

1) 10pts

What is a fluorocarbon?

A compound with a C-F bond.

What are the three characteristics that make fluorine such a special and unique substituent?

1. F is the most electronegative element
2. Next smallest substituent after Hydrogen
3. It forms a stronger bond to carbon than Hydrogen does.

Name two famous fluorine chemists and state what area of fluorine chemistry they each contributed to.

Scheele - HF

Moissan - F₂

Swarts - Aliphatic FC's

Chambers - Fluoro organic

Dolbier - Radicals, allenes

Christe - F₂ from Solids

O'Hagan - Enzymatic Fluorination, Naturally occurring FC's.

2) 10pts

Draw a Lewis structure with lone pairs for a Fluorine atom; fluorine molecule; fluoride ion; hydrogen fluoride.



Which, if any, of these forms of fluorine can be found to occur naturally.

Fluoride ion, in mineral form CaF₂

3) 5pts

State and briefly explain one historical reason why organofluorine chemistry grew rapidly during the 1900's.

CFC production for coolants.

F₂ research for UF₆ / atom bomb research

Give one possible reason why nature finds it (almost) impossible to synthesize organofluorine compounds?

- Fluoride sources are generally water insoluble.
- Aqueous F⁻ is heavily solvated - poor nucleophilicity
- F⁺ / F[•] hard to generate biologically

4) 22pts

Circle which bond is longer

C-H or

C-F

Circle which bond is stronger

C-H or

C-F

Circle which bond is more polar

C-H or

C-F

Circle the molecule with the stronger σ bond:

CF₄

CBr₄

CF₄

CF₂H₂

BBr₃

BCl₃

F-F

Cl-Cl

State two similarities between H and F

Both: small, univalent, nuclear spin $I=1/2$, form strong bonds to carbon, form stable $[CX_2]$ polyethers...

State two similarities between F and Cl

Both: halogens, 7 valence electrons, electronegative, leave as anions, etc.

5) 10 pts

Match the reagents with the correct process:

Pb(OAc)₄, HF

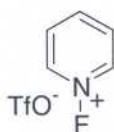
Nucleophilic Trifluoromethylation

Electrophilic Fluorination

(CH₃OCH₂CH₂)₂NSF₃

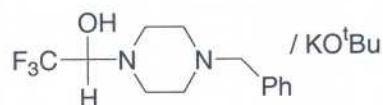
Electrophilic Trifluoromethylation

Oxidative Fluorination



E.C.F.

Chiral Cartman Fluorination



Nucleophilic Fluorination

Radical Fluorination

Radical Trifluoromethylation

CsF, Diglyme

DeoxoFluorination

Simon's Cell

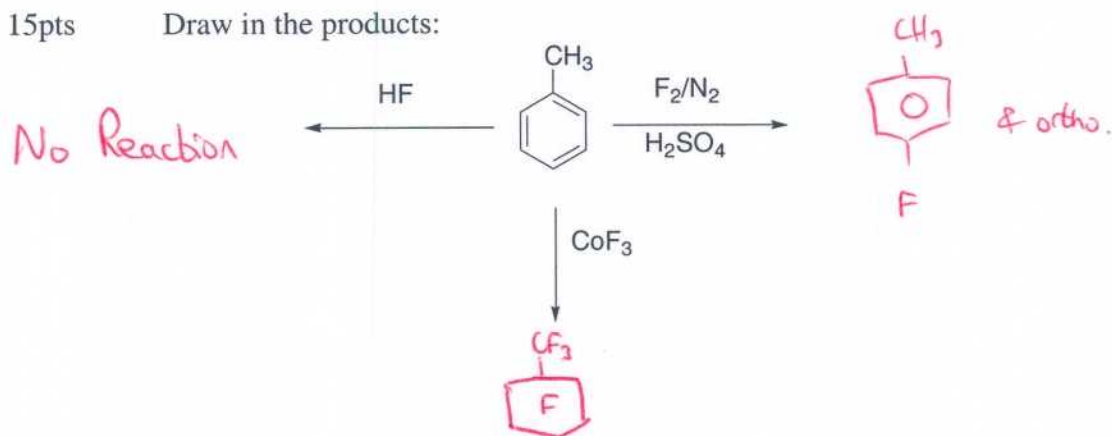
6) 8pts Explain how CFC's are detrimental to the Ozone layer.

CFC's cause the destruction of Ozone (O_3) through a chlorine radical catalysed process.

As the CFC rises into the stratosphere, the u.v. rays homolytically split the weak C-Cl bond.

