Chemistry 35: Organic Preparations, Autumn Q, 1909, Professor John U. Nef

Notes taken by Parke H. Watkins, S.B., 1910

Add to John U. Nef Papers?
Organic Lectures

P. H. Matthews

Fell 04.
Dec. 18 09.

Lavoisier work formal classification by the dualistic system. All compounds contain oxygen.

H = non metallic elements.

\[ H = \]

\[ r = 0 \] = acids

\[ r > 0 \] = bases.

\[ 0 = \text{Salts} \]

\[ \text{Elect. current} \]

\[ 1824 \quad K_2 \text{SO}_4 \quad \text{K}_2 \text{O} \quad \text{SO}_3 \]

Electro chemical Henry Berchezius to his system as most chebro mag. all elements.


Soder disc. NYC. Russie Acid. 1890. 37.

Gay Lussac analyzed. 1st. He disc. this to be free from oxygen. Replaces H.

\[ \text{HCl} = \text{Cl} \quad \text{HNO}_3 = \text{NO}_3 \quad \text{H}_2 \text{SO}_4 \quad \text{I} \text{KR} \]

Hg[NO] leads into \( \text{KN}_2 \).

Ag[NO] 150 cyanides. CN in cyanogen.
(CN)\textsubscript{2} is similar to the halides in its reactions. Prussic acid is very weak as compared with HCl. Tinitzh and H. Lussac 1816 when he syn. his (CN)\textsubscript{2} radical. Tintig + Thöllner 1832. Better: Edmund Babel, Benzylaldehyde, Br, I, Cu.

\[
\text{HBr} + \text{Cu} \rightarrow \text{Benzyl alcohol}
\]

Neutral to acid properties.

\[
\begin{align*}
\text{C}_7\text{H}_4\text{Cl} & \rightarrow \text{C}_7\text{H}_4\text{O} + \text{HCl} \\
\text{Cu} & \rightarrow \text{CuCl} + \text{H}_2
\end{align*}
\]

At Benzic Acid.


\[
\text{Kd} = 0.5 (\text{H}_2\text{O}) \times \text{As}_2\text{H}_6.
\]

\[
\text{Kd}_2\text{O} + \text{KCl} \rightarrow \text{Kd} \text{O} \text{H} + \text{KCl}
\]

\[
\text{Kd} \text{Cl} \rightarrow \text{Kd} \text{Br} + \text{KAI} + \text{KdCl}
\]

\[
\text{Kd} \text{Cl} + 3 \text{HCl}
\]

Kd\textsubscript{2} is spontaneously combustible to liquid.

\[
\text{Kd}_2 \text{O} \text{H} \rightarrow 150^\circ \text{Bnuss to Kd}_2\text{O}
\]

and its base. Strong elec. positive Kd plays role of elec. positive element in all changes.

Tunnas, happened substitution in metaldos.

\[
\begin{align*}
\text{C}_2\text{N}_2\text{O}_2 & \rightarrow \text{C}_2\text{H}_3\text{O}_2 + \text{H}_2 \\
\text{Cl} & \rightarrow \text{C}_2\text{N}_2\text{Cl}_2\text{O}_2 \rightarrow \text{Monochlor} \\
\text{C}_2\text{H}_3\text{Cl}_2\text{O}_2 \text{N} & \rightarrow \text{Bnuss} \\
\text{C}_2\text{Cl}_3 & \text{O}_2 \text{N} \rightarrow \text{Tnuss}
\end{align*}
\]

Tunnas pass student D. H. Lussac. He has taken over. + + with the element, Cl.
Monday Oct. 11. 04.

Dumas introduced metallic theory.
Berzelius had only 1 kind of P.

H - C - H Replace H with Cl.

C - 0

1848 - 1852 K 0 + NH 3

Ratio was written H O till 5:3.
N 2 + C l 2 → 2 NH C l

2H 2 + O 2 → H 2 O 2.

Gerhard Thirium, French chemist.

Würg Hoffmann (died 1890 age 66.)

R - NH 2
R 2 NH
R 3 NH
R 3 N. N H 3 .
R 4 NH.

