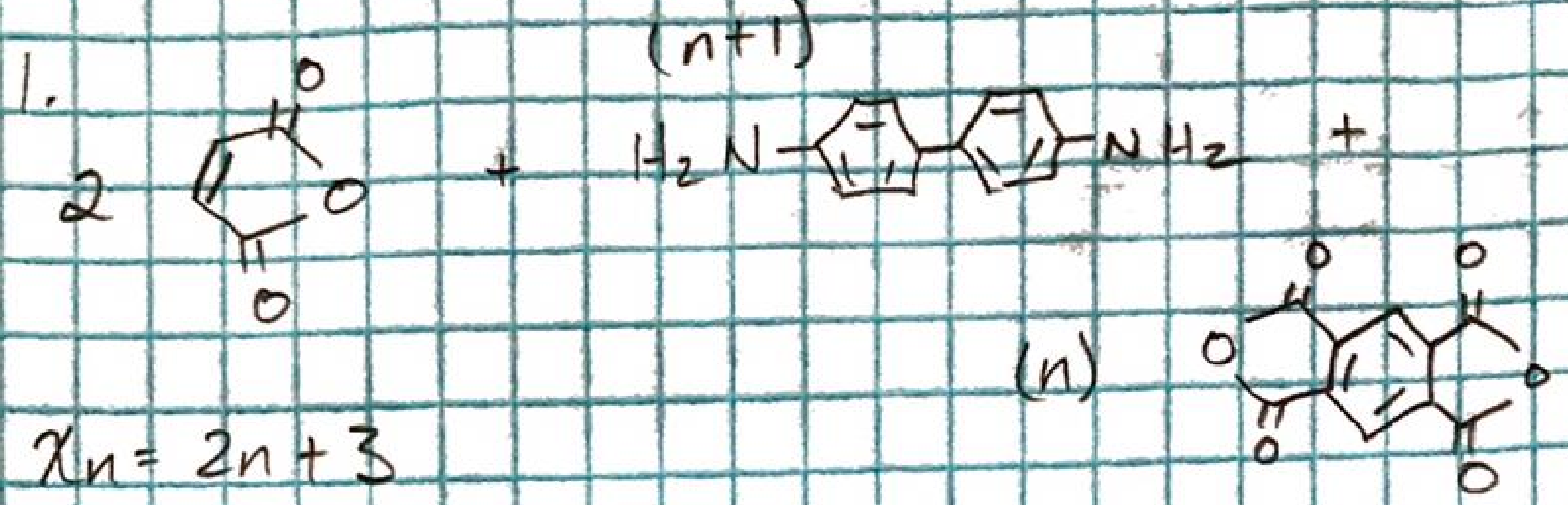
Zac Ahmad Exam 3
947102

1.



$X_n = 2n + 3$

$2000 = 366.33\,n + 344.326$

$4.51962 = n$

↑
This value won't convert to a fraction in my calculator, I didn't forget :)

2 mols maleic anhydride
$n = 4.51962$ mols pyromellitic anhydride
$n+1 = 5.51962$ mols benzidine

$$\frac{1000\,g}{2000\,g/mol} = \frac{1}{2} \text{ mol oligomer}$$

$2 \text{ mols} \times \frac{1}{2} \text{ mols} = 1$ mol maleic anhydride
$4.51962 \times \frac{1}{2} \text{ mol} = 2.2598$ mols pyromellitic anhydride
$5.51962 \times \frac{1}{2} = 2.7598$ mols benzidine

2. Structural features - small rings & small atoms (row 1 or 2 on periodic table). Cyclic compounds that display ceiling temperatures are characterized by small rings that exhibit <u>bond-angle</u> strain. For these small rings, there is added constraint that originates from the angles between atoms being less than the optimal 109.5°. These compounds are therefore enthalpy driven since their polymerizations would require a high level of energy release upon opening of small rings.

3. $T_c = 400\text{ K}$ - $[M] = 10$ mol/L

$T_c = 306\text{ K}$ - $[M] = 1$ mol/L

$$\ln \frac{[M]_c}{[M]^\circ} = \frac{\Delta H^\circ}{RT_c} - \frac{\Delta S^\circ}{R}$$

$$RT_c(\ln[M]) = \left(\frac{\Delta H}{RT_c} - \frac{\Delta S}{R}\right)(RT_c)$$

$$RT_c(\ln[M]) = \Delta H - \Delta S(T_c)$$
$$+\Delta S(T_c) \qquad +\Delta S(T_c)$$

