

Topic II Test Study Guide 2

1. Classification of Matter

Understand what is meant by the number of phases in a mixture, homogeneous and heterogeneous mixtures, pure substances (elements and compounds, compounds being both molecular and ionic or salts);

Know examples for all of the above from homework, lab, and class notes

Mixtures & Pure Substances

Matter

I

I

I

-----Can Substances be separated physically?-----

NO

Pure Substances

I

I

Elements

substance the can't be broken down into other substances even by chemical processes (1 type of atom)

Compounds

Substance made up of 2 or more elements that can be broken down chemically
ex) H₂O, CO₂, NaCl

Homogeneous

uniform through out uniform composition
1 phase (one part)
"solution"
ex.) salt water, sugar water, brass (alloy)

YES

Mixtures

I

I

Heterogeneous

not uniform not uniform comp.
2 or more phases
ex) sand + H₂O
oil + H₂O
salad dressing
chex mix
blood

2. Physical Properties/ Physical Changes:

Review examples from homework and class notes

States of matter

Sublimation, deposition

Boiling point, Freezing point, Melting, Condensation

Solubility

Chemical Properties/Chemical Changes:

Review examples from homework and class notes.

Combustion, corrosion, rusting, acid and base reactions

Evidence of chemical reactions

Reactants → Products

Law of Conservation of Mass

Physical Change/Properties

Change when properties of the material change, but composition does not.

- Color
- Shape
- Density
- Malleability
- Dissolving
- Melting point
- Boiling point
- Freezing Point
- (Change of state)

Reversible:

Change of state (dissolving)

Irreversible:

- malleability
- breaking
- cracking
- spitting
- tearing,
- cutting

Extensive:

Depends upon the **amount** of matter in a sample.

ex.) mass, volume, length, width

Intensive:

Depends on **composition** of matter in a sample

ex.) density, boiling point, freezing point, melting point, luster (shiny), malleable (shape it), hardness, conductivity, color, texture, ductility (pull into wire)

(odor) (taste)--> could be both

States of Matter:

State	Definition	Examples	Diagram
Solid	Definite shape Definite volume rigid	Banana, coconut, rock, ice	*particles* vibrate, close together. Dense very little room to move.
Liquid	No definite shape (shape of container) Definite volume	Water, oil, syrup, mercury, ethanol	Pourable (fluidity), particles slide past each other
Gas	No definite volume No definite shape Takes shape and volume of container	Oxygen, hydrogen, chlorine, carbon monoxide	Made up of mostly empty space
Plasma	High energy state of matter		

Gas vs. Vapor:

Gas: Any substance that is a gas at room temperature

Vapor: any substance that is typically a liquid/solid at room temperature

Chemical Change/ Properties

Change that alters the chemical composition of a substance, a new substance is formed.

- burning (combusting)
- reacting
- fizzing/bubbling
- formation of precipitate
- rusting

Law of Conservation of Mass: Matter is not created or destroyed

3. Separation of Mixtures

(usage for homogeneous and heterogeneous mixtures)

Chromatography

Using a separatory funnel

Simple distillation

Filtration

Fractional Distillation

Decanting

Evaporation

Centrifuging

Know examples in your notes and handout.

Technique 1: Simple distillation

- separates a mixture by boiling points. Could be used for soluble solid (homogeneous mixture) , but able to recover both solid and liquid.

Technique 2: Filtration

- When you separate insoluble solid from a liquid. Able to recover both solid and liquid.

Technique 3: Chromatography

- homogeneous mixture-1 phase. Separate by attraction to 2 phases in chromatography. Set up stationary-paper & mobile-water. The liquid that travels the furthest(mobile. The liquid that travel's shortest (stationary)

Technique 4 : Evaporation

- Separation of mixture by boiling point. Soluble solid in liquid (ex. salt)-don't care about liquid. Evaporate liquid-left with solid. Not going to recover liquid.

Technique 5: Fractional distillation

- boiling point used to separate homogeneous mixture, two liquids that are "miscible" ("mix")

Technique 6: Centrifuge

- Uses centripetal force, separate insoluble solid from liquid. The particles are too fine to go through filtration (ex. blood)

Technique 7: Decanting "pour off"

- Used for separating 2 immiscible liquids (ex. oil & water)

Technique 8: Separatory Funnel

- two immiscible liquids-pour off one layer--> better than decanting

Method	# Phases	Type of Matter	Example
1. Chromatography	1	miscible (soluble liquids)	ink
2. Simple distillation	1	homogeneous (soluble solid in all liquid) recover <u>both</u> solid and liquid)	salt + H ₂ O
3. Fractional distillation	1	homogeneous 2 miscible liquids	alcohol + H ₂ O
4. Evaporation	1	homogeneous soluble solid in a liquid liquid is not recovered	salt + H ₂ O
5. Decant	2	heterogeneous 2 miscible liquids	oil + H ₂ O
6. Separatory Funnel	2	"	"
7. Filtration	2	heterogeneous insoluble solid in a liquid	Sand + H ₂ O
8. Centrifuge	2	" particles are too small & would pass through filter	Lead (II) Iodide (PbI ₂) muddy H ₂ O Blood

4. Solubility and Aqueous Solutions

Units of solubility: # grams of solute/100 grams of solvent

Compare solubility of gas and solid solute (liquid - miscible/immiscible)

Nature of solute, Temperature, Pressure (partial pressure of a gas and the effect on the solubility of the gas in aqueous solution)

Soluble substance, insoluble substance, saturated solution, unsaturated solutions, supersaturated solutions

Solvent: dissolving medium usually present in larger amount (H₂O universal solvent)

Solute: What's being dissolved usually present in smaller amount
g solute/100 g H₂O

Solubility: Amount of solute that dissolves in a given amount of solvent at a given temperature and pressure.

