



**Welcome to
chemistry**

Science

a search for facts about the world around us

understanding the past , predicting the future

Aristotle (384-322 B.C.)

one can work out all the laws that govern the universe by pure thought

Roger Bacon (1300's)

science should base its reasoning on experimental evidence.

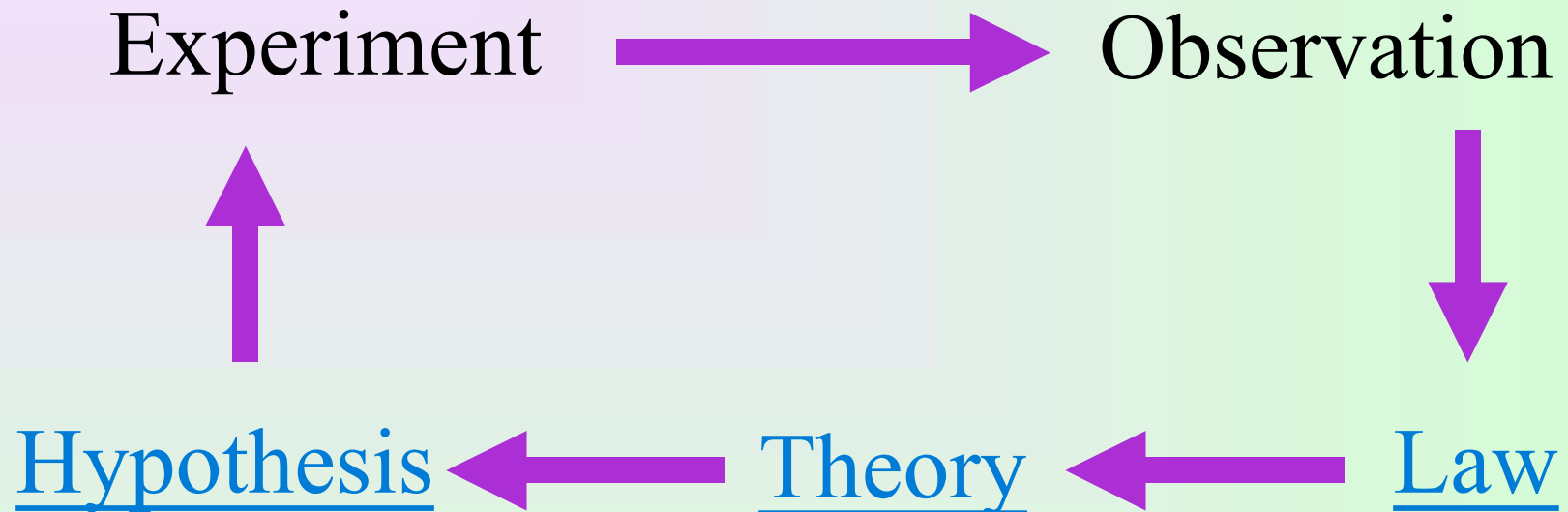
science replaces philosophy

science

A procedure for processing and understanding certain types of information

If there is no test for its possible “wrongness”, then it is not scientific.

The Scientific Method



click on any underlined word for its definition

Science and Technology

**science is a method of answering
theoretical questions**

**technology is a method of solving
practical problems.**

chemistry

The study of matter, its structure, properties, composition and changes that matter undergoes.

Chemists are problem solvers

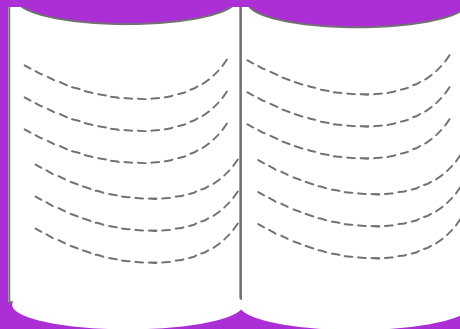
Problem:

