

## Equations and Constants

$$\Delta = hc/\lambda$$

$$\pi = iMRT$$

$$\Delta T = i K_b m$$

$$\Delta T = i K_f m$$

$$P = k_H X$$

$$P_1 = X_1 P_1^{\circ}$$

$$P_{\text{total}} = X_1 P_1^{\circ} + X_2 P_2^{\circ}$$

$$h = 6.626 \times 10^{-34} \text{ J s}$$

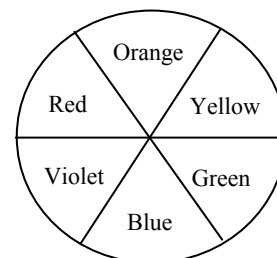
$$c = 3.0 \times 10^8 \text{ m/s}$$

$$1 \text{ nm} = 1 \times 10^{-9} \text{ m}$$

$$R = 8.3145 \text{ J mol}^{-1} \text{ K}^{-1}$$

$$R = 0.08206 \text{ L atm mol}^{-1} \text{ K}^{-1}$$

$$1 \text{ atm} = 760 \text{ torr}$$



## The visible region of the electromagnetic spectrum

	violet	blue	green	yellow	orange	red
$\lambda$ (nm)	400		500	600		700

## The Spectrochemical Series



weak field ligands

small  $\Delta$

strong field ligands

large  $\Delta$

**Ligands** bonding atoms in bold, charge indicated, unidentate unless noted otherwise

**H<sub>2</sub>O** aqua

**OH<sup>-</sup>** hydroxo

**NO<sub>2</sub><sup>-</sup>** nitro

**NH<sub>3</sub>** ammine

**CN<sup>-</sup>** cyano

**SCN<sup>-</sup>** thiocyanato

**NCS<sup>-</sup>** isothiocyanato

**CO** carbonyl

**X<sup>-</sup>** halides (fluoro, chloro, bromo...)

**en** ethylenediamine (bidentate)

## Periodic Table

		1A										3A						4A		5A		6A		7A		8A											
		1										3						4		5		6		7		8											
		H										B						C		N		O		F		He											
		1.008										10.81						12.01		14.01		16.00		19.00		20.18											
												13						14		15		16		17		18											
												26.98						28.09		30.97		32.07		35.45		39.95											
Period	3		4		5		6		7		8		9		10		11		12		31		32		33		34		35		36						
	Li		Be		Sc		Ti		V		Cr		Mn		Fe		Co		Ni		Cu		Zn		Ga		Ge		As		Se		Br		Kr		
		6.941		9.012		44.96		47.88		50.94		52.00		54.94		55.85		58.93		58.69		63.55		65.39		69.72		72.61		74.92		78.96		79.90		83.80	
		11		12		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54	
		Na		Mg		Y		Zr		Nb		Mo		Tc		Ru		Rh		Pd		Ag		Cd		In		Sn		Sb		Te		I		Xe	
		22.99		24.30		88.91		91.22		92.91		95.94		(98)		101.1		102.9		106.4		107.9		112.4		114.8		118.7		121.8		127.6		126.9		131.3	
		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36	
		K		Ca		La-Lu		Hf		Ta		W		Re		Os		Ir		Pt		Au		Hg		Tl		Pb		Bi		Po		At		Rn	
		39.10		40.08		178.5		178.5		180.9		183.8		186.2		190.2		192.2		195.1		197.0		200.6		204.4		207.2		209.0		(209)		(210)		(222)	
		85.47		87.62		88.91		91.22		92.91		95.94		(98)		101.1		102.9		106.4		107.9		112.4		114.8		118.7		121.8		127.6		126.9		131.3	
		55		56		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86			
		Cs		Ba		La-Lu		Hf		Ta		W		Re		Os		Ir		Pt		Au		Hg		Tl		Pb		Bi		Po		At		Rn	
		132.9		137.3		178.5		178.5		180.9		183.8		186.2		190.2		192.2		195.1		197.0		200.6		204.4		207.2		209.0		(209)		(210)		(222)	
		87		88		104		105		106		107		108		109		110		111		112				114				116				118			
		Fr		Ra		Ac-Lr		Rf		Db		Sg		Bh		Hs		Mt		Uun		Uuu		Uub		Uuq		Uuh		Uuo		Uuo		Uuo			
		(223)		(226)		(261)		(262)		(263)		(264)		(265)		(268)		(269)		(272)		(269)				114				116				118			
		s block		d block												p block																					