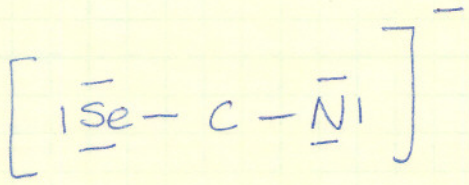
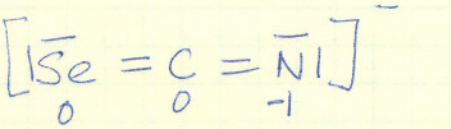
ADVANCED CHEMISTRY

INORGANIC CHEMISTRY – WINTER – WEEK (2)

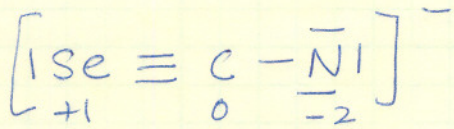
Chapter 3

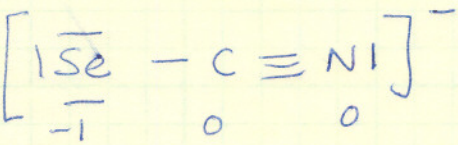
(2) (a)





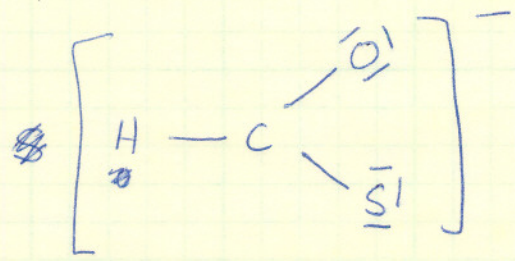
← best one

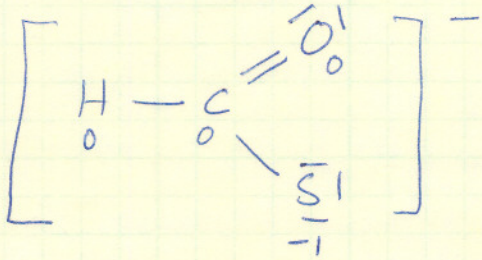


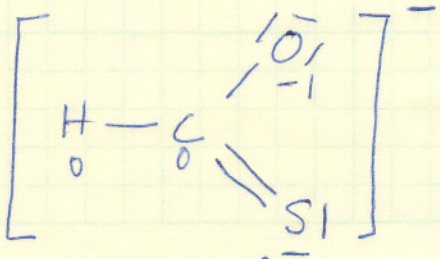


Se		6
C		4
N		5
		15
−1		1
2		16 ē
		8 ē pairs
		−2 bonds
		6 ē pa

(b)





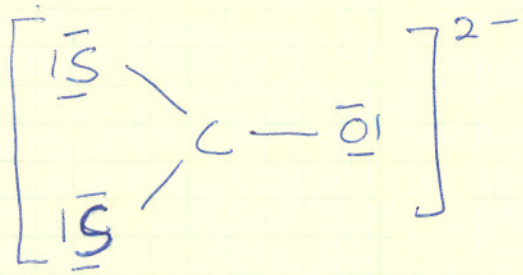


← better one

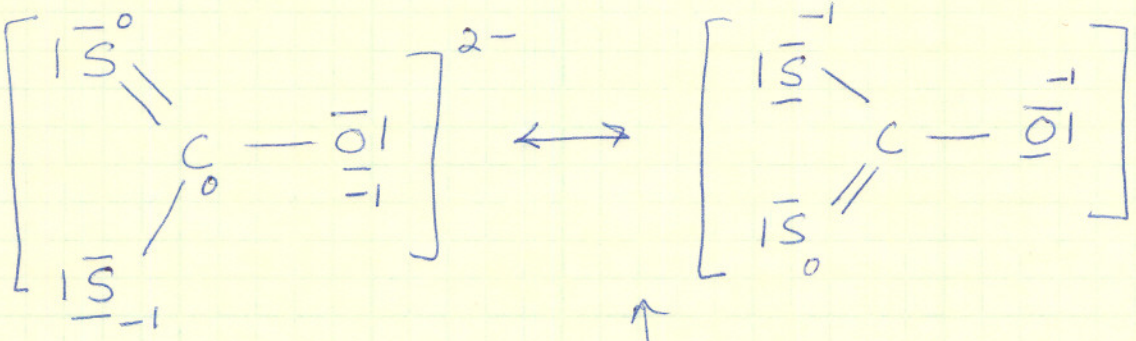
H	1 ē
C	4 ē
S	6 ē
O	6 ē
−1	1 ē
2	18 ē
	9 ē pairs
	−3 bonds
	6 ē pairs

