 10 million compounds discovered so far, about 9 million are molecular compounds.

Writing Formulas For Molecular Compounds

It is similar to the way it is done in ionic compounds, except that no ions are present and the ion charge is not used in the formulas. This makes it difficult to predict how the non-metals will combine. The formulas do tell how many of each type of atom is present in the molecule.



Naming of Molecular Compounds

Rules:

1. The first element in the compound uses the element name (just like the ionic compounds do).
2. The second element has a suffix – **ide** – (like the ionic compounds).
3. When there is more than 1 atom in the formula, a prefix is used which tells how many atoms there are:

Number of Atoms	Prefix	Number of Atoms	Prefix
1	mono	6	hexa
2	di	7	
3	tri	8	octa
4	tetra	9	
5	penta	10	deca

4. Exception to #3 above – when the first element has only 1 atom the prefix mono is not used.

Examples: CO_2 carbon **dioxide** CCl_4 carbon **tetra**chloride

Comparing Ionic And Molecular Compounds

Use a cover card to begin listing the comparison attributes for both the ionic and molecular compounds. This technique will be discussed in class.

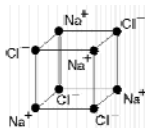
Section 3**Formation of Ionic and Molecular Compounds**

- Compounds are formed when elements combine in different chemical reactions. This identifies which elements combine and how many of them are present in the compound.
 - Chemical Name**
 - Atomic Mass Unit**
 - Atomic Number**
 - Chemical Formula**
- In the formula for baking soda [$\text{NaHCO}_{3(s)}$] the following indicates how many atoms are present in each molecule ...
 - 1 sodium, 1 hydrogen, 3 carbon dioxide**
 - 1 atom of each element**
 - 1 sodium, 1 hydrogen, 1 carbon, 3 oxygen**
 - 1 sodium, 1 hydrogen, 1 calcium and 3 oxygen**
- In the formula for baking soda $\text{NaHCO}_{3(s)}$ the (s) indicates that this molecule is ...
 - safe**
 - stable**
 - strong**
 - solid**
- Pure substances formed as a result of the attraction between charged particles of opposite charges are ...
 - Stable elements**
 - Ionic compounds**
 - Molecular compounds**
 - Charged elements**
- When ionic compounds are formed, the ions combine to form a ...
 - crystal**
 - block**
 - irregular pattern**
 - cloud**
- When sodium (a very reactive metal) is placed in chlorine (a green gas), the sodium explodes with a bright yellow flame. As it burns, this white, coarse-grained powder is produced.
 - silicon**
 - carbon**
 - alum**
 - salt**
- A group of ions 'that act as one' are called ...
 - Subatomic ions**
 - Polyatomic ions**
 - Molecular ions**
 - Aqueous ions**
- When naming ionic compounds there are two rules to remember: The first is that the name of the metal is always placed first, the second is the name of the non-metal ion(s) changes to
 - 'ous'**
 - 'ade'**
 - 'ide'**
 - 'ate'**
- The ion charges of a particular element will help you determine the chemical formula for the compound that is formed. Calcium [Ca^{2+}] combines with chlorine [Cl^{1-}] to produce Calcium Chloride. The correct formula for Calcium Chloride is ...
 - Ca_2Cl**
 - CaCl_2**
 - 2CaCl**
 - Ca2Cl**

10. The alkali metals include Lithium and Sodium, each having an ion charge of 1+, are often reactive with the elements that have an ion charge of 1-. The group of elements that alkali metals react with are called the ...

- A. Halogens
- B. Earth Metals
- C. Non-Metals
- D. Metalloids

11. This type of lattice structure represents the compound, **sodium chloride**.



The characteristic that identifies this compound as an ionic compound is its **distinct crystal ...**

- A. size
- B. shape
- C. ion
- D. element

12. N_2O_3 is a molecular compound. The chemical name - following the rules for naming molecular compounds - for N_2O_3 is ...

- A. trinitrogen oxide
- B. dinitrogen oxide
- C. trinitrogen dioxide
- D. dinitrogen trioxide

13. Sugar $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ is a molecular compound. This compound contains ...

- A. 3 carbon atoms, 4 hydrogen atoms and 2 oxygen atoms
- B. 3 calcium atoms, 4 helium atoms and 2 organic atoms
- C. 12 carbon atoms, 22 hydrogen atoms and 11 oxygen atoms
- D. 12 calcium atoms, 22 helium atoms and 11 oxidizing atoms

14. Use the information in the following table to answer this question.

Compound	Formula	Melting Point °C	Boiling Point °C
baking soda	NaHCO_3	455°	1550°
carbon dioxide	CO_2	sublimates	-79°
rubbing alcohol	$\text{CO}_3\text{H}_8\text{O}$	-90°	82°
salt	NaCl	801°	1413°

The molecular compounds from the table above are ...

- A. baking soda and salt
- B. rubbing alcohol and salt
- C. carbon dioxide and baking soda
- D. carbon dioxide and rubbing alcohol

15. A Tetra Pak is a drink container that is used by manufacturers to provide juice in a handy convenient format. Tetra means ...