Substance smelling like NH 3 but it burned.

Hence not NH 3.

CH 3 NH 2
C 2 H 5 NH 2
C 5 H 11 NH 2

{ Sulphur H 2 are different.
Substances dissolve in K 0 .
\[\text{Strongy base}\]

Kolmann started with NH 3 + R I

R N H 2
R 2 N H 2
R 3 N H 2
R 4 N H 2

Alcohol sets free base.

\[\text{Sulphate}\]

K X Chemistry of NH 3 salt.

Basic type theory.

Water hydrogen or ammonia derivative.

\[\text{H}_2\text{O} + \text{R} 10 \rightarrow \text{R} 10\]

N a 2 + H 1 0

N a 2 + H 1 0

N a 2 + H 1 0
Williamson's work on ETH. 3-5-2
Presented some theory
\[ C_2H_5O\cdot\text{HF} + \text{Na} \rightarrow C_2H_5\cdot\text{OH} + \text{NaF} \]
\[ C_2H_5\cdot\text{OH} + \text{Na} \rightarrow C_2H_5\cdot\text{Na} \text{ TV.} \]
\[ C_2H_5\cdot\text{Na} + \text{CH}_3\cdot\text{OH} \rightarrow C_2H_5\cdot\text{CH}_3 + \text{NaOH} \]
\[ C_2H_5\cdot\text{Na} + \text{H}_2\text{O} \rightarrow C_2H_5\cdot\text{OH} + \text{NaOH} \]
\[ C_2H_5\cdot\text{OH} + \text{Na} \rightarrow C_2H_5\cdot\text{Na} + \text{H}_2\text{O} \]
\[ \text{C}_4\text{H}_9\cdot\text{O} \text{ ester.} \]
\[ \text{C}_4\text{H}_9\cdot\text{OH} \text{ alcohol.} \]
\[ \text{C}_4\text{H}_9\cdot\text{Cl} \text{ chloride.} \]

Tues. Oct 12, 69

\[ \text{(Unknown)} \]
\[ \text{Acetyl} \]
\[ \text{Amyl} \]
\[ \text{Butyl} \]

C\text{H}_4\text{H}_9\cdot\text{O} \text{ esters known} \]
\[ \text{C}_4\text{H}_9\cdot\text{OH} \text{ alcohols unknown.} \]
\[ \text{C}_4\text{H}_9\cdot\text{Cl} \text{ chlorides.} \]

\[ C_3\text{H}_7\cdot\text{C} = \text{C} \text{C}_2\text{H}_5 \text{ ethylene.} \]

\[ C_3\text{H}_7\cdot\text{C} = \text{C} \text{CH}_3 \text{ propylene.} \]

\[ \text{C}_4\text{H}_9\cdot\text{O} \text{ esters known} \]
\[ \text{C}_4\text{H}_9\cdot\text{OH} \text{ alcohols known.} \]

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\[ \text{C}_4\text{H}_9\cdot\text{Cl} \text{ chlorides.} \]
Kekulé was the dominant spirit of organic chem.

I. There are at least three different kinds of atoms: carbon, hydrogen, and nitrogen.
II. Carbon atoms always exist in groups of four, forming a tetrahedron.
III. To be equivalent, the four units of the carbon skeleton must act in the direction of the axes of a tetrahedron.
IV. The valences of carbon atoms are:
   - C always has a valence of 4.
   - H always has a valence of 1.

Exceptions: C=O, C=NH, C=N, C=N

C₂: I₂, C₂: H₂, C₂: Br₂, C₂: I₂, C₂: HCl, C₂: NCl

C = N₂H
C = N₂H₄

C₂H₄

C₂H₅

C₂H₆

C₂H₇

C₂H₈

C₂H₉

C₂H₁₀

C₂H₁₁

C₂H₁₂

C₂H₁₃

C₂H₁₄

C₂H₁₅

C₂H₁₆

C₂H₁₇

C₂H₁₈

C₂H₁₉

C₂H₂₀

C₂H₂₁

C₂H₂₂

C₂H₂₃

C₂H₂₄

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C₂H₈₉

C₂H₉₀

C₂H₉₁

C₂H₉₂

C₂H₉₃

\[ \text{CH}_3 \quad \text{CH}_3 \]

\[ \text{HO} - \quad \text{HO} + \quad \text{OH} \]

\[ \text{COOH} \quad \text{COOH} \]

\[ \text{Lactic acid} \quad \text{Lactic acid} \]

Pasteur established this.