2/

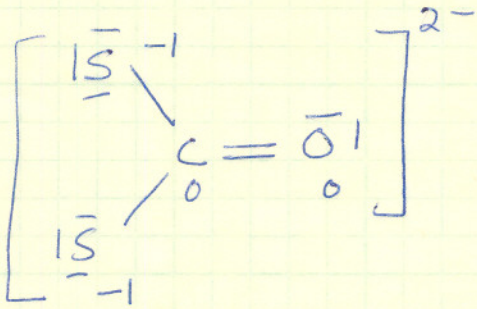
(1)



$2 \times 5 = 12\bar{e}$
$C = 4\bar{e}$
$O = 6\bar{e}$
$-2 = 2\bar{e}$
$2 \mid 24\bar{e}$
$12\bar{e}$ pairs
-3 bonds
$9\bar{e}$ pairs

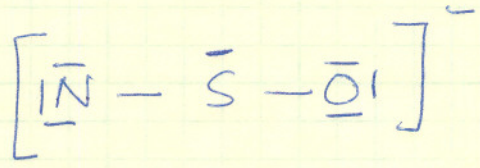


better one.



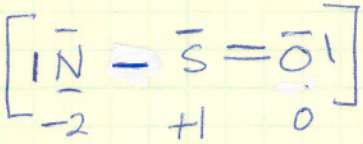
5-2-3

(3)

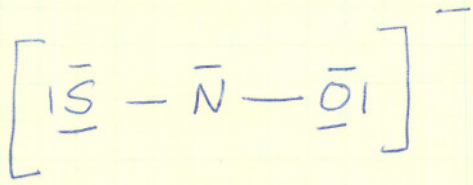


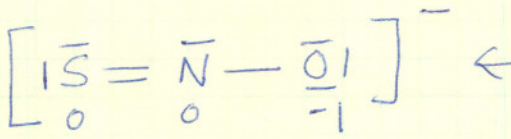
$N = 5\bar{e}$
$S = 6\bar{e}$
$O = 6\bar{e}$
$-1 = 1\bar{e}$
$2 \mid 18\bar{e}$
$9\bar{e}$ pairs
-2 bonds
$7\bar{e}$ pairs

← better one

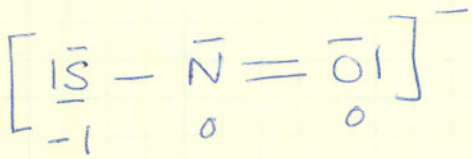


6-4-2

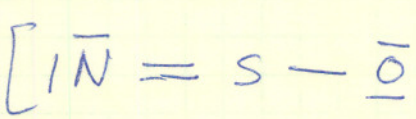
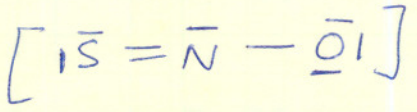




← better one

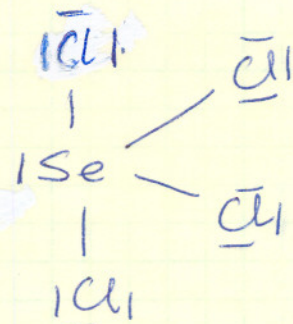


Based on the two <u>best</u> structures

 and 

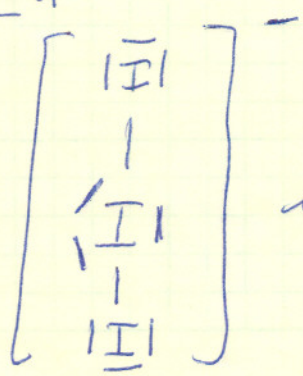
the most stable ion is SNO^- (has the negative fromal charge on electronegative Oxygen atom and zero formal charges on all other atoms).