- A. recyclable
- B. four
- C. wax paper
- D. convenient

4.0 Substances undergo a chemical change when they interact to produce different substances.



4.1 Chemical Reactions (pgs. 157-161)

Chemical Reaction Movies <http://jchemed.chem.wisc.edu/jcesoft/cca/cca0/sampmovs.htm>

A **chemical reaction** takes place when two or more substances combine to form new substances. Different [types of chemical reactions](#) can occur, including **combination**, **decomposition**, **displacement** and **exchange** reactions. The substances at the beginning of the reaction are called **reactants**. The new materials produced by the reaction are called **products**. Chemical reactions can be written as **word equations** which gives the names of all the reactants (separated by a 'plus' sign +) followed by an arrow which points to the names of all the products (separated by a 'plus' sign +)

eg. (**iron + oxygen + water ---> rust**)
(**Iron plus oxygen plus water produces rust**)

A **chemical change** results from a chemical reaction. Evidence that a chemical change has occurred include:

- A change on colour
- The formation of an odour
- The formation of a solid or a gas (bubbles)
- The release or absorption of energy
 - A chemical change, which **releases** energy, is called **EXOTHERMIC**.
 - A chemical change, which **absorbs** energy, is called **ENDOTHERMIC**

Chemical Reactions Involving Oxygen

Combustion is a chemical reaction that occurs when oxygen reacts with a substance to form a new substance and gives off energy.

Identification Tests:

- for **OXYGEN** Light a wooden splint. Blow out the flame, allowing the splint to continue glowing. Hold the glowing splint in a small amount of the unknown gas. If the splint bursts into flame, then the gas being tested is oxygen.
- for **HYDROGEN** Light a wooden splint. Hold the glowing splint in a small amount of the unknown gas. If you hear a "**pop**", then the gas being tested is Hydrogen.
- for **CARBON DIOXIDE** If you put a burning splint into Carbon Dioxide, the flame will go out and you will know the gas is not oxygen or hydrogen, but you will not know for sure that it is Carbon Dioxide. The test for Carbon Dioxide is not a combustion test, but rather uses a liquid called **limewater** (a clear colorless solution of calcium hydroxide, or slaked lime) Bubble the unknown gas through the limewater solution, or add a few drops of the limewater solution to the gas and swirl it around. If the limewater turns **milky**, the gas is Carbon Dioxide.

Corrosion is a slow chemical change that occurs when oxygen in the air reacts with a metal. Corrosion is a chemical reaction in which the metal is decomposed (eaten away), when it reacts with other substances in the environment.



The corrosion of iron is called '**rusting**'.

Many metals can corrode. The green roofs of the parliament buildings are an example of corrosion. The red-brown copper color is replaced with the green color because copper corrodes. Gold does not corrode. Solid solutions of metals (alloys) resist corrosion. Corrosion protection involves protecting the metal from contact with the environment and the factors that affect the reaction rate of this chemical reaction (e.g. painting the metal)

Cellular Respiration - <http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/C/CellularRespiration.html>

Cellular Respiration is a chemical reaction that takes place in the cells in your body.

Animations of cellular respiration - <http://science.nhmccd.edu/biol/bio1int.htm>

4.2 Conservation of Mass in Chemical Reactions (pgs. 163-165)

The Law of Conservation of Mass

*In a chemical reaction, the total mass of the reactants,
is always equal to the total mass of the products.*

This law ties in well with the atomic theory, which states that atoms are never created or destroyed. In a chemical reaction the atoms and molecules are simply rearranged.

This law of conservation of mass however does not apply to nuclear reactions, because there is some loss of mass: **the mass is changed into energy**. This was first suggested by **Albert Einstein** in his famous equation:

$$E = MC^2$$

(**E** is Energy, **M** is Mass, **C²** is a large number)

A very tiny amount of mass is equal to a very large amount of energy

In an **open system** some of the mass seems to disappear, when it is in the form of a gas.

Chemistry Tutorials

<http://www.chemistrycoach.com/tutorials-2.htm>

Law of Definite Composition
Law of Multiple Proportions

4.3 Factors Affecting the Rate of a Chemical Reaction (pgs. 166-169)

Reaction Rate

The speed of a chemical reaction is called the **reaction rate**.

- **Temperature** of the reactants affects the rate of all reactions (The higher the temperature the faster the reaction rate)
- **Surface Area** of the reactants affects the reaction rate (The more surface in contact, the faster the reaction rate)
- **Concentration** of the reactants affects the reaction rate. (The higher the concentration, the faster the reaction rate)
- **The presence of a Catalyst** affects the reaction rate (Catalysts are substances that help a reaction proceed faster).

Catalysts

Catalysts are not consumed in the reaction. Types of reactions involving catalysts can be found in living and non-living things. **Enzymes** help in the reactions in the body, which break down food. They also get rid of poison in the body.

Catalase <http://www.seps.org/cvoracle/faq/catalase.html>

(an enzyme found in plant and animal cells) speeds up the breaking down of hydrogen peroxide into harmless oxygen and water.

