

CFCs and Substitutes, alphabetical naming: B(Bu), C(Ce), F(F)

chemicals	structures	PROPERTIES — positives & (negatives) non-corrosive? non-toxic? non-flambl? degrades? O3-depl-potentl bp-range	USES of these chemicals
NH ₃ SO ₂		NH ₃ + HOH → NH ₄ ⁺ + OH ⁻ (BASE) H ₂ O + SO ₂ → H ₂ SO ₃ → H ⁺ + HSO ₃ ⁻ (ACID)	before 1930, household refrigerators now, some INDUSTRIAL refrigerants
CFC standard for comparison	GH - no H, some Cl CCl ₂ F, dt = 60y CCl ₂ F ₂ , dt = 120y (as F ↑, Cl ↓, dt ↑)	non-toxic non-flam (inert) colorless, odorless, tasteless not removed by RAIN or by REACTNS only in stratosph. CFC → Cl [•] (EQU 2.9, CFC pg 90) CFC, pg 90-1, 43-4 + long lifetimes Lec 18, slides 57-65	1- REFRIGERANT GAS (refrigants, car AC) 2- PROPELLANT for spray cans (hair, deodorant) 3- PROPELLANT for drugs (for asthma, bronchitis, emphysema) 4- to FIGHT FIRES
HCFC ↑ LIFETIME ↓	GH - some H, some Cl CH ₂ ClF, dt = 15y (141b) CH ₃ CClF, dt = 9y (141b)	compared w CFCs, H ₂ → more reactive, a little more toxic, (sl 33) more flambl. * dt ↑ as more Fs (replacing Cl) but H ₂ are bigger factor F ₂ replace Cl, but dt ↓ F ₂ has lots of Fs L19, sl 53	5- FOAMING AGENT (for styrofoam and more). (but not in L-19) (I think (but not on L-19 slides) are replacement for some CFC uses: REF?
HFC and no Cl, no Br, no O ₃ ↓	GH - some H, no Cl COPs, 134a is HFC this was in you lat, pg 7-10, w CH ₂ F ₂ CH ₃	HFC has no Cl, no Br, w no O ₃ ↓ HFC is praised for 4 paragraphs on pg 98, but not longer term solution (GREEN HOUSE)	refrigerators, auto refuim AC (L19, sl 46-52)
FC ↑ FEF	GH - strong C-F bonds	doesn't deplete O ₃ non-toxic ("generates non-toxic") highly biodegradable, w "innocuous products" effective at 10 concentration of halons (→ less waste)	
HBFC	H, Br, F, along with C	UV → Br [•] , O ₃ ↓	
Halons BFC + CBFC?	Br & F, sometimes Cl no H	Lec 19, sl 36-39, 43-45 sl 43 (why the difference?) Halon-1301, CBrF ₃ -225y → long blue curve Halon-1211, CBrClF ₂ -25y → short red curve (Bu → O ₃ ↓)	Lec 18, sl 46-50 fire fighting where water LIBRARIES, MUSEUMS, AIRCRAFT, COMPUTERS (electronics)
CH₃Br	not in COPs, w in L-18, L-19, L-25, MONTREAL for PROTOCOL	non-polar (LOW polarity) (but not ZERO) CFCs etc are non-polar (LOW polarity) (but not ZERO) (polarity - canceling due to tetrahedral geometry) so don't dissolve much ("washout") in RAIN	

LECTURES:

#19 (w, Oct 19)
#18 (M, Oct 17)
L18, sl

2.9 (pp 82-83), f-2.15 (p. 85), 2.11-2.12-C (pgs 88-94), W (Oct 20); Ozone Hole, 2.10 + M-11 and beyond.

Greenhouse Gases
• CO₂, H₂O, CH₄, CFC, HCFC, etc
not (N₂, O₂, H₂, Ar... (nobles))
default: absorbs IR

CO₂ only 0.4%
if absorb, Na₂CO₃ 18%
O₂ 21%
Ar 9%
too much GH T₂ too high

Molecules
Bond #s (C-4, N-3, O-2, F-1, Ne-0), H-O-H or O=O.
How many directions to see electrons? (bonding, non-b) els repel/avoid → logical shapes → logical names:
2 (linear), 3 (trigonal planar), 4 (tetrahedral) but with non-b els: 3 (OSO bent), 4 (HOH bent, NH₃ trig pyr).
radical: if unpaired el (≠ non-b els); always if odd #.
On a test, you must draw every bond and every atom, you structural formula. And you must draw electrons you a Lewis formula, chemical formula, C₂H₆ condensed structural f, CH₃CH₂CH₃ structural f, draw ALL atoms and bonds Lewis f = structural f + unshared electrons

isomers defin: if same chemical formula (same # of each type of atom) but different structural formula (different connectivity)
drawing: be creative (get all, for each + critical (eliminate all duplicates systematically chain-length #) with same connectivity)
alkanes (CH, only C-C, C_nH_{2n+2}); draw structure to see why (1 extra, each end).
alkenes (CH, one C=C, lose 2 Hs); draw each (ane, ene, yne, ring) to see why.
alkynes (CH, one C≡C, lose 4 Hs). draw: hexane (6 5 5 4 4), butene (4 4 3).
any ring (CH, if only C-C, lose 2H). also C-C-OH (alcohols), C-O-C (ethers).

SHAPE, ask "how many directions are els?"
if only 2 atoms, linear
if 3 dirns (O=C=O) is LINEAR
if 3 dirns (SO₂) is TRIGONAL PLANAR
if 4 dirns (CH₄, NH₃, H₂O) is TETRAHEDRAL (is polar ≠ 0, unless all 4 bonds are same)
CF₄ polarity = 0, CCl₄, CBr₄ ≠ 0

non-metals
C, F, N, Cl
H
metals
POLARITY depends on
• EN diffms
• geometry (shape)
→ cancels?

CFC pg 176
BOND ENERGIES
C-H (416)
C-F (485)
C-Cl (327)
C-Br (285)