Chemistry Final Equations Cheat Sheet

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Exam 1

Kelvin to Celsius	K=C +273	
Fahrenheit to Celsius	F=9F/5C (C) + 32F	
density	d=m/V	SI: kg/m^3; g/mL or g/cm^3 commonly used
moles to atoms and molecules	1 mole = 6.022 x 10^{23} atoms or molecules	
moles to grams	1 mole = atomic mass (g)	1 mole = formula mass (g)
grams to atoms or molecules	atomic mass (g) = 6.022 x 10^{23} atoms	formula mass (g) = 6.022 x 10^{23} molecules
avagadro's number	6.022 x 10^{23} moles	
kinetic energy of a moving object	Ek = 1/2 mu^2	u: velocity

Exam 1 (cont)

electrostatic energy	Eel = Q1Q2/d	Q1 and Q2: product of charges; d: distance between charges
joule	1 J = 1kg x m^2/s^2	1 J = 1 N x m
speed, wavelength, and frequency	c = (wavelength) (v)	c: speed of light - 3.00 x 10^8 m/s; wavelength: in meters; frequency (v): in s^{-1} or Hz
energy of a photon	E = hv	h: 6.63 x 10^{-34} J x s; v: frequency in s^{-1} or Hz

Exam 1 (cont)

energy (hv) of a photon used to eject electrons from a metal surface via the photoelectric effect is equal to the sum of kinetic energy of the ejected electron (Ek) and the work function (W)	hv = Ek + W	Ek = hv - W
wavelength of emitted/absorbed light when an electron transitions from one quantum state to another	1/wavelength = 1.097 x 10^7 $m^{-1}$$(1/n(f)^2 - 1/n(i)^2)$	

Exam 1 (cont)

difference in energy between two quantum states	E = hv = -2.18 x 10^{-1} J $(1/n(f)^2 - 1/n(i)^2)$	
energy of an electron with a given quantum state	En = -2.18 x 10^{-18} J $(1/n^2)$	
wavelength of emitted/absorbed light	1/wavelength = 2.18 10^{-18} J/hc $(1/n(f)^2 - 1/n(i)^2)$	
de broglie wavelength	wavelength = h/mu	m: mass of particl in kg; u: veloci of the particl in s^{-1} or Hz

Exam 1 (cont)

heisenberg uncertainty principle	deltax x deltap > h/4pi	deltax x mdeltau > h/4pi	position of particle x; momentum of particle: p (defined as mass times velocity)
energy and wavelength	E = hc/wavelength	wavelength = hc/E	
charge of a single electron	-1.6022×10^{-19} C	C: coulombs	
atomic mass units (amu)	1 amu = 1.66×10^{-24} g	1 amu = 1.66×10^{-27} kg	
angstrom	1 A = 1×10^{-10} m		
mass of a single electron	9.10×10^{-28} g		
mass of a proton	1.67262×10^{-24} g		
charge-to-mass ratio of an electron	1.76×10^{8} C/g		

Exam 2

effective nuclear charge (Zeff)	Zeff = Z - o	Z: number of protons; o: shielding constant or number of core electrons
force (coulomb's law)	F = $Q1Q2/d^2$	
ionic EN difference	> or equal to 2.0	
polar EN difference	.5 - 2.0	
nonpolar (or purely covalent) EN difference	< .5	
% by mass of an element	= n x atomic mass of element/molecular or formula mass of compound (100%)	

Exam 2 (cont)

% ionic character	= u (observed)/u (calculated) (100%)	u: dipole moment
dipole moment	u = Q x r	u: dipole moment (in debeye units (D)); Q: charge magnitude; r: distance between charges (bond length)
charge magnitude	Q = u/r	
formal charge	= valence electrons - (all nonbonding electrons + 1/2 bonding electrons)	
electronegativity	EN = IE1 + EA /2	
coulomb	1 C = 6.242×10^{18} electron charge	

Exam 3

bond order	= number of electrons in bonding MO - number of electrons in antibonding MO/2
atom economy	= sum of molar mass of desired product/sum of molar mass of reactants
% yield	= actual yield/theoretical yield (100%)

1 D = 3.336×10^{-30} C x m

Exam 4

molarity	M = moles solute/L solution		
dilution	Mc x Lc = Md x Ld	Mc x mLc = Md x mLd (product in millimoles)	c: concentrated; d: diluted
Kinetic energy	Ek = $1/2 mu^2$		

Exam 4 (cont)

average kinetic energy of a group of gas molecules	$u^2 = uN^2/N$	u^2: average speed for all the molecules in the sample; mean square speed	N: number of molecules in sample
total kinetic energy of one mole of any gas	Ek = 3/2 RT	R: 8.314 J/K x mol	T: temperature in Kelvin
root-mean-square-speed	Urms = square root of 3RT/molar mass	R: 8.314 J/K x mol	molar mass in kg/mol
comparing Urms values of molecules in different gas samples	Urms(1)/Urms(2) = square root of molar mass (2)/molar mass (1)		
graham's law	rate = 1/square root of molar mass	rate of diffusion or effusion is inversely proportional to the square root of the molar mass	

Exam 4 (cont)

pressure	P= force/area	SI unit of force: Newton (1 N = 1kg x m/s^2)	
pressure exerted by a column of fluid	P = hdg	P: pressure in Pa	
h: height of column in meters	d: density of fluid in kg/m^3	g: gravitational constant - 9.80665 m/s^2	
SI units of pressure: pascal (Pa, 1 Pa = 1 N/m^2)			
Boyle's law	P1V1=P2V2	pressure of a fixed amount of gas at constant temperature is inversely proportional to the volume of the gas	

Exam 4 (cont)

charles law	V1/T1= V2/T2	volume of a fixed amount of gas at constant pressure is directly proportional to the absolute temperature of the gas

Exam 4 (cont)

avogadros law	V1/n1=-V2/n2	volume of a sample of gas at constant temper-ature and pressure is directly propor-tional to the number of moles in the sample
combined gas law	P1V1/n-1T1-=P2-V2/n2T2	P1V1/T-1=P-2V2/T2

Exam 4 (cont)

ideal gas equation	PV=nRT	R: 0.08206 L x atm/K x mol	T and n: K and mol	P and V: atm and L
density of a gas	d = P(molar mass)/RT	molar mass in kg/mol	R: 0.08206 L x atm/K x mol	
molar mass of a gas	molar mass = dRT/P	R: 0.08206 L x atm/K x mol	molar mass: in kg/mol	
van der waals equation	(P + an^2/V^2)(V - nb) = nRT	a and b dependent on the element		
compre-ssibility factor	Z = PV/RT			

Exam 4 (cont)

partial pressure	P total = sum of partia	
mole fraction	Xi = ni/n total	Xi = Pi/P total
amount of reactant consumed	n = P x (V/RT) at constant volume and temper-ature	n: number of moles consumed
pressure exerted over water	P total = P O2 + P H2	