the paper in 40% of old library books is crumbling

how to preserve the crumbling books

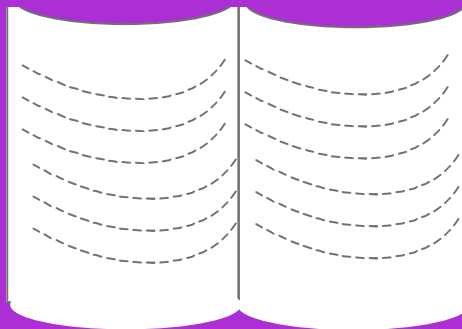
paper is made from cellulose

cellulose is formed from long chains of
glucose ($\text{C}_6\text{H}_{12}\text{O}_6$)



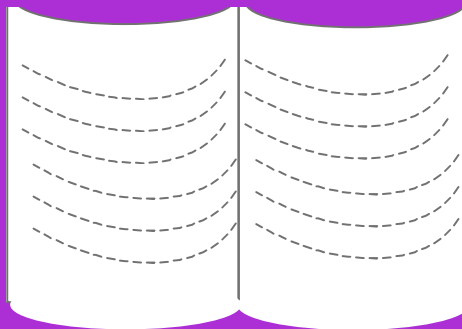


is used to prevent ink from “fuzzing”



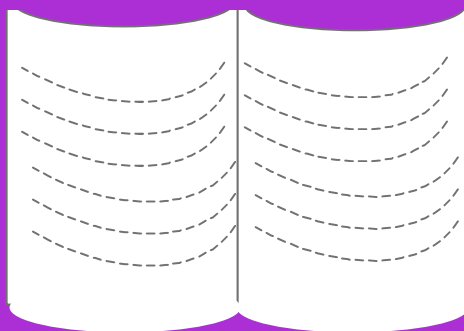


ions interact with water to form



an equilibrium is established producing H^+ ions

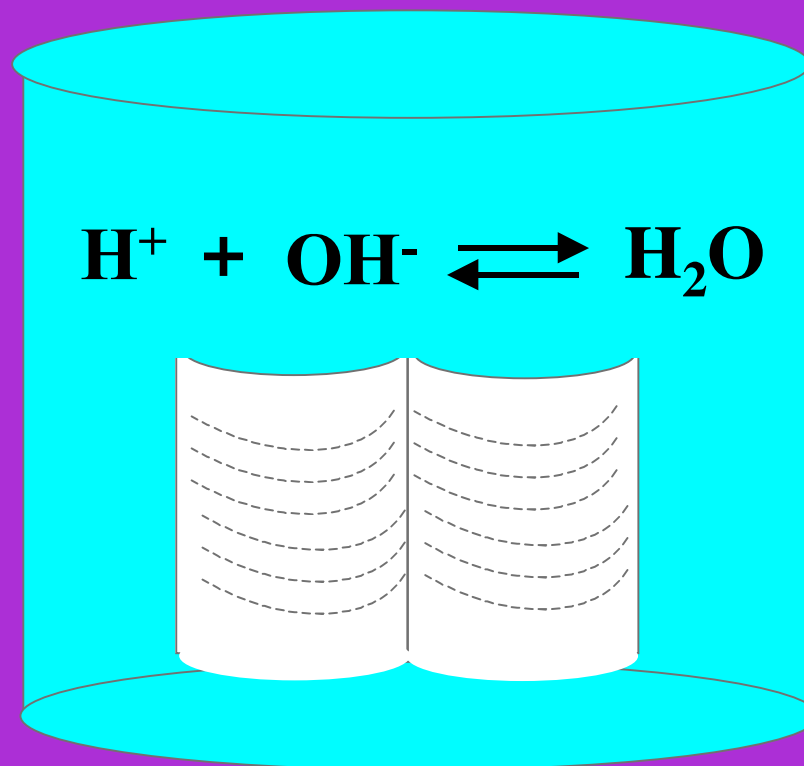
H^+ ions destroys cellulose ie: crumbling paper



