

1) 10pts

What is a fluorocarbon?

A compound that contains a carbon-fluorine bond.

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

- F is the most electronegative element
- Next smallest substituent after Hydrogen
- 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.

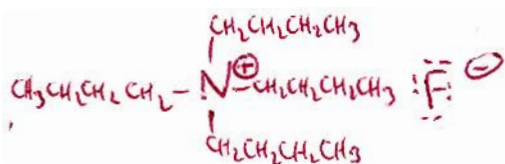
Scheele (HF); Moissan (F₂); Swarts (aliphatic fluorocarbons); Simon (E.C.F.); Chambers (fluorogenic); Dolbier (F physical organic, radicals...); O'Hagan (Naturally occurring fluorocarbons, fluorinase...); Prakash (CF₃-TMS); ...

2) 10pts

Draw a Lewis structure with lone pairs for:

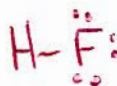
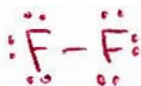
Tetrabutylammonium fluoride

A Fluorine atom



A Fluorine molecule

Hydrogen fluoride



3) 5pts

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

- Research into CFC's for cooling agents
- F₂ handling for U₂₃₅ and related materials for atomic bomb research

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

- Natural fluoride ion sources are generally water insoluble.
- Aqueous fluoride is very well solvated, & ∴ poor nucleophile.
- F⁺ & F[•] are too difficult 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

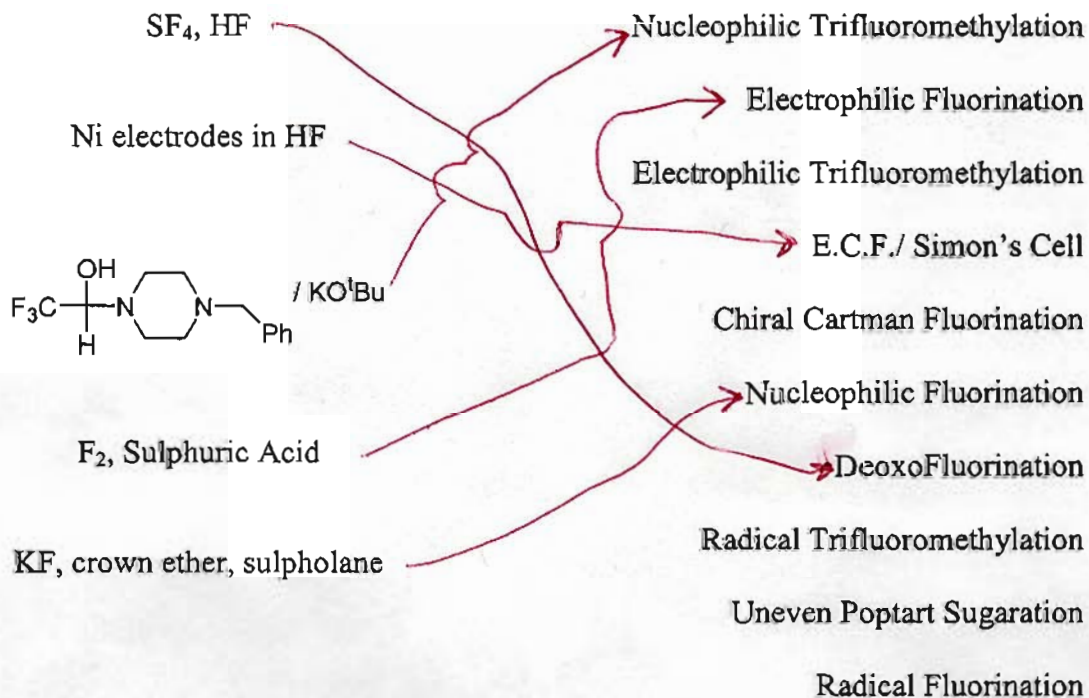
State two similarities between H and F

Both are: small, univalent; Nuclear spin $I=1/2$; form strong bonds to carbon; form stable polyethers, need $1e^-$ for full outer shell; ...

State two similarities between F and Cl

Both are: halogens; 7 valence electrons; electronegative; leaving groups; o/p directors for E.A.S.; ...