All methods of resolving tartaric acid to lactic + dextrose acid: by this way: Treat + lactic acid with quinol to get the d & l acid. This is due to asymmetric carbon.

By heat $130^\circ$ equilibrium we can get the $\pm$ back again. Agar, twice will do the same thing.

Mixtures of two gives racemic acid.

\[ \text{COOH} \]

Pasteur's life gives this result.

\[ \text{COOH} \quad \text{COOH} \]

\[ \text{Br} + \text{H} \quad \text{H} + \text{Br} \quad \text{COOH} \quad \text{COOH} \]

Racemic

\[ \text{COOH} \]

\[ \text{H} + \text{COOH} \]

\[ \text{H} + \text{COOH} \]

Meso tartaric. (H. T. maner)

\[ + \quad \text{COOH} \quad \text{H} - \quad \text{COOH} \]

\[ \text{H} - \quad \text{COOH} \quad \text{H} + \quad \text{COOH} \]

\[ \text{Ag} \quad \text{H} \]

\[ \text{Br} + \text{H} \]

Valences are different in character.

The OH + H would go to both places OH to + in both cases H to - in both cases.
The above demonstrates once again
of atoms
Organic reactions go on slowly
being difficult among which pass
very rapidly. Hence life is

Monday Oct. 15, 1809.
6th Assumption.
Ring and chain compounds.
6th elements are most stable.
Cur H2 = 2 Saturated. Paraffines are
main essential of our petroleum.
(C6H5)3 = O 
Dissociate + we can
(C6H5) = 7
get test of vat. tints.
CH2 - CH Absorb blue quickly readily,
CH2 - CH # Captures. In H2. Doubly bonded
Cations in the weak joint instead of
being strong.
Anion ethylene. CHe

$\frac{x}{2}$ $\frac{-}{2}$ + $\frac{e}{2}$ $\frac{+}{2}$ $\frac{e}{2}$ $\frac{-}{2}$ Active molt.

C4H4 Acetylene + isomologues.
C4H4 C4 H4 = 1. Triple bond
has loosen effect on H atoms. They dissociate.
The unsaturated carbonic acid is associated with
$\text{C}_6 \text{H}_5 + \text{H}_2$
\[ \text{C}_6 \text{H}_5 \text{H}_2 \]
\[ \text{C}_6 \text{H}_5 \text{NO}_2 \]
\[ \text{C}_6 \text{H}_5 \text{COOH} \]

Ether. Diss. Acetic acid for alcohol.
It is due to the fact that carbon.
\[ \text{C}_6 \text{H}_5 + \text{O} \]
\[ \text{C}_6 \text{H}_5 \text{CH}_3 \]

Paraffins,
Methane hydrocarbons,
Alkane (alkanes) $\text{C}_4 \text{H}_8 - 143^\circ \text{BP}$
Methane $\text{C}_2 \text{H}_6 - 96$
Ethane $\text{C}_3 \text{H}_8 - 45$
Propene $\text{C}_4 \text{H}_10 \text{ran} + 1 \text{d} 0 - 77$
Butane $\text{C}_5 \text{H}_{12}$
Pentane $\text{C}_6 \text{H}_{12}$
Hexane $\text{C}_7 \text{H}_{16}$

$\text{C}_2 \text{H}_5 \text{H}_2 \text{CH}_3$ Methyldiethyl
$\text{CH}_3$ Ethylmethane
$\text{C}_4 \text{H}_{10}$ Propane (Methyl ethyl)
$\text{CH}_3 \text{CH}_2 \text{CH}_3$ Propyl hydrocarbons
$\text{C}_4 \text{H}_{10}$ Isopropyl
$\text{CH}_3 \text{CH}_2 \text{CH}_3$ Methyl ethane
$\text{CH}_3 \text{CH}_2 \text{CH}_3$ Ethyl methane