(8) (a)



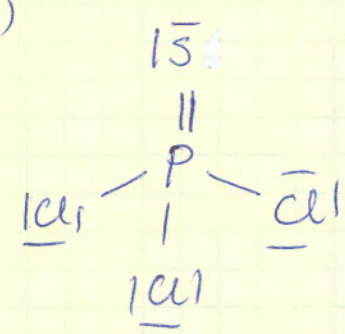
see-saw structure or distorted tetrahedron

(b)



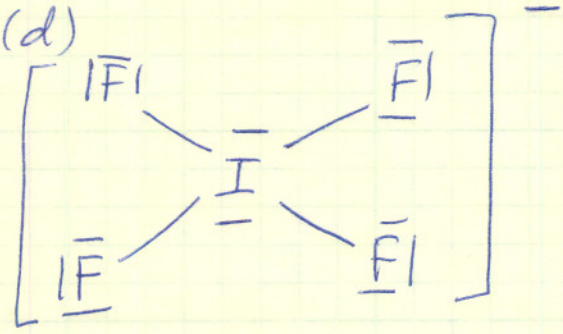
linear geometry

(c)



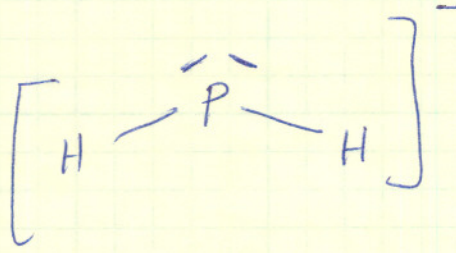
tetrahedral

(d)



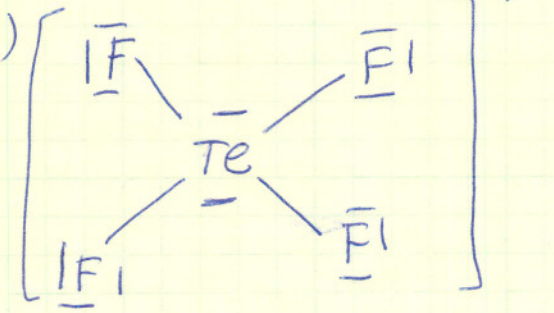
square planar

(e)



bent (angular) geometry

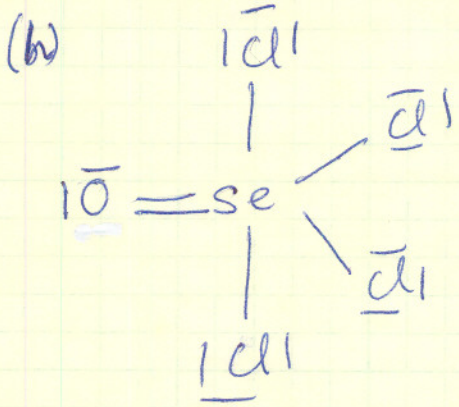
(f)



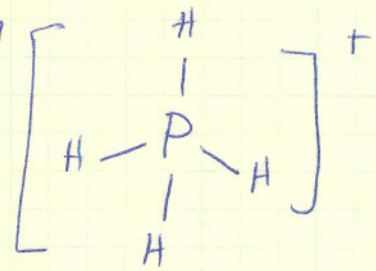
square planar

(g) $\left[\overline{N}=N=\overline{N}\right]^- \leftrightarrow \left[N\equiv N-\overline{N}\right]^- \leftrightarrow \left[\overline{N}-N\equiv N\right]^-$

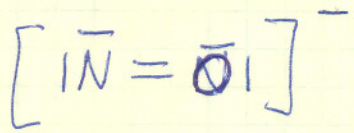
linear geometry.

