

Basic stuff

Mass	amount of matter (g,kg,ml)
matter	anything occupies space & has mass
Volume	room space, l, ml, gas, solid, liquid
Density	mass/volume=kg/m ³
pressure	barometer, manometer 760torr=760mmHg=1atm
energy	to work, transfer heat, cal, j,kj, calorimeter heat, light,kinetic, bond
temper- ature	average kinetic energy of molecule,- 273k=0°C,373k=100°C
heat	flow of kinetic energy from body of high temp to low temp
heat capacity	amount of heat abosorbed with 1°C increase
specific heat	heat capacity of 1 gram of substance
q=mc*d- eltaT	heat=mass <i>specific heat</i> delta Temp

Atom: building blocks of matter

element	substance can't be broken down into a simpler substance by chemical reaction;most funder-mental union of matter, can't broken down w/o losing their identity
atom	smallest particle of an element that still retains the chem properties of the element neucleon(proton+neutron)+el-ectron

Atom: building blocks of matter (cont)

ion	atom lose/gain electrons: cation(+) anion(-)
proton	+1,1amu
neutron	0,1amu
eletron	-1,0amu
perodic table	group=column, row=period
atomic number	=proton#, identity
atomic mass	=proton mass + neutron mass
isotype	same proton#,different neutron
atomic weight	= average mass of isotypes occurred on earth

Solution

Measures	Molarity, molality, percent of mass
solubility	solid, gas, solvent, solute, like solve like, pressure, temper-ature
saturation	
electr- olytes	ionic substance, break of ionic bond, neutral overall,conduct electricity
boiling & freezing point	delta T = kmi; k constant of solvent; m molality; i particles solved into; CaCl2 in snow day
precip- itation	ionic solution,double replac-ement reaction
solubility rules	soluble:NO3-,ClO4-,Alkali metal,aNH4+ insoluble:silver,lead,mercu-ry,OH-

Kinetics and equilibrium

Kinetics	reaction rate: collision/re-orien-tation, bond break/making,ac-tivated complex
kinetic factors	concentration(g,l), pressure(g), surface area(s,l),temperature-(10c=double), nature of reacta-nts(bond strenght),catalyst,
catalyst	not consume, lower Ea activation energy,not change equilibrium
collision freq	concentration, surface area, temp
collision energy	temp, nature of reactant,cat- alyst
chemical equilibrim	dynamic chemical equilibrim, both direction in the same speed, reactant concentration not changed anymore
Keq	>1 favor forward reaction, <1 favor reverse reaction
phase change equilbrim	
Le Chaetlier's principle	
Keq never changes with reacted concentra- tion; Keq change with heat stress;reaction shift to relieve the stress	
pressure change the equilibrium on gas reactant	
catalyst won't change equilibrium	
Ksp	solubility product constant for precipitation reaction equilibrium

acid and base	
autoionization	$H^+ + OH^- \rightleftharpoons H_2O$
Kw	$[H^+][OH^-] = 10^{-14} M^2$ at 25°C
pH=7	$-\log([H^+]) = -\log(10^{-7})$ at 25°C
acid	proton/ H^+ donor; electron pair acceptor
base	proton(OH^-) acceptor; electron pair donor
amphoteric ion	$HCO_3^-(aq)$
strong acid/base	complete dissociating and not reversible
Strong acid:0	HCl, HBr, HI, HNO_3 , H_2SO_4 , $HClO_4$
Strong base:14	LiOH, NaOH, KOH... $Sr(OH)_2$, $Ba(OH)_2$
calc pH	$pH = -\log([H^+]) = 14 - (-\log[OH^-]) = 14 - pOH$
weak base acid	partial /reversible dissociation, <10%
calc pH	using K_a or K_b to get concentration of H^+ and OH^-
polyprotic acid	monoprotic acid
conjugate acid/base pair	mol formula same, except ONLY 1 H^+
	HCl-Cl ⁻ , H_2O-OH^- , $H_2SO_4-HSO_4^-$, Na^+-NaOH
Buffer	minimize pH change with a conjugated pair of weak acid and base,