$$RT_c(\ln[M]) + \Delta S(T_c) = \Delta H$$

$$RT_c(\ln[M]) + \Delta S(T_c) = RT_c(\ln[M]) + \Delta S(T_c)$$
$$(8.314)(306)(\ln(1)) + \Delta S(306) = (8.314)(400)(\ln(10)) + \Delta S(400)$$
$$0 + \Delta S(306) = 7657.477 + \Delta S(400)$$

my calculator won't convert ↗

$$\frac{-94\Delta S}{-94} = \frac{7657.477}{-94} \rightarrow \Delta S = -81.4625$$

$$\ln[1] = \frac{\Delta H}{(8.314)(306)} - \frac{(-81.4625)}{(8.314)}$$

$$\ln[1] = \frac{\Delta H}{2544.084} + 9.7982319$$

$$-9.7982319(2544.084) = \Delta H$$
$$-24927.525 = \Delta H$$

$$\ln[1] = \frac{(-24927.525)}{(8.314)(306)} - \frac{\Delta S}{(8.314)}$$

$$\ln[1] = (-7.495647) - \frac{\Delta S}{8.314}$$

$$7.495647 = -\frac{\Delta S}{8.314}$$

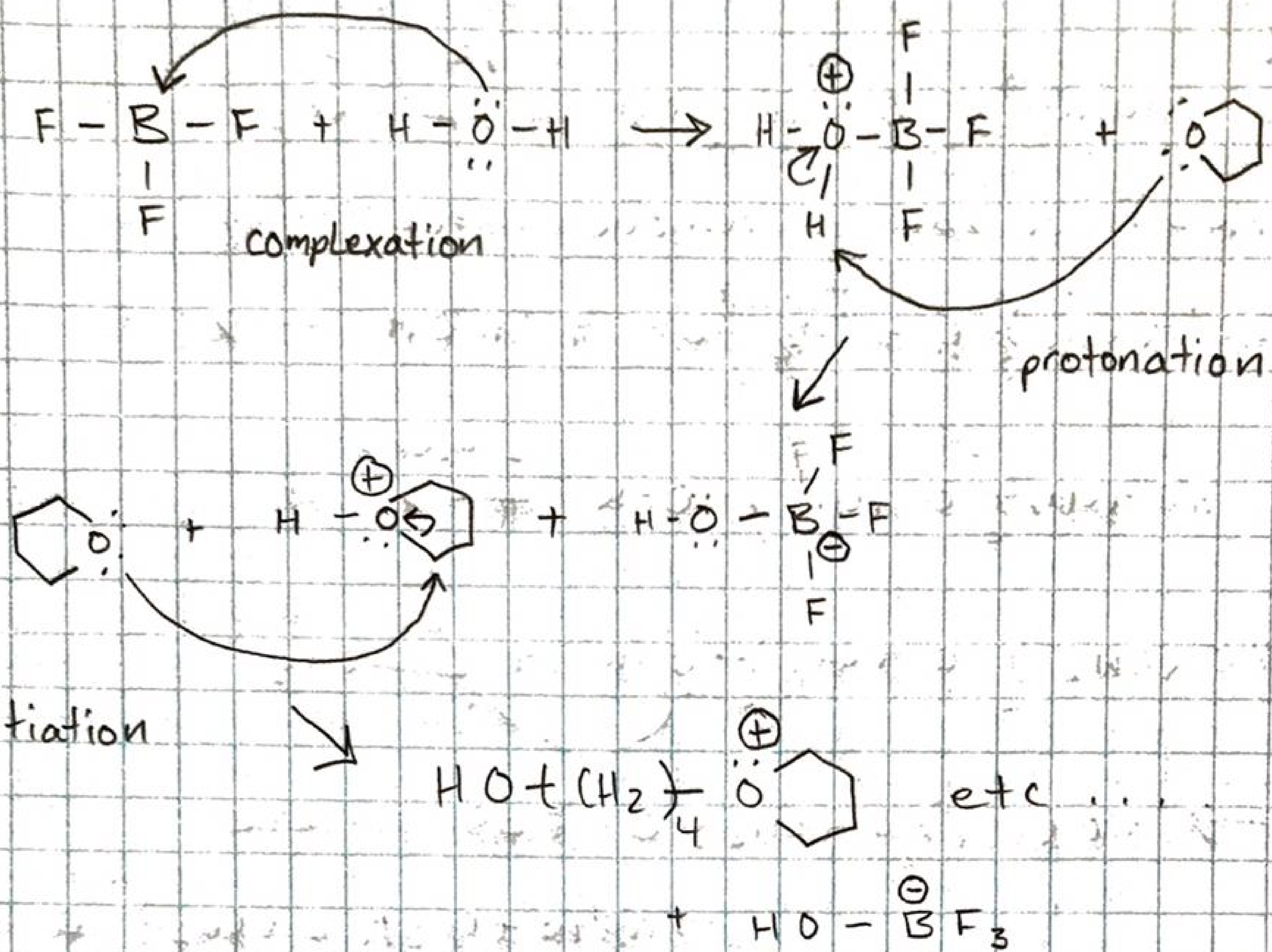
$$-62.3188 = \Delta S$$

$\Delta H^\circ = -24,927.525$ J/mol

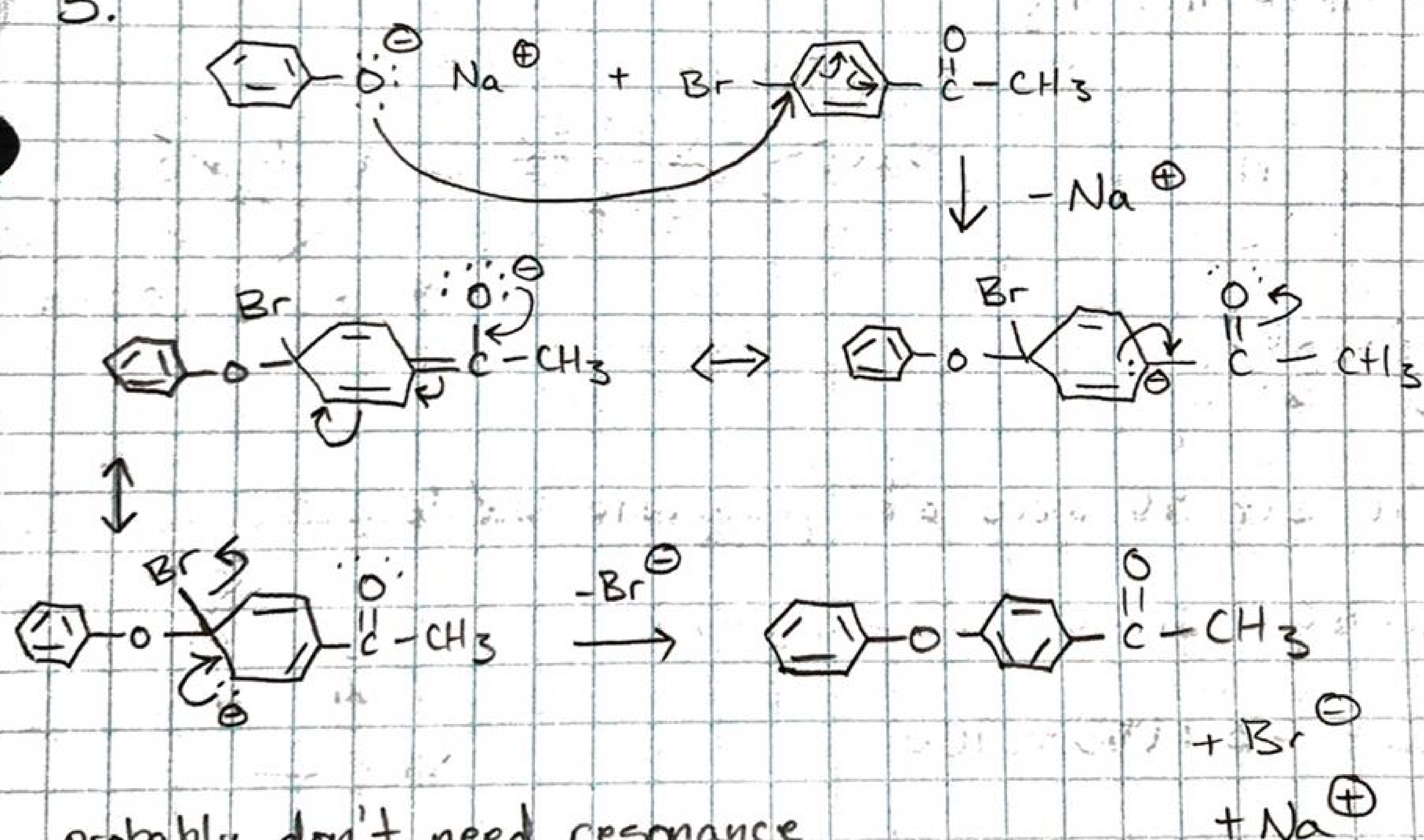
$\Delta S^\circ_{pure} = -81.4625$ J/mol-K

$\Delta S^\circ_1 = -62.3188$ J/mol-K

4.