(h) 

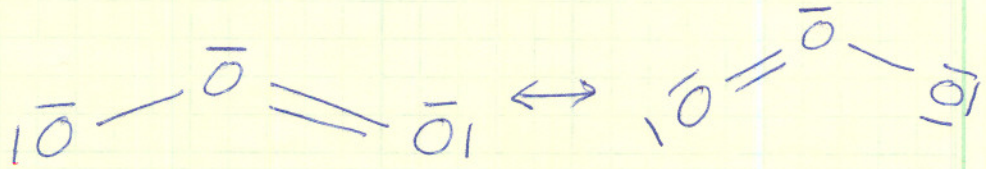
trigonal bipyramidal

(i) 

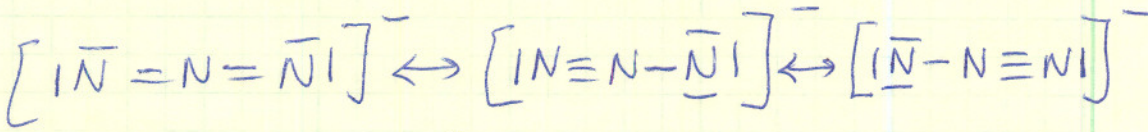
tetrahedral

(j) 

linear

(11) (a) Ozone 

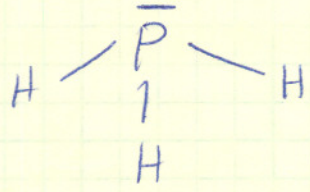
bent geometry

azide 

linear geometry

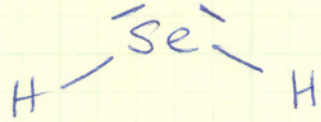
(b) If an electron is added to ozone to make O_3^-, the added electron can reside partially on the central O atom, increasing $\bar{e}$–$\bar{e}$ repulsion

(16) (a)



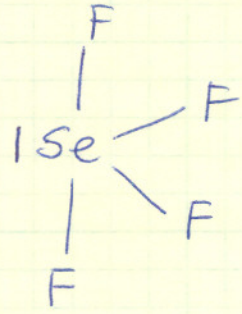
trigonal pyramidal

(b)



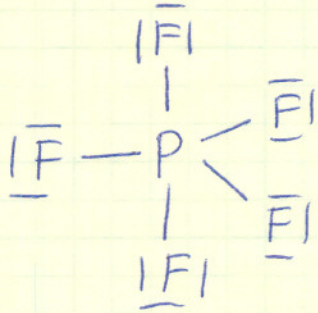
bent (angular)

(c)



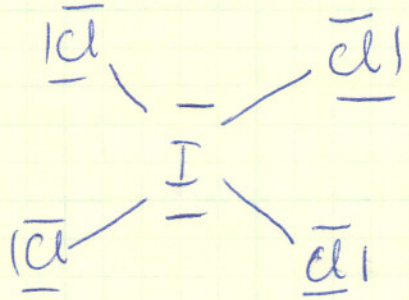
See-saw structure

(d)



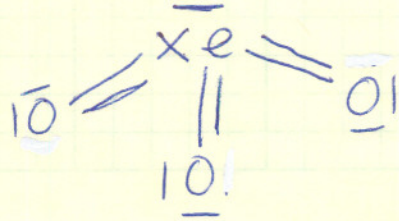
trigonal bipyramidal

(e)