Section 4

Chemical Reactions

1. A chemical reaction takes place when two or more ...

- A. **molecular compound are mixed**
- B. **ionic compounds are mixed**
- C. **substances are mixed**
- D. **substances combine to form new substances**

2. Use the following chemical reaction word equation to answer the question.



The reactants in this chemical word equation are ...

- A. **wood and oxygen**
- B. **carbon dioxide and water**
- C. **oxygen and energy**
- D. **wood and energy**

3. A chemical reaction occurs when this evidence is present ...

- A. **a solution is formed**
- B. **a change of state occurs**
- C. **energy is needed or released**
- D. **the reaction is reversible**

4. The following word equation identifies what happens when hydrogen peroxide is left out in the sun. It changes to water and oxygen gas.

- A. **Water + Oxygen \longrightarrow Hydrogen peroxide**
- B. **Hydrogen peroxide + Energy \longrightarrow Water + Oxygen**
- C. **Water + Energy + Oxygen \longrightarrow Hydrogen peroxide**
- D. **Hydrogen peroxide + Oxygen \longrightarrow Water + Energy**

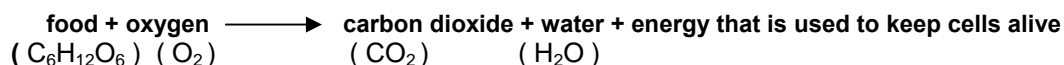
5. The reaction above is classified as ...

- A. **catalytic**
- B. **exothermic**
- C. **endothermic**
- D. **oxidization**

6. Fire keeps going because of three factors. These factors are ...

- A. **fire - water - air**
- B. **fire - fuel - air**
- C. **fuel - air - energy**
- D. **fuel - air - heat**

7. The following reaction takes place in the cells in your body.



This word equation represents ...

- A. **cellular respiration**
- B. **photosynthesis**
- C. **transpiration**
- D. **combustion**

8. The difference between a **combustion** reaction and a **corrosion** reaction is ..
- A. intensity
 - B. products
 - C. speed
 - D. reactants
9. To treat an injury in sport, **cold packs** are used to reduce the swelling where the injury occurs. These cold packs are examples of ...
- A. Endothermic reactions
 - B. Exothermic reactions
 - C. Combustion reactions
 - D. Corrosion reactions
10. Alexander performed an experiment with Alka-Seltzer and water. He carefully weighed the reactants and found that the total mass was 110 g. When he recovered the products and weighed them the combined mass was only 106g. The difference was 4g. What would account for the difference in mass?
- A. The mass of the reactants didn't account for the oxygen need for the reaction to occur.
 - B. The mass of the products didn't account for the gas bubbles that were released.
 - C. The total mass did not include the mass of the beaker he used.
 - D. The beaker had a crack in it and some of the water leaked out.
11. A catalyst was used in an experiment. The effect that the catalyst had was ...
- A. There was no effect at all
 - B. The reaction happened slower
 - C. The reaction produced more products
 - D. The reaction happened faster
12. Enzymes are catalysts used in our body to break down food. Without the presence of enzyme the reactions in our body would ...
- A. not occur at all
 - B. happen more quickly
 - C. require much higher temperatures
 - D. produce different substances
13. Chewing on a **TUMS** tablet enables the reaction that occurs in our mouth and body to happen faster. This is because we have increased the ...
- A. surface area
 - B. concentration
 - C. temperature
 - D. work of enzymes
14. Conserving mass means to keep the same amount. The **Law of Conservation of Mass** does not apply to nuclear reaction because ...
- A. this reaction can destroy mass
 - B. nothing happens to the mass in this reaction
 - C. energy is changed into mass
 - D. mass is changed into energy



Science In Action 9

Unit 2

Matter and Chemical Change

Section 1.0 Physical and Chemical Properties of Matter

- **WHMIS** - Classification of matter – states of matter
- Physical properties – color, luster, hardness, melting/boiling pt. etc.
- Chemical properties – describes substance interactions

Section 2.0 Nature of Matter

- Understanding grew as observations were explained – Theories confirmed or rejected this understanding
- **Democritus** – matter was indivisible particles **Boyle** – matter is made of tiny particles (further research identified **atoms** and **subatomic** particles (**protons** and **neutrons** in a **nucleus** with **electrons** orbiting the nucleus)
- **Elements** are pure substances with only one type of atom
- The **Periodic Table** organizes the elements by their **atomic number** (protons in the nucleus) and **atomic mass** (average mass of 1 atom)
- Periodic Table patterns: **metals**, **metalloids** and **non-metals**

Section 3.0 Compounds

- Chemical compounds have a chemical formula and chemical name
- An **ion** is an atom or group of atoms that is electrically charged by losing or gaining electrons
- **Ionic bonds** form between atoms of metals and non-metals
- **Molecular bonds** form between atoms of non-metals