Chloroform $\text{CH}_3 \text{CH}_2 \text{CH}_2 \text{Cl}$ Normal butane
$\text{C}_4 \text{H}_{10} \text{Cl}$ iso-Butane
$\text{C}_4 \text{H}_{10}$ Triethyl methane

$\text{C}_5 \text{H}_{12} \text{CH}_2 \text{CH}_2 \text{CH}_3$ Pentane, 38
$\text{C}_6 \text{H}_{14} \text{CH}_2 \text{CH}_2 \text{CH}_3$ iso-Heptane, 30
$\text{C}_8 \text{H}_{18}$ Toluene, methyl methane + 9.
Lucy's.

CH₃ CH₂ CH₂ CH₂ CH₃ 19 RP
CH₃ CH₂ CH₂ CH₂ CH₃ 20 62

CH₃ CH₂ CH₂ CH₂ CH₃ 5 8

CH₃ CH₂ CH₂ CH₂ CH₃ 6 4

Slightly saline 11:00. Lighter than 00.
Bed Act 20, 09.

*Note:* Unreadable entries.

<table>
<thead>
<tr>
<th>Reaction</th>
<th>Product 1</th>
<th>Product 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cu₂₅⁺ + X + 2H₂O</td>
<td>Cu₅⁺ + H₂ + X⁺</td>
<td>H₂O</td>
</tr>
<tr>
<td>2. Cu₂⁺ + X + Na₂</td>
<td>Cu₂⁺ + Na₂⁺</td>
<td>X⁻</td>
</tr>
</tbody>
</table>

- **Cu₂⁺**:
  - 20%
  - 40%
  - 20%

- **Cu₅⁺**:
  - 50%
  - 26%
  - 25%

- **X⁻**:
  - 30%
  - 8%
  - 20%

- **H₂O**:
  - 20%
  - 42.2%
  - 42.2%

- **Na₂⁺**:
  - 5%
  - 50%
  - 50%
\[ \text{C}_2 \text{H}_5 \text{I} \cdot \text{Na} \]\n
This process is getting annulated radicle that \( \text{H} \cdot \text{H} \) has 2 H and is root \( \text{H}_2 \text{O} \). Alcohols are most sub. post. Others have interm. Wasser-um-salt. Yield of unk. alkyl to be small. Arg. books should begin with alcohols + alkyl halides.

\[ \text{R}^+ \text{Na} \cdot \text{I} \rightarrow \text{I} \text{Na} \cdot \text{R} \quad \text{o.t.} \]

From this work, both are spontaneously, etc. Must learn from atmosphere. CO.

100°C

1. \( \text{RNa} + \text{I} \cdot \text{Na} \)

2. \( \text{RNa} + \text{H} \cdot \text{R} \)

3. \( \text{RNa} \cdot \text{H} \cdot \text{R} \)

Ethano made this day.
Alkyl halides give mainly atoms H. Alkyl hydrides goes much smoother.

\[ R_I + 2K \rightarrow R^+ + HI \]

\[ R_I + I^- + K^+ \]

[Marked as incorrect]

Alkyl hydride No fission.

\[ CH_3 COOK \]

Electrolysis

Valeric acid KO salt.

\[ CH_3 CH_2 CH_2 CH_2 COO^- + K^+ \]

[Root acetic diethyl butyl]

\[ CH_3 COO^- + K^+ \]

Much else unstable going on than given.

\[ CH_3 CO_2 \]

Can get mixed molecules by electrolysis.
Nov 26, 1909.

R - C - OH. Synthesis there is in 10 - 20.

Even now C aldehydes are accessible to

CH$_3$CH$_2$CHO + CH$_3$CH$_2$OH $\rightarrow$ CH$_3$CH$_2$CH$_2$C=O

Reduced by $\text{HI} \rightarrow$ HI

Have tunic T, at 200 to 200.

P + HI back to HI.