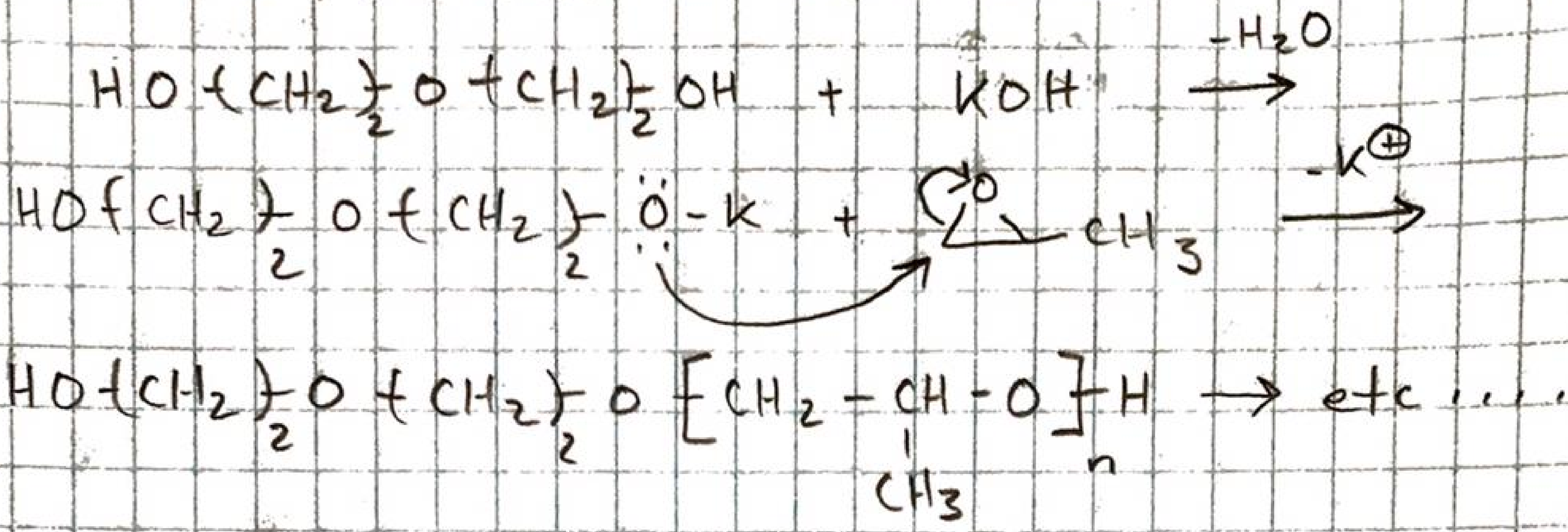


5.



probably don't need resonance structures, but I like showing them.