Section 4.0 Chemical Change

- **Physical Change** is a change of state, not composition
- **Chemical Change** results in formation of new substances
- Most common reactions involving oxygen: **combustion**, **corrosion** and **cellular respiration**
- **Reactants** interact to produce **products** in a chemical reaction
- **Conservation of mass**: mass of reactants = mass of products
- **Exothermic** (gives off energy) **Endothermic** (takes in energy)
- Reaction rate can be affected by temperature, concentration, surface area or the addition of a catalyst

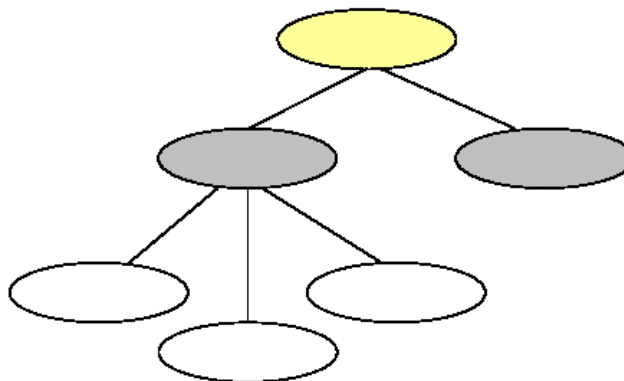
1.0 Matter can be described and organized by its physical and chemical properties

- Key Concepts
- Workplace Hazardous Materials Information System (WHMIS) and safety
 - substances and their properties

Recognition of **WHMIS** symbols is important to lab safety. Identify the following **WHMIS** symbols.

	_____		_____
	_____		_____
	_____		_____
	_____		_____

Matter can be organized in different ways. One way is as solids, liquids, and gases. Another way is as mixtures and pure substances. Complete the Organizational Chart showing how matter is organized as pure substances and mixtures. (p. 103) (Extend the chart if you need to)



Identify the 4 different types of mixtures and explain how they are different from each other.

Physical properties of matter such as color, hardness, boiling point, and density are used to identify substances. Describe each of the following physical properties of matter. (p. 99)

Ductility	
Solubility	
Malleability	
Conductivity	
Density	

Chemical properties describe how a substance interacts with other substances. Describe 5 examples of chemical properties. (p.102)

Identify the **evidence** that would be used to determine if a chemical change has occurred

2.0 An understanding of the nature of matter has developed through observations over time.

- Key Concepts
- elements, compounds, and atomic theory
 - periodic table

Human understanding of matter grew as people suggested explanations for their observations of the natural world. Theories were confirmed or rejected as people learned more about matter.

Describe the evolving theories of matter from the stone age, the bronze age and the iron age.

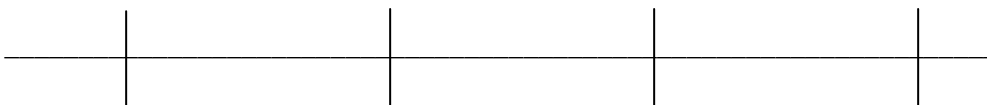
Stone Age	Bronze Age	Iron Age

The Greek philosopher Democritus stated that matter was made up of tiny indivisible particles called atomos. This theory was not widely accepted for 2000 years.

Outline a brief timeline that describe the experiments with matter from **Alchemy to Chemistry**

Aristotle's
view

Matter Made up of
Earth, Air
Fire, Water

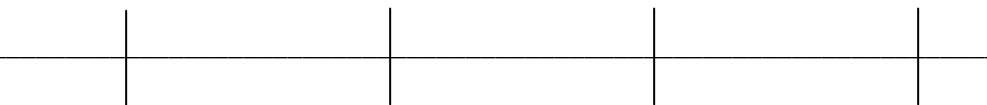


Investigations by scientists, such as Robert Boyle, in the 1600s confirmed that matter is made up of tiny particles. Further investigation by researchers gradually developed the understanding we have today that matter is made up of atoms. Each atom has a nucleus containing protons and neutrons. Electrons orbit the nucleus.

Outline a brief timeline that describes the **Atomic Theory**

Dalton
suggested
(1808)

Matter was made
Up of elements



Elements are pure substances made up of only one type of atom.

What symbols were used in Ancient times to represent the 7 known elements?

gold	silver	iron	mercury	tin	copper	lead
Sun	Moon	Mars	Mercury	Jupiter	Venus	Saturn

The periodic table organizes the elements according to their atomic number and atomic mass. The atomic number is the number of protons in the nucleus. The atomic mass is the average mass of an atom of an element.

16	S	2- 4+ 5+
Sulphur		
32.1		

Identify the following for the element shown:

Atomic Number _____ Atomic Mass _____

Ion Charge _____

Patterns of information on the periodic table include groupings of metals, metalloids, and nonmetals. Complete the chart by describing each of the identified patterns of information in the Periodic table

Alkali metals

Group 1 elements This group of elements are _____

Alkali-earth metals

Group 2 elements This group of elements _____

Halogens

Group 17 elements This group of elements are _____

Noble gases

Group 18 elements This group of elements are _____

3.0 Compounds form according to a set of rules.

- Key Concepts
- chemical nomenclature
 - Ionic and Molecular compounds

Every chemical compound has a chemical formula and chemical name. The chemical formula identifies the elements in the compound and their proportions.