acid and base (cont)	
titration	concentration of unknown; weak or strong acid/base of unknown; pK_a pK_b of unknown
equivalence point	titration curve, reflection/end point; $M_1V_1 = M_2V_2$
red-blue indicator	$H-Indicator \rightleftharpoons H^+(aq) + indicator(aq)$; color change at 7, buret

oxidation and reduction	
LEO	lose electron=oxidation
GER	Gain electron=reduction
oxidation state	adds up to 0; assign oxidation number based on electronegativity
oxidation number	total=0; oxygen(-2), alkali(+1), -alkali earth(+2), halogens (-1), OH(+1)
balance redox reaction: total electron balance	
oxidant=oxidant agent, reducing agent	
activity series	
Rustin-g(O ₂)	$2Fe(s) + 3O_2 \rightarrow Fe_2O_3(s)$
dissolving(H ⁺ , H ₂ O)	$Pb(s) + 2H^+ \rightarrow H_2(g) + Pb^{2+}$
Nitric acid dissolution	NO_2 is brownish yellow toxic gas produced

Organic chem and environmental chemistry	
Organic chemistry	
Carbon, no polar covalent bond	
soluble in non polar solution, not in water	
no dissociate in solution, no ion in solution, not conductor, not electrolyte	

Organic chem and environmental chemistry (cont)	
isomer: same composite different geometry and chemical property, ethanol vs dimethyl	
Hydrocarbon	
alkanes	C_nH_{2n+2} , single bonds
Meth- eth- prop-but-pent-hex-	
alkenes	C_nH_{2n} , ≥ 1 double bond
-ane(all single bonds), -ene(≥ 1 double), -yne (≥ 1 triple)	
alkynes	C_nH_{2n-2} , ≥ 1 triple bond
Hydrocarbon rings	aromatic hydrocarbons
functional groups	
-OH, -Cl, -COOH, -NH ₂ , -COH aldehydes, ketone -C=O, ether -COC-, ester COOC	
Organic reactions	
Addition: $C=C \rightarrow C-C$	
substitution	
polymerization: monomer $\rightarrow$	
cracking	
combustion: hydrocarbon $\rightarrow CO_2 + H_2O$, $CO_2:44$, $H_2O:18$	
esterification: $COOH + OH \rightarrow COOC + H_2O$	
Biomolecular	
Lipids; carbohydrate, nucleic acid, protein	
Environmental chemistry	
atmosphere: N_2 78%, O_2 20%, Ar <1%, H_2O , other <1%; Troposphere, strato, meso, thermo	
Ozone, O_3 : $O_2 + \gamma \rightarrow 2O$ (photodissociation), $O + O_2 \rightarrow O_3$ (absorb solar radiation), CFCs consume O_3 (CFCs + light $\rightarrow$ free Cl, then consume O_3 to form ClO)	
GreenHouse effect	
Acid Rain: $SO_2 \rightarrow SO_3 + H_2O \rightarrow H_2SO_4(aq)$	
Carbon monoxide	



Lab

Safety

accuracy: how correct a measure is;
precision is how exact a measure is,
compared to real measurement

Buret washing; hot object weight;

significant figures: least significant after
operation, 2500 has 2 significant figures,
2500. has 4, 3 mole = 3.000000 moles

Procedures

filtration -> distillation -> chromatography

titration: $M_a V_a = M_b V_b$, litmus: pink->blue,
phenolphthalein: clear->pink

Identifying chemicals

precipitation: AgCl

Conduction: Ion conductivity

Flame test: alkali (earth metal) Li/Sr Red,
Ca: orange, Na: yellow, Ba: green, K: Violet

colored solution: Cu^{2+} blue, Ni^{2+} green,
 Co^{2+} pink, Fe^{3+} yellow, CrO_4^{2-} Yellow,
 CrO_7^{2-} Orange, MnO_4^{2-} deep purple

gas evolution: manometer, Erlenmeyer
tube, splint test

calorimetry: $Q = mc \Delta T$

Equipment

Beaker, buret, burner, crucible tongs,
dropper pipette, Erlenmeyer flask, evapor-
ating dish, Florence flask, forceps, funnel, gr-
aduated cylinder, volumetric flask, metal
spatula, mortar and pestle, pipette bulb,
platform balance, ring clamp,



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