6. First, we have to remove water



n is propylene oxide so I'll say we have 1 mol diethylene glycol

1 mol DEG (106 g/mol) + n mols PO (58.1 g/mol) = 1000 g

$$106 + 58.1n = 1000$$

$$\frac{58.1n}{58.1} = \frac{894}{58.1}$$

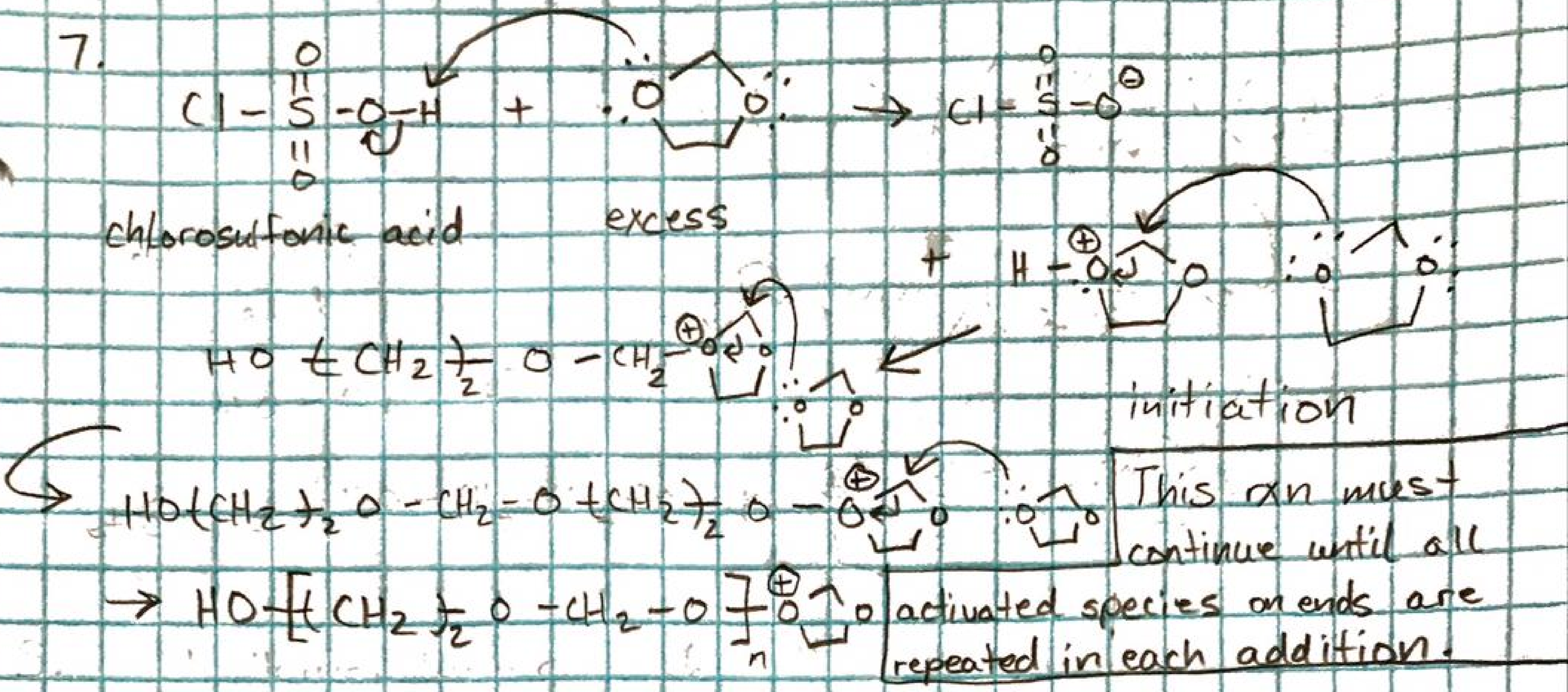
$$n = \frac{8940}{581} \text{ mols PO}$$ ← AHA! This fraction stayed

1 mol DEG = 106 g DEG

$\frac{8940}{581}$ mols PO × 58.1 g/mol = 894 g PO

catalytic amount of KOH

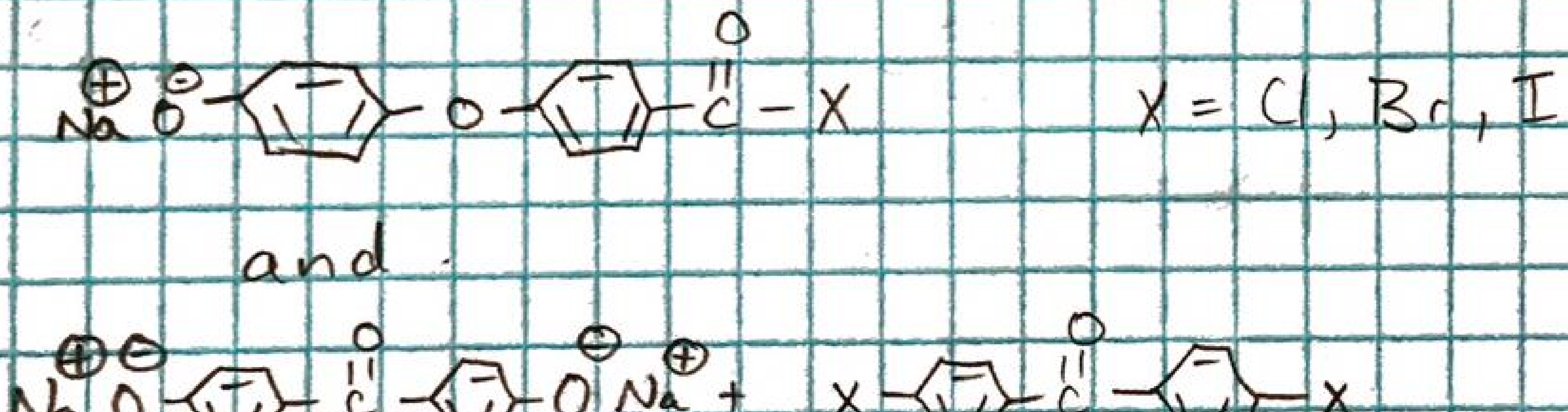
7.



8.

1 Homopolymer
2 Homopolymer
3 Homopolymer
4 Copolymer
5 Homopolymer
6 Homopolymer
7 Copolymer
8 Copolymer
9 Copolymer
10 Homopolymer

9.



Poly ether ketone or 'PEK'