Identify the chemical name or formula in the following chart and tell whether it is ionic or molecular.

Chemical name	Chemical formula	Ionic or Molecular
Sodium Bicarbonate	NaHCO_3	Ionic
Sodium Chloride		
Sugar		
Sulfuric Acid	H_2SO_4	
	H_2O	
	CO_2	Molecular
Lithium Oxide		
Copper (II) Sulfate	CuSO_4	

An ion is an atom or a group of atoms that has become electrically charged through the loss or gain of electrons from one atom to another.

Complete the comparison chart showing how ionic and molecular compounds are different.

Ionic Compounds	Characteristic	Molecular Compounds
Ionic compounds form between atoms of metals and non-metals	Type of elements present	Molecular compounds form between atoms of non-metals.
	Boiling point	

4.0 Substances undergo a chemical change when they interact to produce different substances.

Key Concepts

- endothermic and exothermic reactions
- reactants and products
- conservation of mass
- factors affecting reaction rates

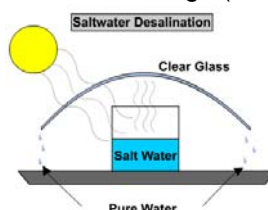
A physical change may change the appearance or state of a substance but not its composition. A chemical change results in the formation of one or more different substances.

Identify the following either as a physical or chemical change (*circle your choice*)



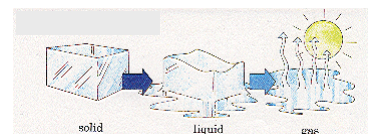
A fire

Physical Chemical



Removing salt from saltwater

Physical Chemical



Ice melting

Physical Chemical

Reactions involving oxygen are some of the most common types of chemical reactions. These include combustion, corrosion, and cellular respiration.

What is the difference between a **combustion reaction** and a **corrosion reaction**?

A chemical reaction occurs when substances called reactants interact to produce different substances called products.

Identify the **reactants** and **products** in the reaction below:



Reactants are _____

Products are _____

Identify the **chemical word equation** for the information provided below

Reactants are $\text{C}_6\text{H}_{12}\text{O}_{22}$ and O_2

Products are CO_2 and H_2O and **energy** (released)

This word equation represents _____

According to the principle of the conservation of mass, the mass of the products in a chemical reaction equals the mass of the reactants.

What is necessary in order for this **Law Of Conservation of Mass** to be accurately verified when doing any experiment?

An exothermic reaction gives off energy. An endothermic reaction takes in energy.
What is the difference between an **endothermic reaction** and an **exothermic reaction**?

The rate of reaction can be affected by the addition of a catalyst, or an increase in the concentration, temperature, or surface area of the reactants.
Describe the action of an **enzyme**, such as **catalase**, that is present in our cells.

Matter and Chemical Change Unit Test

Section 1

Properties of Matter

1. Aluminum foam is used to create lighter, safer cars. The reason that a lighter car is a safer car is because aluminum foam is ...
- less rigid
 - much cheaper than aluminum
 - unable to be dented
 - able to absorb more impact energy

2.



This symbol means ...

- flammable
- corrosive
- dangerously reactive
- biohazardous

3.



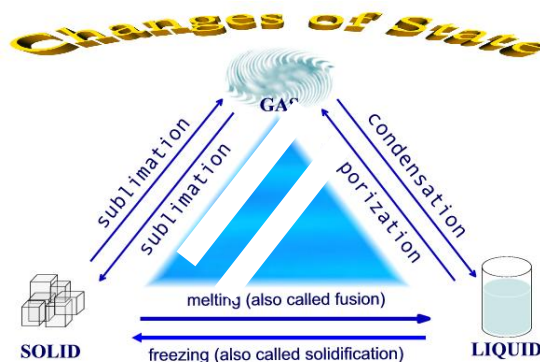
This symbol means ...

- caution
- warning
- danger
- special care

4.

When a substance undergoes a change of state it can use energy or give off energy. The change that occurs when a substance changes **from a gas to a solid** is referred to as ...