remove H^+ stop the crumbling

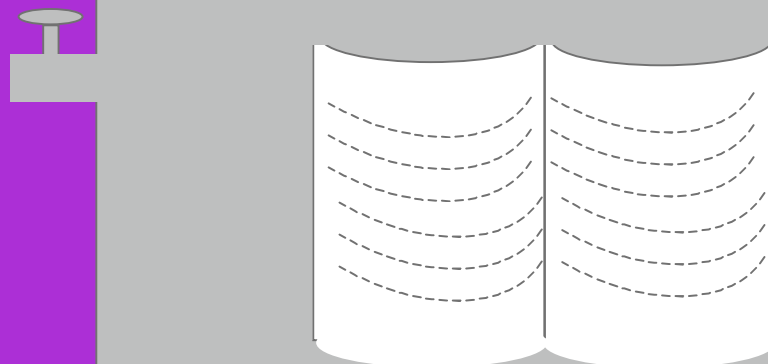
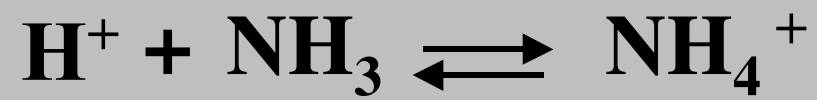
add a base remove the acid

Add NaOH(aq)

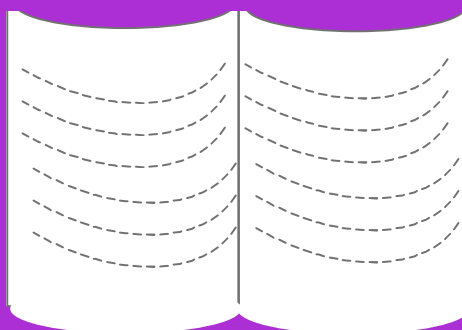
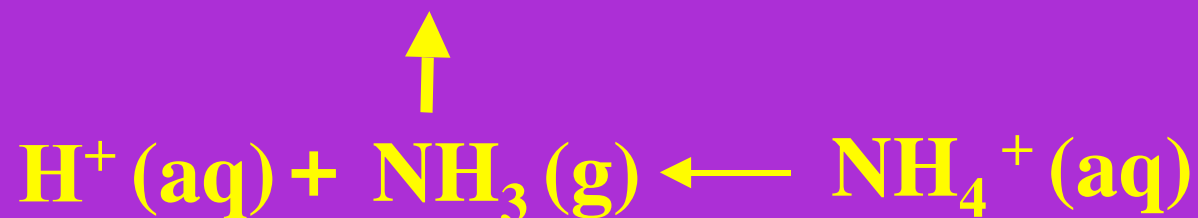