By this process C$_6$H$_6$ $\rightarrow$ C$_6$H$_{12}$

R - C - O $\rightarrow$ R - C = O $\rightarrow$ RCO$_2$ + $\rightarrow$

RCH$_2$OH

RCH$_2$$\bar{F}$

RCOOH $\rightarrow$ H$_2$ + RCH$_3$

9/13, 15, 17, 19. Capturated

Ca$\text{N}_2$$+$1/2 O$_2$ $\rightarrow$ Ca$\text{N}_2$$+$1 H$_2$, when 9 in large

$\text{CH}_3$ONa

4/3 CO$_2$Na

1/0 Na$_2$

Merged fur gas Methane

45.90

N$_2$

C$_2$H$_6$

C$_2$H$_4$

C$_2$H$_2$

Ca$\text{N}_2$$+$1, dies at high T.

By distillation

$\rightarrow$ Ca$\text{N}_2$$+$1 1000 Na$_2$

Let lets Natrium H from Na$\text{O}$$+$1 CH$_3$

CH$_4$ $\rightarrow$ Ca$\text{N}_2$$+$1 1000 $\text{N}_2$$+$1

Burns automatically at 180$^\circ$ + explodes.
C from iron obtained as charcoal + S.

C + H2S → CH4 + C2H6

Run vapors over copper.
C + H2 → CH4

In alcohol + alcohol.
C2H2 + 2H2 → C2H6

Electrons are 3000 °C carbon vapor.

C + CO2 → CaC2

CaC2 + CO2 → CaCO3

N2 + H2 → (N2)2H4

Si increases atomic N. very much.

H2 + N2 → H2N2, *H2N2* made very cheaply.

Almost all nitrogen derivatives may be
changed in this way.

C2H4 + 2H2 + N2 + H2O → C2H2 + N2

Russian first contains cycle.

Phenol in N.

C2H2 + N2 + H2 + H2O

Sulfate + IIIH2S.

C2H2 + H2 + H2O

C + C + N2 → (C2H2)2

Sulfur gives odor to Rock oil.
SR2 H SR minute grains only.

CaH14 + C10 H2n.

Your can thus get all compounds.

[Chemical reactions and notes on materials and temperatures]

[Handwritten notes on temperatures and reactions]

[Notes on distillation and chemical compounds]

[Further handwritten notes and calculations]

[Handwritten note: "Benzine" and "Paraffine"]

[Notes on reactions and properties of substances]

[Handwritten note: "H2 addition increases Bp 20-30°"]

[Notes on distillation and chemical processes]

16 Aug 1859. [Handwritten note]
Russian jet hasn't much 0.8-0.8 fuel. It is richer by 0.3. Calculating cycle, foraffines.

\[ \text{Fe} + \text{Cl}_2 \rightarrow \text{FeCl}_2 \text{ foraffines} \]

Catalysts:

\[ \text{NaCl}_2 + \text{Cl}_2 \rightarrow \text{NaCl}_2 + \text{Cl}_2 \text{ foraffines} \]

\[ \text{F}_2 \text{Cl}_2 \rightarrow \text{FeCl}_2 \]

Foraffines. 2 similar less energetic.

Covers: Cl, C, etc. act slowly on affines.

Fickly burning of C, O, \( \text{C}_x \text{O}_y \).

\[ \text{Cu}_x \text{H}_y \rightarrow \text{Cu}_x + \text{H}_2 \text{O} + 2 \]

\[ \text{(1) Cu}_x + \text{H}_2 \rightarrow \text{Cu}_x \text{H}_2 + \text{H}_2 \]

\[ \text{(2) Cu}_x + \text{H}_2 \rightarrow \text{Cu}_x \text{H}_2 + 2 \text{H}_2 \]

\[ \text{(3) Cu}_x + \text{H}_2 \rightarrow \text{Cu}_x \text{H}_2 \]

\[ \text{NH}_3 + \text{H}_2 \rightarrow \text{N}_2 + 3 \text{H}_2 \]

\[ \text{(1) N}_2 + \text{H}_2 \rightarrow \text{N}_2 + 2 \text{H}_2 \]

\[ \text{(2) C}_x \text{H}_y \rightarrow \text{C}_x \text{H}_y + \text{C}_x \text{H}_y + 2 \text{H}_2 \]

Cracking at Pet. \( \text{Cu}_x \text{H}_2 \) to 1000°C.
Oct. 27, 1909.