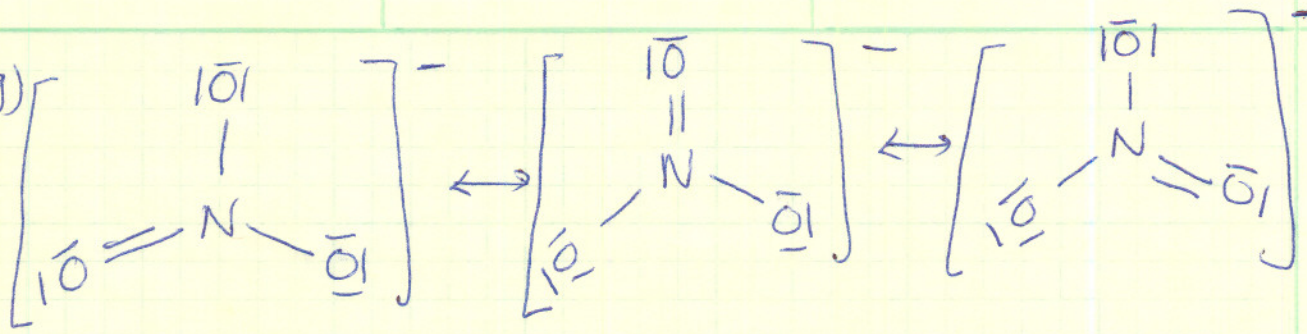


square planar

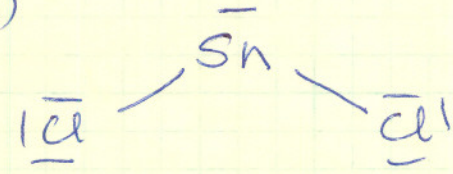
(f)



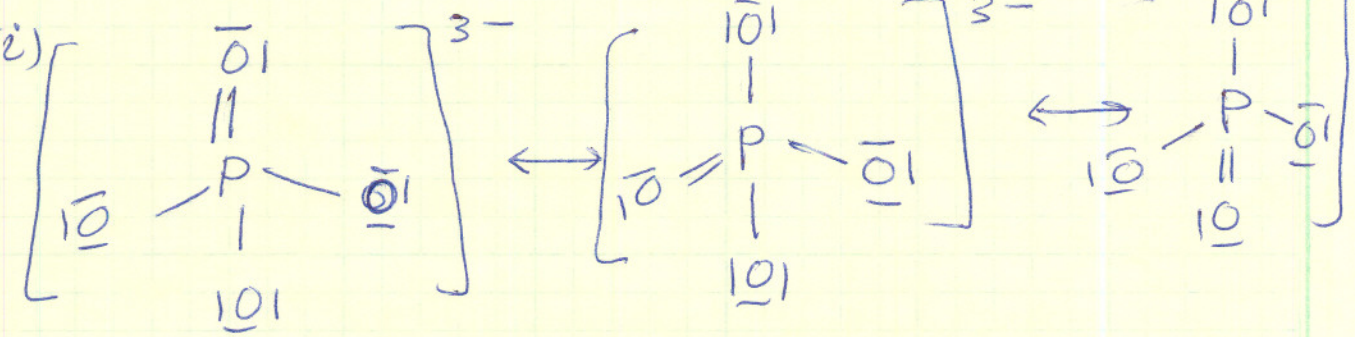
trigonal pyramidal

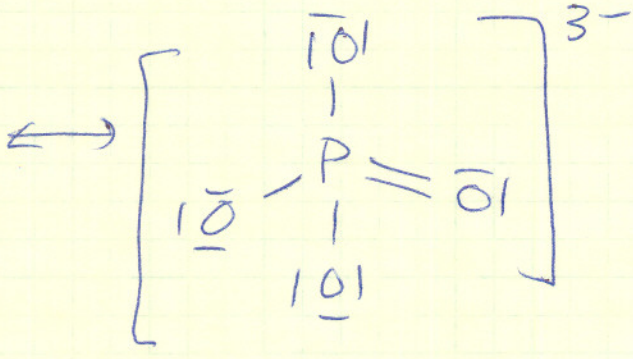
(g) 

trigonal planar

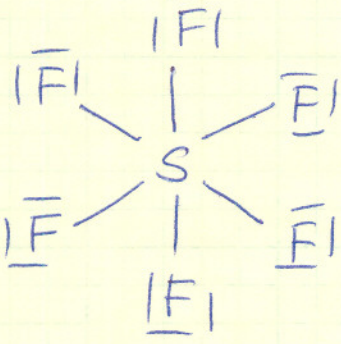
(h) 

bent geometry
(not a covalent compound!)