we are left with wet paper

Add $\text{NH}_3(\text{g})$

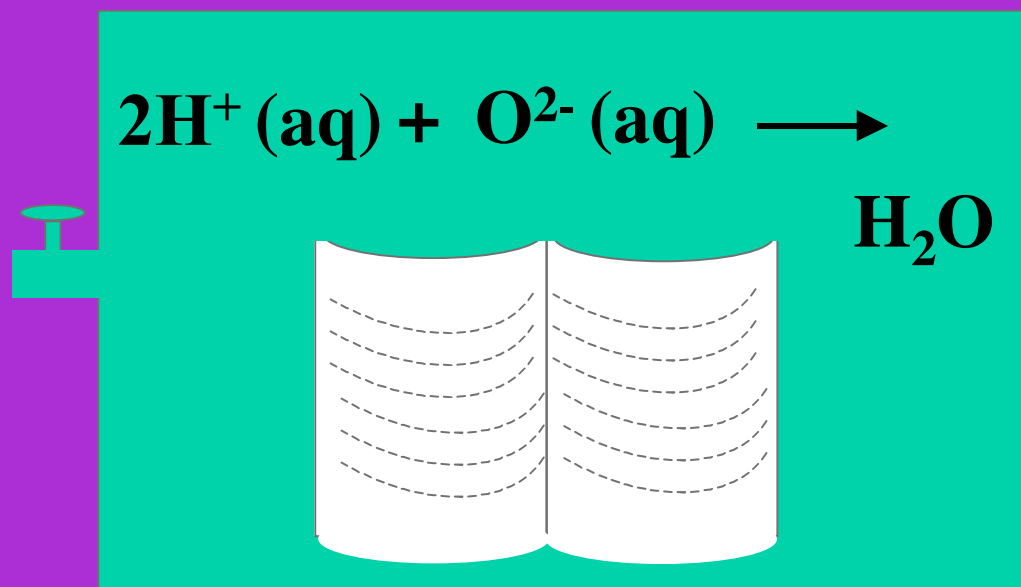
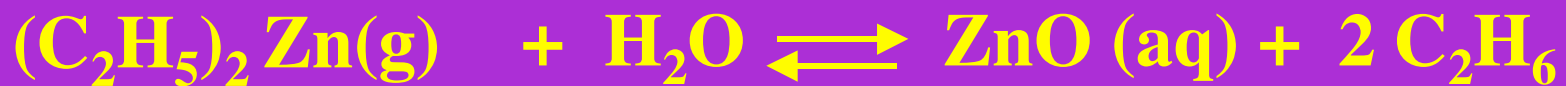


as the pressure is reduced $\text{NH}_3(\text{g})$ leaves,
shifting the equilibrium producing more
 H^+



the solution to the problem is only temporary

adding $(\text{C}_2\text{H}_5)_2\text{Zn}(\text{g})$ diethyl zinc



thus ZnO is a nonvolatile base that can be placed on paper by a gaseous substance

Classifications of Matter

Matter is anything that occupies space and has mass.

mass - a measure of the quantity of matter

Volume - space

Matter

Homogeneous mixtures

Mixture

Heterogeneous mixtures

Compounds

Substance

Elements

Matter

Homogeneous mixtures

Compounds

Mixture

Substance

Heterogeneous mixtures

Elements

click on words for definitions

Physical and Chemical Properties of Matter

Properties

A set of characteristics by which a substance can be recognized

Physical property

can be measured and observed without changing the composition or identity of a substance

Chemical property

requires a chemical change in order to be observed

Extensive property

depends on amount of material; mass and volume are examples of extensive properties

Intensive property

does not depend on amount of material; density and temperature are examples of intensive properties

Periodic Table of the Elements

Chemical Symbols

abbreviations for the names of the elements

the first letter is always capitalized

O, Al, C, Cl, H, He.....

An elements position on the periodic gives indications of its various physical and chemical properties

Main groups

group numbers indentified by suffix A

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
	1A	2A											3A	4A	5A	6A	7A	8A	
Period																			
1	1 <u>H</u>																		2 <u>He</u>
2	3 <u>Li</u>	4 <u>Be</u>											5 <u>B</u>	6 <u>C</u>	7 <u>N</u>	8 <u>O</u>	9 <u>F</u>	10 <u>Ne</u>	
3	11 <u>Na</u>	12 <u>Mg</u>											13 <u>Al</u>	14 <u>Si</u>	15 <u>P</u>	16 <u>S</u>	17 <u>Cl</u>	18 <u>Ar</u>	
4	19 <u>K</u>	20 <u>Ca</u>											31 <u>Ga</u>	32 <u>Ge</u>	33 <u>As</u>	34 <u>Se</u>	35 <u>Br</u>	36 <u>Kr</u>	
5	37 <u>Rb</u>	38 <u>Sr</u>											49 <u>In</u>	50 <u>Sn</u>	51 <u>Sb</u>	52 <u>Te</u>	53 <u>I</u>	54 <u>Xe</u>	
6	55 <u>Cs</u>	56 <u>Ba</u>											81 <u>Tl</u>	82 <u>Pb</u>	83 <u>Bi</u>	84 <u>Po</u>	85 <u>At</u>	86 <u>Rn</u>	
7	87 <u>Fr</u>	88 <u>Ra</u>											113 Uut	114 Uuq	115 Uup	116 Uuh	117 Uus	118 Uuo	