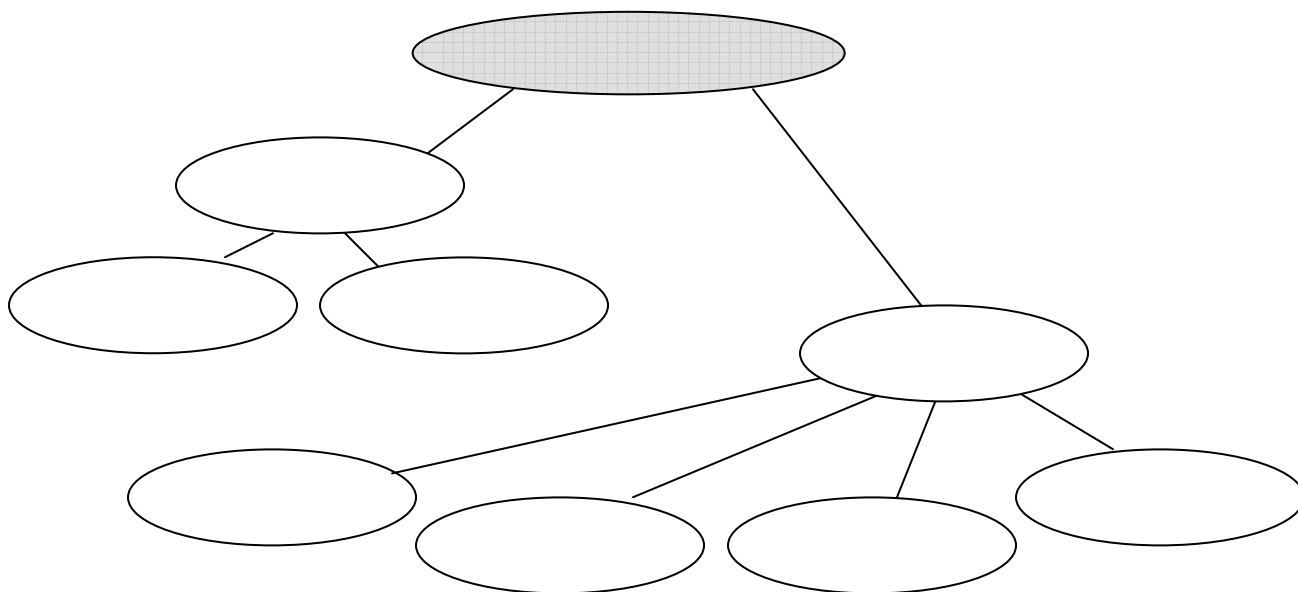
- fusion
- deposition
- sublimation
- condensation



5. A substance's ability to resist being scratched is the physical property of matter known as ...
- ductility
 - malleability
 - hardness
 - conductivity
6. An obvious chemical property of pancakes is ...
- ability to combine ingredients easily
 - the positive reversibility of the process
 - the heat it gives off
 - the new substance that appears to form
7. The difference between an element and a compound is that an element ...
- is a pure substance and a compound is a mixture
 - has only one substance, while a compound has more than one substance
 - can be made into a mixture, but a compound cannot
 - Can be a pure substance, while a compound cannot be a pure substance

8. Use the following words to complete a visual organizer, showing the relationships between and among the words provided. Use each word only once.



Pure Substances, Colloids, Matter, Solutions, Compounds,
Mixtures, Mechanical Mixtures, Suspensions, Elements



9. A cloudy mixture in which the particles of the suspended substance are so small they cannot be easily separated out is called a ...
- mechanical mixture
 - suspension
 - colloid
 - solution
10. Physical or chemical change can be identified by evidence. When a substance undergoes a chemical change the pieces of evidence used include all of the following, **EXCEPT** ...
- colour
 - odour
 - state
 - formation of a gas
11. Freeze-drying is a technique used to preserve food for long periods of time. In the freeze-drying method the first step is to ...
- add hot water
 - put it in a pressure chamber
 - freeze the water, in the food
 - refrigerate the food
12. MRE's are especially useful for astronauts, soldiers and mountain climbers. They are heated in a special package called a 'flameless ration heater'. MRE stands for ...
- Military Ration Envelope
 - Mission Ration Envelope
 - Meal, Ready to Eat
 - Meals Requiring Energy

Section 2

Nature of Matter Over Time – Periodic Table

13. The first chemists lived before 8000 B.C. Because metals had not been discovered, humans used only simple tools made from these ...
- A. rocks, scissors and paper
 - B. wood pulp and ink
 - C. stones and bones
 - D. plants and animal remains
14. This is derived from “khemeia” (a Greek word) ...
- A. Caustic
 - B. Chemistry
 - C. Copper
 - D. Copernicus
15. ‘alkimiya’ (an Arabic word) translates as ...
- A. Alchemy
 - B. Alkali
 - C. Apostle
 - D. The Chemist
16. The scientist who developed the ‘billiard ball’ model of the atom was ...
- A. Lavoisier
 - B. Boyle
 - C. Libeu
 - D. Dalton
17. Most models of the atom include the sub-atomic particles, called electrons, orbiting the nucleus. The quantum model of the atom has these electrons in ...
- A. a charged cloud
 - B. fixed orbits
 - C. random patterns
 - D. scattered orbits
18.  This ancient element symbol means ...
- A. copper
 - B. silver
 - C. gold
 - D. tin
19.  This element symbol means ...
- A. oxygen
 - B. hydrogen
 - C. silver
 - D. carbon
20. Demitri Mendeleev wanted to find a pattern that would allow him to predict the properties of elements not yet discovered. By using information cards he charted the pattern that seemed to work. The characteristic that showed that the properties of elements vary periodically was the ...
- A. color
 - B. atomic number
 - C. atomic mass
 - D. symbol

21.

19	2
K	8
Potassium	8
39.0983	1

In this element –
Potassium –
19 refers to the ...

- A. mass
- B. reactivity
- C. number
- D. Ion charge

22.

19	2
K	8
Potassium	8
39.0983	1

In this element –
Potassium –
39.0983 refers to the ...