(i) 

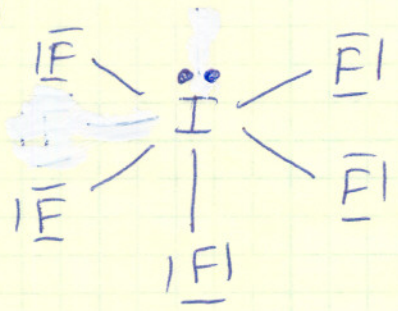


tetrahedral

(j) 

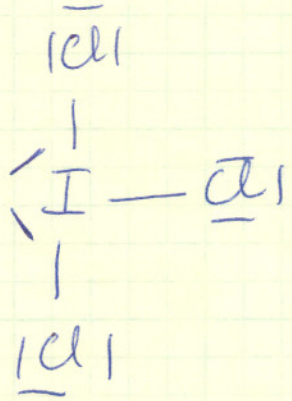
octahedral

(k)



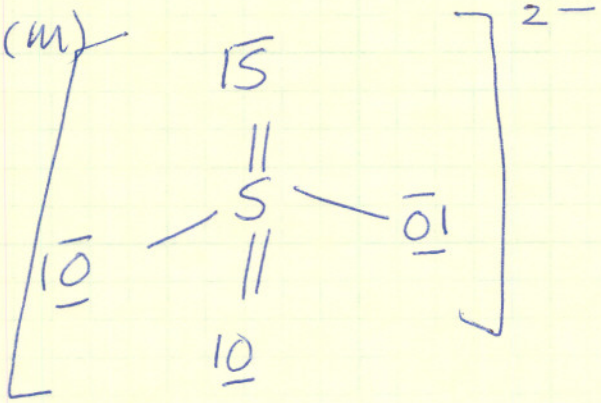
Square pyramidal

(l)



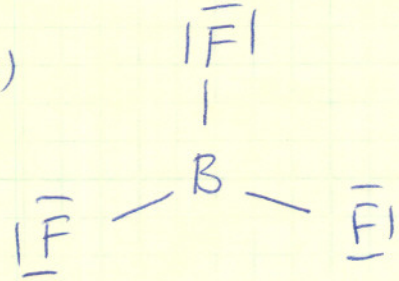
T-shape

(m)



tetrahedral

(n)



trigonal planar

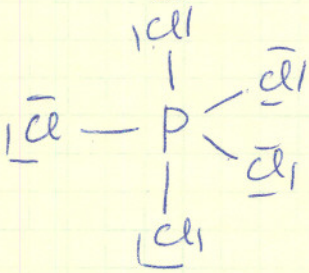
(20) (a) $\overset{\delta+}{C}-\overset{\delta-}{N}$ (b) $\overset{\delta+}{N}-\overset{\delta-}{O}$ (c) $\overset{\delta-}{C}-\overset{\delta+}{I}$

(d) $\overset{\delta-}{O}-\overset{\delta+}{Cl}$ (e) $\overset{\delta+}{P}-\overset{\delta-}{Br}$ (f) $\overset{\delta+}{S}-\overset{\delta-}{Cl}$

O–Cl > N–O > C–N > P–Br > S–Cl > C–I

⟶ bond polarity decreases

(21)



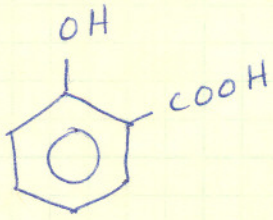
in PCl_5, P has 10 electrons around it (expanded valence). Since P is in the 3rd period, it is able to accomodate the extra electrons (in excess of the octet) in the 3d orbitals.

N is in the 2nd period and does not have d orbitals. It can only accomodate 8 electrons ($2s^2 2p^6$) in its valence orbitals. Therefore N cannot form compounds with expanded valence (such as NCl_5)

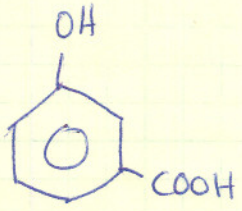
(22) (a) There is H-bonding in methanol, but not in CH_3SH. As a result CH_3OH has a higher b.p. than CH_3SH.