Main group metals

Alkali metals



Alkaline earth metals



Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1A	2A	3B	4B	5B	6B	7B	8B			1B	2B	3A	4A	5A	6A	7A	8A
Period																		
1																		
2	3 Li	4 Be																
3	11 Na	12 Mg																
4	19 K	20 Ca																
5	37 Rb	38 Sr																
6	55 Cs	56 Ba																
7	87 Fr	88 Ra																

13 Al			
31 Ga	32 Ge		
49 In	50 Sn	51 Sb	
81 Tl	82 Pb	83 Bi	84 Po

Nonmetals

Halogens

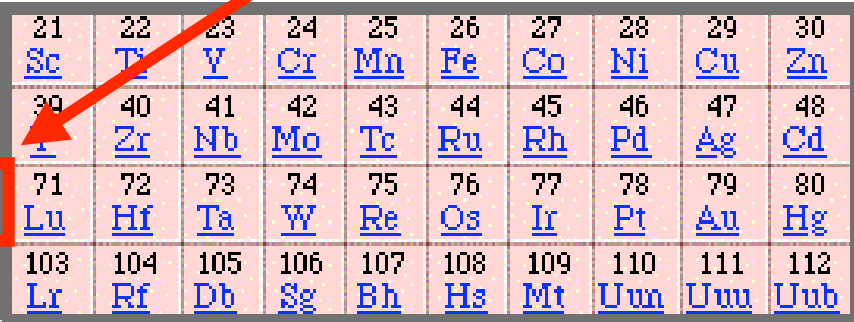
Noble gases

Group	1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
	1A	2A		3B	4B	5B	6B	7B	8B			1B	2B	3A	4A	5A	6A	7A	8A	
Period																				
1	<u>H</u>																			2
2														<u>B</u>	<u>C</u>	<u>N</u>	<u>O</u>	<u>F</u>	<u>Ne</u>	
3															<u>Si</u>	<u>P</u>	<u>S</u>	<u>Cl</u>	<u>Ar</u>	
4																<u>As</u>	<u>Se</u>	<u>Br</u>	<u>Kr</u>	
5																	<u>Te</u>	<u>I</u>	<u>Xe</u>	
6																		<u>At</u>	<u>Rn</u>	
7																				

Lanthanides

transition metals

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1A	2A	3B	4B	5B	6B	7B		8B		1B	2B	3A	4A	5A	6A	7A	8A
Period																		
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	* La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	** Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uun	111 Uuu	112 Uub	113 Uut	114 Uuq	115 Uup	116 Uuh	117 Uus	118 Uuo
lanthanides			* La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb		
actinides			** Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No		