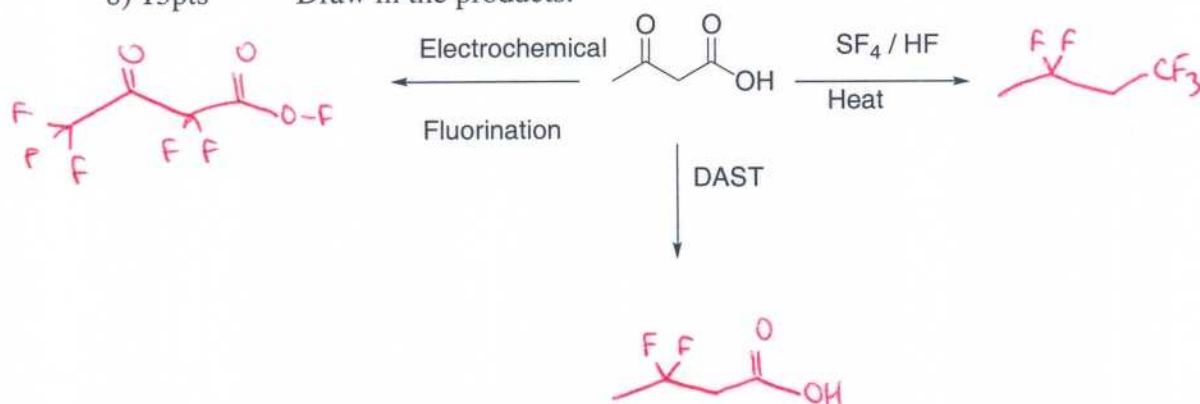


7) 15pts Draw in the products:



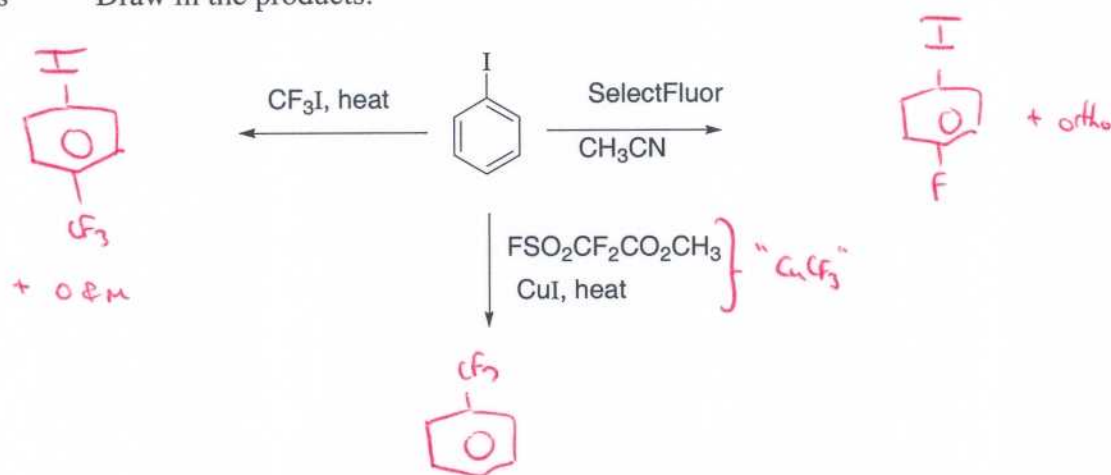
8) 15pts

Draw in the products:



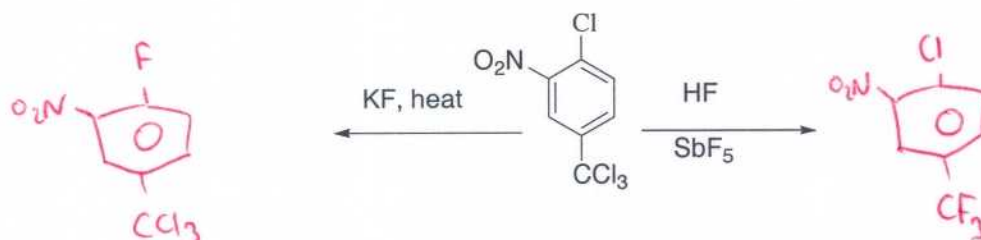
9) 15pts

Draw in the products:



10) 10pts

Draw in the products:



11) 4 x 20pts

Write the mechanism (no words) for **four** of the following fluorinating agents.
(If you do all 5 I will just grade the first 4)