(b) The bond in CO is polar compared with the bond in N_2, which is non-polar. Polarity leads to CO molecules sticking to each other, increasing the melting and boiling points.

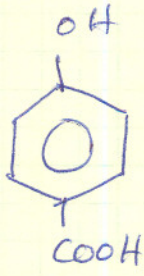
(c)



ortho

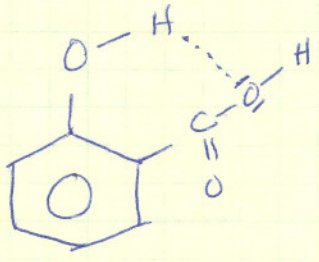


meta

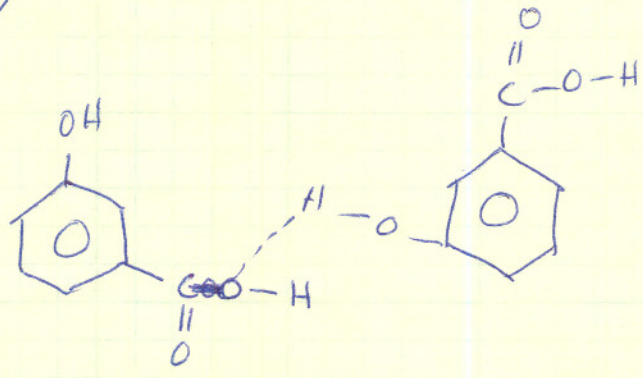


para

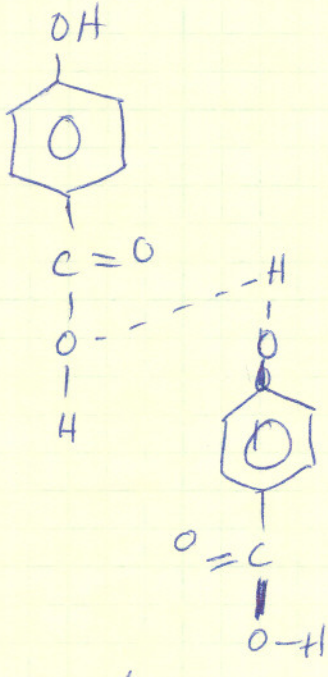
The ortho isomer forms intra-molecular hydrogen bonds. The meta and para isomers form inter-molecular hydrogen bonds.



ortho
(intra-molecular)



meta
(inter-molecular)

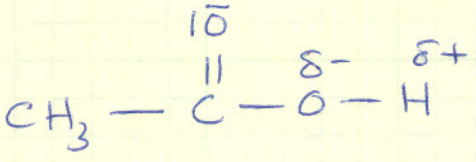


para (inter-molecular)

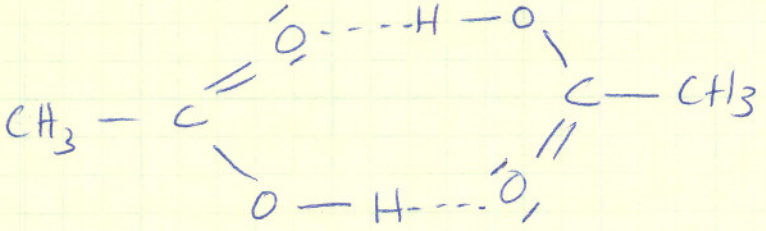
Inter-molecular hydrogen bonding results in higher melting points.

(d) as the atomic number increases in the noble gas group, the atoms get larger and hence easier for them to polarize (slightly). Polarized atoms can "stick" together more easily, which ~~~~ increases their boiling point.

(e)



This molecule has a polar O-H bond resulting in H-bond formation



Dimers are therefore often formed in the gas phase, lowering the vapor pressure than expected (without the dimer) by the ideal gas law.