Actinides

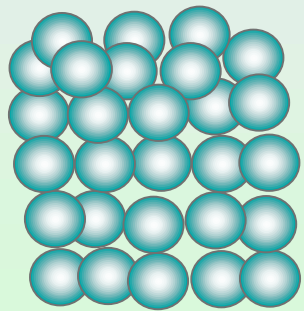
Lanthanides

transition metals

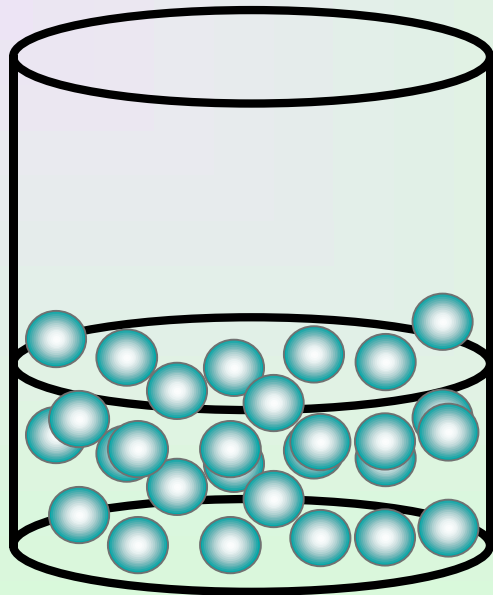
Group	1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1A	2A		3B	4B	5B	6B	7B		8B		1B	2B	3A	4A	5A	6A	7A	8A
Period																			
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4	19 K	20 Ca		21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr		39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	* *	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	** **	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uun	111 Uuu	112 Uub	113 Uut	114 Uuq	115 Uup	116 Uuh	117 Uus	118 Uuo
lanthanides			* *	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb		
actinides			** **	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No		

The Three States of Matter

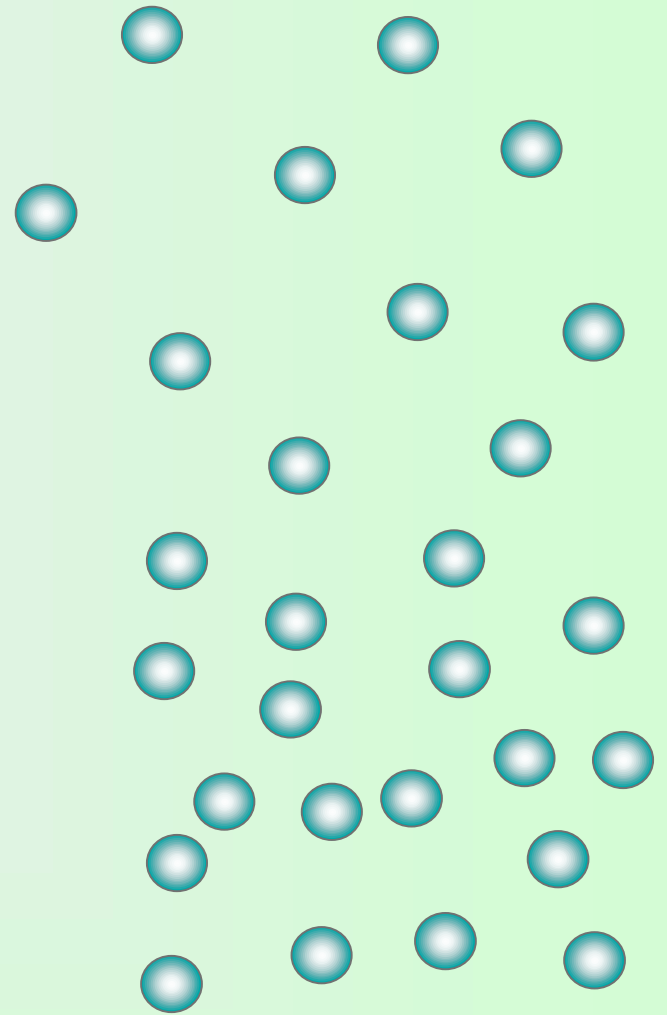
solid
liquid
gas



solid



liquid



gas

(slides that follow are linked to earlier ones)

law

a concise verbal or mathematical statement of a relationship between phenomena that is always the same under the same conditions

theory

**a unifying principle that explains a
body of facts and those laws that are
based on them**

hypothesis

a tentative explanation for a set of observations

leads to “if... then...” questions

test of theory

**a substance is form of matter that has
a definite or constant composition
and distinct properties, for example**

water

ammonia

table sugar

gold

oxygen

a mixture is a combination of two or more substances in which the substances retain their distinct identities, for example

air

milk

cement

the composition of a homogeneous mixture is the same throughout, for example

sugar dissolved in water

**a mixture of nonuniform composition
is a heterogeneous mixture, for
example**

air

Sand and iron filings

**an element is a substance that cannot
be separated into simpler elements by
chemical means**

**a compound is a substance
composed of atoms of two or more
elements chemically united in fixed
proportions**