5) 10 pts Match the reagents with the correct process:



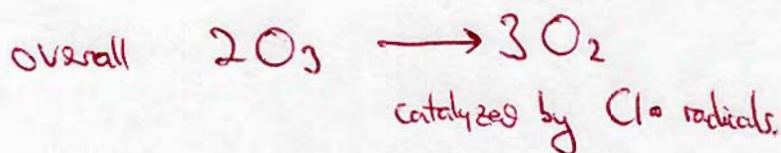
6) 8pts

Explain how CFC's are detrimental to the Ozone layer.

CFC's are ChloroFluoroCarbons, which when rise up into the stratosphere and react with the powerful u.v. rays. This generates $\text{Cl}\cdot$ which destroy the OZONE LAYER.

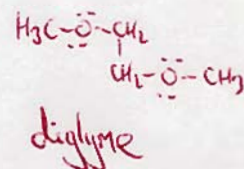
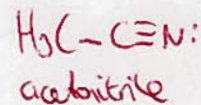
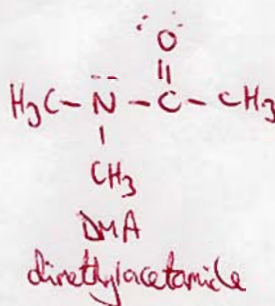
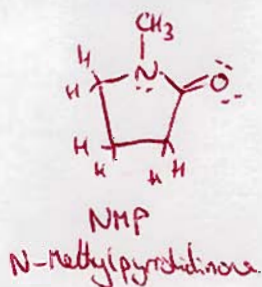
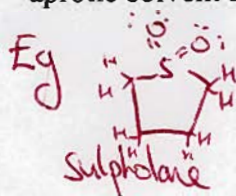


regenerated & carries on the chain process.



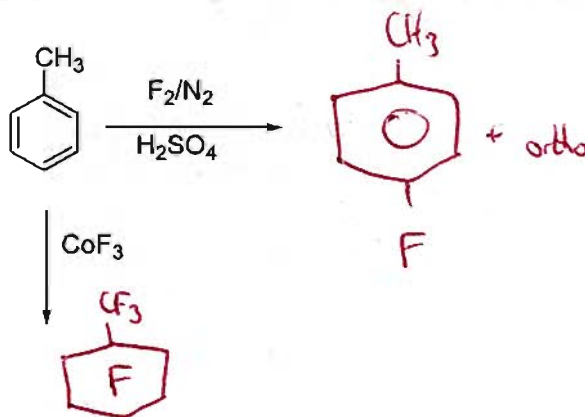
7) 5 pts.

Name and draw (correct Lewis structure, including lone pairs) a polar, aprotic solvent suitable for fluoride ion Halex reactions.



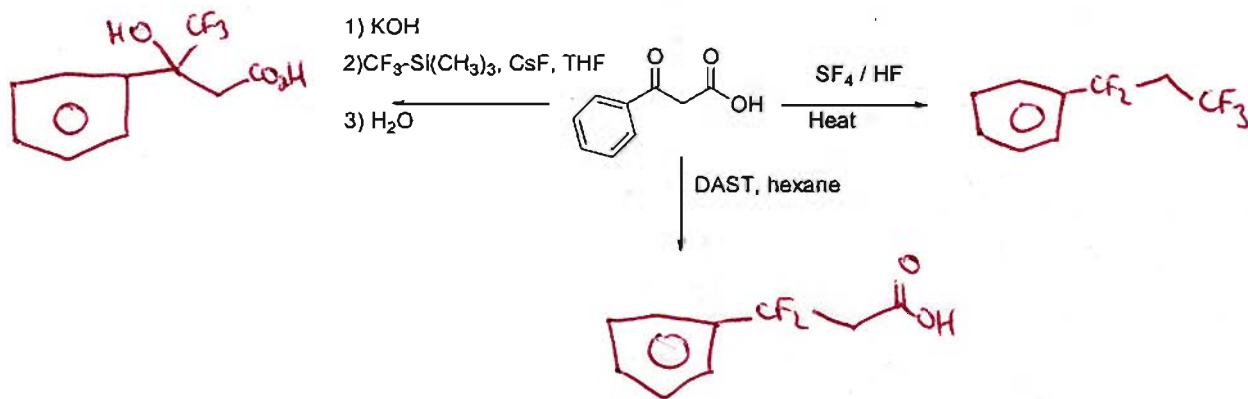
8) 10pts

Draw in the products:



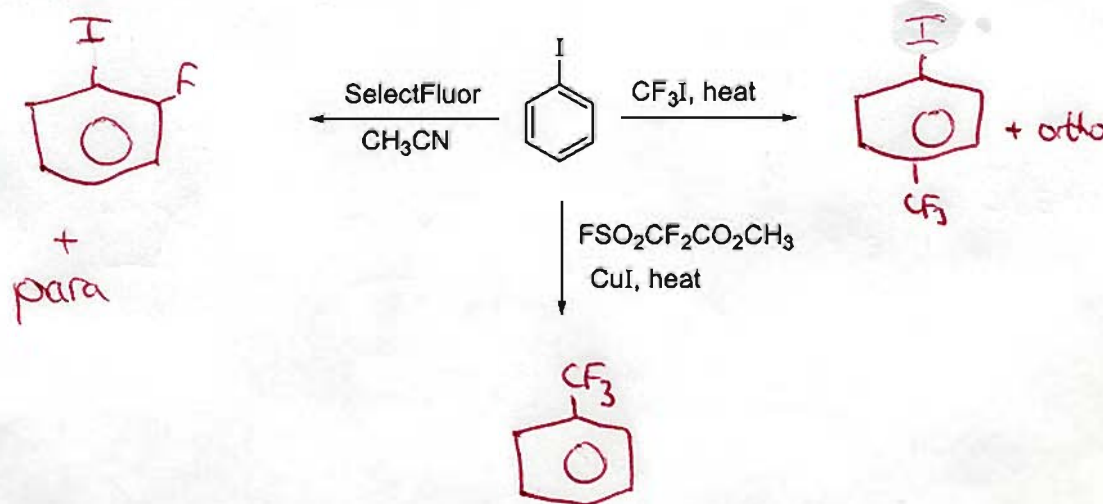
9) 15pts

Draw in the products:

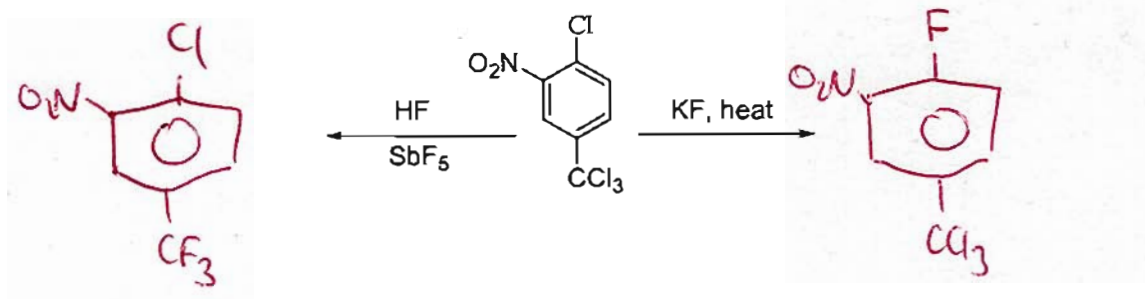


10) 15pts

Draw in the products:



11) 10pts Draw in the products:



12) 20pts

10 True and False questions:

BAST and DAST reagents are safer alternatives to SF₄. T

A Fluorine atom has 10 neutrons. T

Fluorine prefers to be bound to atoms of high p character. T

A Fluorine atom has 9 valence electrons. F

Perfluorocarbons are normally more dense than hydrocarbons. T

Perfluorocarbons can dissolve large amounts of oxygen and carbon dioxide. T

The Fluorinase enzyme can make a C-F bond. T

Fluoride ion is a worse nucleophile in ethanol than in THF. T

Prakash was the first chemist to prepare CF₃-TMS. F

All compounds containing a C-F bond are very toxic. F

13) 3 x 20pts

Write the mechanism (no words) for three of the following fluorinating agents.

(If you do all 4 I will just grade the first 3)