- A. mass
- B. reactivity
- C. number
- D. Ion charge

Use this periodic table information to answer the next two questions

1.0																	4.0
H																	He
1																	2
6.9	9.0											10.8	12.0	14.0	16.0	19.0	20.2
Li	Be											B	C	N	O	F	Ne
3	4											5	6	7	8	9	10
23.0	24.3											27.0	28.1	31.0	32.1	35.5	39.9
Na	Mg											Al	Si	P	S	Cl	Ar
11	12											13	14	15	16	17	18
39.1	40.1	45.0	47.9	50.9	52.0	54.9	55.8	58.9	58.7	63.5	65.4	69.7	72.6	74.9	79.0	79.9	83.8
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
85.5	87.6	88.9	91.2	92.9	95.9	(99)	101.1	102.9	106.4	107.9	112.4	114.8	118.7	121.8	127.6	126.9	131.3
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
132.9	137.3	138.9	178.5	181.0	183.9	186.2	190.2	192.2	195.1	197.0	200.6	204.4	207.2	209.0	(210)	(210)	(222)
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86

23. In the table above the following elements would be described as the Noble Gases.

- A. He, Ne, Ar, Kr, Xe, Rn
- B. Li, Na, K, Rb, Cs, Fr
- C. Be, Mg, Ca, Sr, Ba, Ra
- D. Rf, Db, Sg, Bh, Hs, Mt, Uun

24. How many neutrons does Potassium have?

- A. 15
- B. 17
- C. 19
- D. 20

25. As you move across the periodic table the properties of the elements change.
The most reactive metals include ...

- A. sodium and lithium
- B. iron and copper
- C. aluminum and carbon
- D. lead and zinc

26. The periodic table is organized by the patterns of the properties of the elements.

The rows in the periodic table vary with the amount of elements they contain. These rows are called ...

- A. groups
- B. families
- C. periods
- D. metals

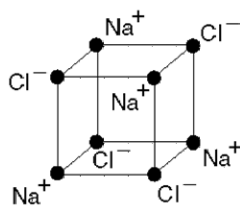
Section 3

Formation of Ionic and Molecular Compounds

27. Compounds are formed when elements combine in different chemical reactions. This identifies which elements combine and how many of them are present in the compound.
- Chemical Name
 - Atomic Mass Unit
 - Atomic Number
 - Chemical Formula
28. In the formula for baking soda [$\text{NaHCO}_3(\text{s})$] the following indicates how many atoms are present in each molecule ...
- 1 sodium, 1 hydrogen, 3 carbon dioxide
 - 1 atom of each element
 - 1 sodium, 1 hydrogen, 1 carbon, 3 oxygen
 - 1 sodium, 1 hydrogen, 1 calcium and 3 oxygen
29. In the formula for baking soda $\text{NaHCO}_3(\text{s})$ the (s) indicates that this molecule is ...
- safe
 - stable
 - strong
 - solid
30. Pure substances formed as a result of the attraction between charged particles of opposite charges are ...
- Stable elements
 - Ionic compounds
 - Molecular compounds
 - Charged elements
31. When ionic compounds are formed, the ions combine to form a ...
- crystal
 - block
 - irregular pattern
 - cloud
32. When sodium (a very reactive metal) is placed in chlorine (a green gas), the sodium explodes with a bright yellow flame. As it burns, this white, coarse-grained powder is produced.
- silicon
 - carbon
 - alum
 - salt
33. A group of ions 'that act as one' are called ...
- Subatomic ions
 - Polyatomic ions
 - Molecular ions
 - Aqueous ions
34. When naming ionic compounds there are two rules to remember: The first is that the name of the metal is always placed first, the second is the name of the non-metal ion(s) changes to
- 'ous'
 - 'ade'
 - 'ide'
 - 'ate'

35. The ion charges of a particular element will help you determine the chemical formula for the compound that is formed. Calcium [Ca^{2+}] combines with chlorine [Cl^{-}] to produce Calcium Chloride. The correct formula for Calcium Chloride is ...
- Ca_2Cl
 - CaCl_2
 - 2CaCl
 - Ca_2Cl_2
36. The alkali metals include Lithium and Sodium, each having an ion charge of 1+, are often reactive with the elements that have an ion charge of 1-. The group of elements that alkali metals react with are called the ...
- Halogens
 - Earth Metals
 - Non-Metals
 - Metalloids

37. This type of lattice structure represents the compound, **sodium chloride**.



The characteristic that identifies this compound as an ionic compound is its **distinct crystal** ...

- size
 - shape
 - ion
 - element
38. N_2O_3 is a molecular compound. The chemical name - following the rules for naming molecular compounds - for N_2O_3 is ...
- trinitrogen oxide
 - dinitrogen oxide
 - trinitrogen dioxide
 - dinitrogen trioxide

39. Use the information in the following table to answer this question.

Compound	Formula	Melting Point $^{\circ}\text{C}$	Boiling Point $^{\circ}\text{C}$
baking soda	NaHCO_3	455°	1550°
carbon dioxide	CO_2	sublimates	-79°
rubbing alcohol	$\text{CO}_3\text{H}_8\text{O}$	-90°	82°
salt	NaCl	801°	1413°

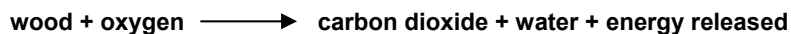
The molecular compounds from the table above are ...

