Electromagnetic Radiation -- page 70 in CiC, spectrum of "gamma rays - x-rays - UV - visible - IR - microwave - radio"

name, λ (in nm)	γ and x	200nm UV-C	280 UV-B	320 UV-A	400 VBGYOR	700nm IR
as λ↑, E↓ — RELATIVE energy (PHOTON)	highest	high	medium	low	lower	lowest (MICROWAVE, RADIO +TV)
% in sunshine	etc (γ - WHAT IT IS - EM rad, WHAT CAUSES - NUC rad)	(its cause) O_2 (bond is 2.0) due to	RESONANCE O_3 (bond is 1.5)	(etc) ← 8%	← pg 78 39% →	53% →
type of rxn:	e^- OFF; IONIZING; BREAKS BONDS also; NUCLEAR; H_2O $\xrightarrow{\alpha,\beta,\gamma}$ $H_2O^+ + e^-$; Ar $\xrightarrow[\text{more?}]{\alpha\ \beta\ \gamma}$ $Ar^+ + e^-$ (in G-COUNTR); BREAKS BONDS: O_2 -(<242)→ 2O, O_3 -(<320)→ O_2+O	BREAKS BOND; O_2 $\xrightarrow[\gamma,x,UV\text{-}C]{<242\ nm}$ 2O (O + O); $O_3 \to O_2 + O$; •[lots of O_2, lots of abs by this RXN, so UV-C ≈ 0 in TROPOsph, and GROUND LEVEL]; C-Cl $\xrightarrow[<220]{UV\text{-}C}$ C• + Cl•; $O_2 \to O_3 \to O_2 \to$ [Chapman	BREAKS BOND; O_3 $\xrightarrow[\gamma,x,C,B]{<320}$ O_2 + O; then colisn (O_2, O) → O_3; •[O_3 << O_2 in amount, so much less abs by rxn, so some UV-B in TROPOsph]	? (demos w Cl_2, Mg were done in 2009, 10 but may not 2011)?; Chapman Cycle is NATURAL, occurs without CFCs-etc, but amounts of O, O_2, O_3 in ChC are affected by CFCs.	USUALLY NO RXN; •N_2O $\xrightarrow{600\ nm}$ NO + O (in O_3 CHAIN); •Cl_2 $\xrightarrow{500\ nm}$ 2 Cl• INITIATN; $H_2 + Cl_2 \to 2\ HCl$ OVERALL (exchange partners); VIS: $2Mg(s) + O_2(g) \to 2\ MgO(s)$ + light; •PHOTOSYNTHESIS (chlorophyll in PLANTS): CO_2 + H_2O $\xrightarrow{\text{VISIBLE LIGHT, CHLOROPHYLL}}$ SUGARS + O_2	later, "greenhouse" EFFECT in global warming. absorbs IR (CO_2...) [but O_2, N_2(...) don't bec diatomic, symmetric default = does absorb IR and Ar (?%) because atom; IR → bond VIBRATION (STRETCH, BEND)
reaction(s) including any non-chemicals, over-the-arrow:			Cycle (pg 74) ⇄ $O_3 \to O_2 \to$ etc.	UV-A absorbed in Step 1 of •fluorescence (ACE); net chemical result of Ch-Cycle is ZERO, but it absorbs UVB, UVC.		
rxn's location & non-location		in STRATOsphere, not TROPOsp (UV-C ≈ 0 because of this rxn in STRATOsph)	STRATOsph (w lots of O_3); TROPOsp (w low amounts of O_3 and UV-B)	STRATOsph (light available but not chemicals); TROPOsph (w chemicals: N_2O, Cl_2, PLANTS)		See pg 104, FIG 3.2 for ≤
HEALTH EFFECTS: skin-effects	(earlier) for Exam 1, hands of early radiologists (who didn't know the danger)	would damage, LOGICALLY, IF UV-C hits use (but not much does, so the IF doesn't occur) this UV-C would be biologically damaging for skin, eyes, ... (but it isn't a concern)	causes SUN-BURN (direct DNA damag) (surface, epidermis) (LOW penetration) (in epidermis: F-8, #7F-8b) (+) body uses UV-B to make Vit D	causes SUN-TAN (MELANIN) penetrates deeper, → AGE-WRINKLES	not much effect?	we feel WARMTH (heat)
cancer-effects	(earlier) - IONIZ-RXNS → H_3O^+, OH• that damage DNA, → cell death (RADN SICKNESS)		SKIN cancers: basal cell carcinoma (comon), squamous cell (outer layer), melanoma (75% die)	some? Are these caused by UVA and/or UVB? SCIENTIFIC CONTROVERSY → for 108, I don't know what "the answer" is; SunScreens* (all abs UV-B, some also-A)		-