C2H4 Thermo is large
C2H4 The products chiefly
C2H6 the fraction tetrachloroethyke
1500

I2 -> 2I
Br2 -> 2Br
Cl2 -> 2Cl
Br2 -> 2Br

Chlorine is greater than
Fl -> active molecular
Cl -> chlorine.

Pic. 1

N+H3 Unsaturated -> e-NH3

Dissociated ammonia. Addition of HCl depends on amount of HCl active NH3.

This other active
7SR2 + 15SR2
Br
Br in dissociated thus two apart.
$\text{H}_2 \text{O} + \text{Br}_2 \rightarrow \text{H}_2 \text{Br} + \text{O}_2$

$\text{H}_2 \text{O} + \text{Cl}_2 \rightarrow \text{HCl} + \text{O}_2$

$\text{H}_2 \text{O} + \text{I}_2 \rightarrow \text{HI} + \text{O}_2$

$\text{F}_2 + \text{I}_2 \rightarrow \text{IF}_4$

The reaction in great
where $\text{x} \cdot \text{Cl}_2$ is less
$\text{x} \cdot \text{Br}_2$ is less still
$\text{x} \cdot \text{I}_2$ is much less.

$\text{SO}_4 \text{H} + \text{H}_2 \rightarrow \text{Ca(NO}_3)_2 + \text{Ca(NO}_3)_2 + 18 = 0$

Acetyl sulfonmide acid
$\text{H}_2 \text{NO}_2 + \text{K}_2 \text{SO}_4 \rightarrow \text{Ca(NO}_3)_2 + 18 = 0$

Water compounds

$\text{H} - \text{C}_6 \text{H}_5 + \text{H}_2 \text{SO}_4$

$\text{C}_6 \text{H}_5 \text{NO}_2 \rightarrow \text{H}_2 \text{SO}_4$

$\text{H}_2 \text{C}_6 \text{H}_5 \text{N}_2 \text{SO}_4 \rightarrow \text{C}_6 \text{H}_5 \text{O}_2 \cdot \text{SO}_4$

Benzyl sulfonmide acid

$\text{C}_6 \text{H}_5 \text{N}_2 = 0$

$\text{C}_6 \text{H}_5 \text{N}_2 \cdot \text{SO}_4 \rightarrow \text{C}_6 \text{H}_5 \text{O}_2 \cdot \text{SO}_4$

Active

$\text{H}_2 \text{SO}_4$

$\text{Ca(NO}_3)_2$

Water molecules

$\text{C}_6 \text{H}_5 \text{N}_2 = 0$

$\text{C}_6 \text{H}_5 \text{O}_2 \cdot \text{SO}_4$

Active and weak.
Monday Oct 1st 1909
Cu H₂N. (a) Cyclamide. (b) Polymethylcenes C₆H₄ CH₃ methyl line C₆H₄
C₄H₂ CH₃ ethyl methyl line C₄H₆
C₆H₆ CH₃ butyl methyl line C₆H₁₂
C₆H₄ CH₃ nhexa methyl line C₆H₁₄
C₆H₄ CH₃ nhexa methyl line C₆H₁₄
C₆H₄ CH₃ nhexa methyl line C₆H₁₄
Trimehtylene absorbs H₂SO₄ + Br₂
C₆H₄ + SO₂Br₂ + H₂O gives normal pyrroles.
(a) Aromatic line
(b) Olefines
(b) Alkyldienes. $R\;CH_2 + R_2 = C$

Mono- & di-sub. prods. of $CH_2$ can as disoc. 7 $CH_2$ methyne.
ethylene. Secondary
$CH_2 = CH_2$, primary
prods. prophydine, alcohol of aldehydes.

$CH_2 = CH_2$ prophydine, secondary.

Halides.

All above are spontaneously. They rearrange
giving olefins.

c) Alkynes. Alkydienes

$CH_2 = CH_2$ alk forming gat is.

$H_2 + H +$ Alcohol. $\rightarrow$ Ethylene

$CH_2 = CH_2$ prophydine.