- baking soda and salt
 - rubbing alcohol and salt
 - carbon dioxide and baking soda
 - carbon dioxide and rubbing alcohol
40. A Tetra Pak is a drink container that is used by manufacturers to provide juice in a handy convenient format. Tetra means ...
- recyclable
 - four
 - wax paper
 - convenient

Section 4

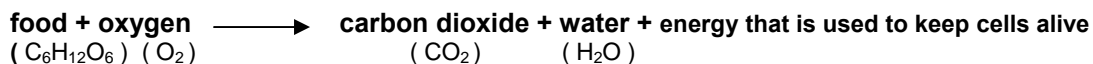
Chemical Reactions

41. A chemical reaction takes place when two or more ...
- molecular compound are mixed
 - ionic compounds are mixed
 - substances are mixed
 - substances combine to form new substances
42. Use the following chemical reaction word equation to answer the question.



The reactants in this chemical word equation are ...

- wood and oxygen
 - carbon dioxide and water
 - oxygen and energy
 - wood and energy
43. A chemical reaction occurs when this evidence is present ...
- a solution is formed
 - a change of state occurs
 - energy is needed or released
 - the reaction is reversible
44. The following word equation identifies what happens when hydrogen peroxide is left out in the sun. It changes to water and oxygen gas.
- Water + Oxygen \longrightarrow Hydrogen peroxide
 - Hydrogen peroxide + Energy \longrightarrow Water + Oxygen
 - Water + Energy + Oxygen \longrightarrow Hydrogen peroxide
 - Hydrogen peroxide + Oxygen \longrightarrow Water + Energy
45. Fire keeps going because of three factors. These factors are ...
- fire - water - air
 - fire - fuel - air
 - fuel - air - energy
 - fuel - air - heat
46. The following reaction takes place in the cells in your body.



This word equation represents ...

- cellular respiration
 - photosynthesis
 - transpiration
 - combustion
47. The **Law of Conservation of Mass** states that mass ...
- will be created in any chemical reaction between two or more substances
 - is created but not destroyed in a chemical reaction
 - is destroyed and can be recreated in an endothermic reaction
 - is neither created nor destroyed in a chemical reaction

48. The only statement below that is true about a closed system compared to an open system is that ...
- only reactants are present in the closed system
 - only products are present in the closed system
 - products and reactants are trapped in a closed system
 - products and reactants are free in an open system
49. This is required by many reactions that break down food in the body, otherwise higher temperatures would be needed – making it deadly for the human body..
- enzymes
 - reactants
 - products
 - oxygen
50. In terms of factors affecting reaction rate in a chemical reaction, only this is true about **concentration** – the greater the concentration of the ...
- reactants the slower the reaction.
 - products the slower the reaction.
 - reactants the faster the reaction.
 - products the faster the reaction.

NR1 - Use the illustration of the element from the periodic table to answer the question.

12	2+
Mg	
Magnesium	
24.3	

What is the atomic mass of this element?

	.	.	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

NR2 - Match the description of the Theory of Matter with the time it occurred.

- 1- Chemists only investigated materials that had a high value to humans
- 2- The use of simple tools and the discovery of fire
- 3- The work of Dalton suggests matter is made up of elements
- 4- A group of Hittites discovered how to extract an element from rock

Stone
Age

Bronze
Age

Iron
Age

Atomic
Theory

	.	.	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Unit B Matter and Chemical Change**ANSWER KEYS****Section 1 Quiz**

1	D	5	C	9	C
2	C	6	D	10	C
3	C	7	B	11	C
4	B	8	Textbook p. 103	12	C

Section 2 Quiz

1	C	5	A	9	C	13	A
2	B	6	C	10	A	14	C
3	D	7	D	11	A		
4	D	8	C	12	D		

Section 3 Quiz

1	D	5	A	9	B	13	C
2	C	6	D	10	A	14	D
3	D	7	B	11	B	15	B
4	B	8	C	12	D		

Section 4 Quiz

1	D	5	C	9	A	13	A
2	A	6	D	10	B	14	D
3	C	7	A	11	D		
4	B	8	C	12	C		

Unit Test

1	D	12	C	23	A	34	C	45	D
2	C	13	C	24	D	35	B	46	A
3	C	14	B	25	A	36	A	47	C
4	B	15	D	26	C	37	B	48	A
5	C	16	D	27	D	38	D	49	D
6	D	17	A	28	C	39	D	50	C
7	B	18	C	29	D	40	B		
8	Textbook p. 103	19	D	30	B	41	D		
9	C	20	C	31	A	42	A		
10	C	21	C	32	D	43	C		
11	C	22	A	33	B	44	B		

Numerical Response Questions	NR1	NR2
	24.3	2143