Unsaturated solution: Contains less solute than the solvent can dissolve

Supersaturated solution: contains more solute than the solvent can theoretically hold

Factors affecting solubility (increase rate of solubility):

- Increase temperature
- Stirring/agitation
- Particle size/ surface area

Aqueous Solutions (Homogeneous)

Solute	Solvent	Solubility
Solid ex) NaCl, KNO ₃ , C ₁₂ H ₂₂ O ₄	H ₂ O	Generally goes up as temp. goes up Depends On: -type solid -composition of solid
Gas ex.)CO ₂ ,O ₂	H ₂ O	-Temp. goes up, solubility goes down -pressure goes down, solubility goes down -pressure goes up, solubility goes up
Liquid ex.) ethanol	H ₂ O	-miscible("mix") -immiscible (not mix)

Soluble substances: Salt & Sugar

insoluble substances

5. Energy $q = c m \Delta T$

Heat energy, change in temperature, heat capacity, specific heat, joules, calories

Specific heats of metals, specific heat of water.

Exothermic and endothermic changes in chemical and physical changes.
Change in Enthalpy (heat content) = q

Temperature:

Measure of the average amount kinetic energy (NG of motion) in a sample (random motion of parcels)

Energy: Ability to do work; supply heat

- **potential:** (stored) Energy of position or composition
- **kinetic:** energy of motion

Chemical Potential Energy:

Energy stored in chemical bonds of substances

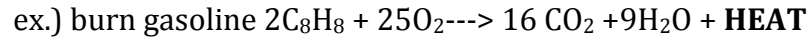
Heat

warmer--> colder

Law of Conservation of Energy:

In any chemical or physical process energy is not created or destroyed, it is just converted from one to another.

Exothermic: heat is released to surroundings



Endothermic: $Ba(OH)_2 \cdot 8H_2O + NH_4Cl + \text{HEAT} \rightarrow \text{products}$

Heat:

measure of the energy transferred from one object to another due to a difference in temperature.

Heat capacity:

Amount of heat needed to increase the temperature on an object by 1° C

Depends on mass & chemical composition

ex.) 20 kg H₂O 20 kg Fe
 in puddle sewer cover
 heat capacity H₂O > heat capacity Fe

Specific heat capacity:

"specific heat"

Amount of heat needed to raise the temperature of 1 gram of a substance by 1° C

"S" specific heat

$$S_{H_2O} = 4.184 \text{ J/g}^\circ\text{C}$$

1 Calorie = 1 Kcal = 1000 calories
(nutritional)

$$1 \text{ calorie} = 4.184 \text{ J}$$

$$q = ms\Delta T$$

q = energy (Joules) J

m = mass (grams) g

s = specific heat (J/g°C)

$\Delta T = T_f - T_i$ (°C)

6. Periodic Table

(see textbook reading and class notes)

Metals, Nonmetals, Metalloids (also called semimetals)

Properties of Metals and Nonmetals

Know location on table:

Alkali metals, alkaline earth metals, transition metals, halogens, noble gases

Look at packet

Periodic Table of Elements

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1 H Hydrogen 1.00794																	2 He Helium 4.002602	
3 Li Lithium 6.941	4 Be Beryllium 9.012182																	
11 Na Sodium 22.98976928	12 Mg Magnesium 24.305																	
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955912	22 Ti Titanium 47.887	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938045	26 Fe Iron 55.845	27 Co Cobalt 58.933195	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.64	33 As Arsenic 74.9216	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.798	
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.96	43 Tc Technetium (97.9072)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90547	54 Xe Xenon 131.29	
55 Cs Cesium 132.9054519	56 Ba Barium 137.327	57-71		72 Hf Hafnium 178.49	73 Ta Tantalum 180.94788	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.222	78 Pt Platinum 195.084	79 Au Gold 196.966569	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98040	84 Po Polonium (209.9824)	85 At Astatine (209.9871)	86 Rn Radon (222.0176)
87 Fr Francium (223)	88 Ra Radium (226)	89-103		104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (277)	109 Mt Meitnerium (268)	110 Ds Darmstadtium (271)	111 Rg Roentgenium (272)	112 Uub Ununbium (285)	113 Uut Ununtrium (284)	114 Uuq Ununquadium (289)	115 Uup Ununpentium (288)	116 Uuh Ununhexium (289)	117 Uus Ununseptium (289)	118 Uuo Ununoctium (284)
For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.																		
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57 La Lanthanum 138.90547	58 Ce Cerium 140.116	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.242	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92535	66 Dy Dysprosium 162.500	67 Ho Holmium 164.93032	68 Er Erbium 167.259	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.054	71 Lu Lutetium 174.9668				
89 Ac Actinium (227)	90 Th Thorium 232.03806	91 Pa Protactinium 231.03688	92 U Uranium 238.02891	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)				

Ptable.com