eye-effects	or damaged DNA cell (lives on as cancer) MAYBE; some DNA damage → cancer		damage eye-STRUCTURE (cornea, lens)	burns eye-SURFACE	eye lets us see colors (with no-damage?)	-
miscellaneous HEALTH HAZARDS: (I.R. γ, x) cancer (UV-C, UV-A) smother (CO_2), suffocate (CO) ABC acid LUNGS, NOx, etc. O_3	probably γx → damage to EYES (MAJOR)		3-part SPLIT of UV-spectrum (200, 280, 320, 400; 80, 40, 80; C, B, A) and BOND-BREAKING ← I, O_3 ← O_2	PLANT silver sword (shiny so reflective); ZnO reflects it (screen); (SUN SCREEN* + reflctv particls → SUN BLOCK)	(dark COLD, no wind) H_2O → 1a PSCs (especly antarctic); 1b RXNs on surface → Cl_2, HOCl; 2a Cl_2, HOCl LIGHT → Cl• Cl• ← CFC + UVC also, HO• Cl•, EVERYWHERE, at all TIMES; 2b Cl• is CATALYST for CYCLE (90-91) that ↓ O_3	- story w 2 ways to get Cl•: •PSC-chem → Cl• → O_3↓; •CFC → Cl• → O_3↓
SPECTROPHOTOMETER LIGHT INTENSITY at λ's	GRAPH (TRANSMITANCE / ABSORBANCE) can be				≡ on pg 91	lots of O; $O_2 + O_3$ (more than above / below) OZONE LAYER 15-30 km; mainly O_2
light can be • reflected • absorbed (in a few systems (+fluorescence) • emitted) • transmitted	in fluorescence, ① light is absorbed (ACE) ② e's are conserved! ③ loses some energy (converted to HEAT) and then emission;	metric prefixes - 529: kilo, k m = 10^3 m; centi, cm = 10^{-2} m; milli, mm = 10^{-3} m; micro, μm = 10^{-6} m; nano, nm = 10^{-9} m; what (UV, vis) goes thru quartz & glass? UV, vis (≠ nuclear penetrtn) both transmit thru QRTZ but UV stopped by GLASS (absorbed)	how do health-effects of UV-B,A depend on dark skin absorbs more skin color (melanin), men/women (why?) outside more (average)	UV intensity varies w altd, latd (HOLE...), O_3 varn; time of YEAR, DAY; (CLEAR, CLOUDS); (OUTSIDE, INSIDE); REFL (SNOW, SAND, WATER)		
Is it a radical? K^+ yes, K^+ no; H_2O no, H_2O^+ Y; Cl Y, Cl_2 no, Cl^-; O (di-RAD), O_2 (BAD, STABLE, IGNORE); (NO_2 Y #? SO_2 no); odd # of e's; OH⁻ no, OH• Y	optical brightener (UV-A, VISIBLE) abs 350, emit 430. Why does it "undo the dinginess"? it adds back the blues (hi-en part of vis spectrum) that dingy (originally white) clothing (WHITE ≡ all VIS-colors) reflected or emitted by source	.0047 3% ⇄ 47.3 ppm				
		methane: 1 mono, 2 di, 3 tri, 4 tetra; chlorine: Cl, Cl_2; chloride: Cl^-; chloro, -C-Cl; ALPHABTCL for Br, Cl, F; naming CFC, HCFC...	CCCCC C; CCCCC C C; CCCCC C C; CCCCC C C; see pg 442, #31	CRITICAL THINKING: all of these are same CONNECTIVITY.	1 butane, 2 both same; CCCC C; CCCC C C; CCCC C C C; ≠ pentane	use BOND-NEEDS for most (C4, N3, O2, F1, H1) but not O_3, SO_2, SO_3, NO_3^-, NO, NO_2 (all have one O=), CO (=N_2) C≡O but poison, bk
			FORMULAS • chemical, C_3H_8O; condensed structural, $CH_3CH_2CH_2OH$ (more detail); C_3H_7OH; structural, H-C-C-C-O-H; Lewis (= structural with el dots on all but C, H)			
			mepbphho 1 2 3 4 5 6 7 8; memrz; GAS at room-T; geometry (pentagon...); LIQUID at room-T (but VOLATILE) as in VOCs		[$Mg]^{2+}$, $[:\ddot{O}:]^{2-}$ •IONIC COMPOUND with IONS (+-); METAL with NON-METAL; H-O-H duet, octet •COVALENT MOLECULE w non-METALS; for •RESONANCE only move electrons, atomic nuclei move; as in SO_2, SO_3, O_3, NO_2, C_6H_6	[⬡ ↔ ⬡] = ⬡; O=O-O ↕ O-O=O; O=O=O; each bond is 1.5, so breaks easier (w UV-B) compared w O_2's bond of 2.0; free •radicals (like NO, NO_2) very reactive