$CH_2 = CH_2$ butylene.

$CH_2 = CH_2$ isobutylene.

$CH_2 = CH_2$ cis & trans.

Position

\[{}^2CH_2 = CH_2 - CD_3 \]

\[{}^2CH = CH_2 - CD_2 - CH_3 \]

\[{}^2CH = CH_2 - CD_2 - CD_3 \]

$N_2$ sympl.

$N_2$ disoc.

$N_2$ sympl.

$N_2$ disoc.

$\rightarrow$ sympl.

5 Structural. Drawers

6 Cyclo
Tuesday Nov. 2, 1907.

1) CuH₂O + 1X → CuN₂ + 2H₂O
   Al₂O₃ or CaO K₂O

2) CuH₂O + 1OH → CuN₂ + 2H₂O
   P₂O₅
   In Cl₂
   H₂SO₄
   Al₂O₃

These hydrating agents do more than take off water hydrating.
Alkylidine diss.:

R - C₂H₅ + I

R > C - I

R > C - II

R > C - H

C₄H₃ + C₄H₄

C₄H₅ + Br₂ → Liquid boils 80°

Vapor density:
115° 14.2°
120° 10.0°
150° 28.0°
188° 42.2°
200° 60.7°
250° 76.7°
300° 85.5°

C₄H₃ + C₂H₅ + Na₂O

C₂H₅ + C > Na

180° 25° Mersage crystals

BaCl₂ 180°
CH₂CH₂Br₂: Boils 110°C

CH₂Br₂

CH₃CH₂Br: 210°C 31.0% NMR

CH₂I

CH₃I

CH₃CH₂I

The I breaks

CH₃CH₄

CH₃CH₃

CH₃CH₂I

CH₃CH₂Br

CH₃Br

The I breaks

CH₃I

CH₃CH₂I

CH₃CH₂Br

CH₂Br₂

CH₃Br

NMR does huge with 99

reg. get 99

If it cann't form new sharing of carbon atoms then we have definite
adiene.

CH₃CH₂CH₂CH₃

CH₃CH₂CH₂CH₂CH₃

CH₃CH₂CH₂CH₂CH₃

CH₃CH₂CH₂CH₂CH₃

CH₃CH₂CH₂CH₂CH₃

CH₃CH₂CH₂CH₃

CH₃CH₂CH₂CH₂

CH₃CH₂CH₂

CH₃CH₂

CH₃

To get same and

CH₃CH₂CH₂CH₂CH₃
does same here

CH₃CH₂CH₂CH₂CH₃
to go up to 100°C

NMR does get same and does

Flame off another 100°C.
<table>
<thead>
<tr>
<th>CH₂CH₂Br</th>
<th>CH₃CO₂H</th>
<th>HBr</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>15%</td>
<td>90%</td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td>85%</td>
<td></td>
</tr>
</tbody>
</table>

CH₂CH₂Cl

<table>
<thead>
<tr>
<th>CH₂CH₂Cl</th>
<th>CH₃CO₂H</th>
<th>HBr</th>
</tr>
</thead>
<tbody>
<tr>
<td>12%</td>
<td>88%</td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td>80%</td>
<td></td>
</tr>
</tbody>
</table>

CH₂Cl₂

<table>
<thead>
<tr>
<th>CH₂Cl₂</th>
<th>CH₃CO₂H</th>
<th>HBr</th>
</tr>
</thead>
<tbody>
<tr>
<td>58%</td>
<td>52%</td>
<td></td>
</tr>
<tr>
<td>59%</td>
<td>51%</td>
<td></td>
</tr>
<tr>
<td>95%</td>
<td></td>
<td>5%</td>
</tr>
</tbody>
</table>

CH₂CO₂H

<table>
<thead>
<tr>
<th>CH₂CO₂H</th>
<th>CH₃CO₂H</th>
<th>HBr</th>
</tr>
</thead>
<tbody>
<tr>
<td>60%</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>75%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>90%</td>
<td></td>
<td>10%</td>
</tr>
</tbody>
</table>

CH₂⁻CH₂

<table>
<thead>
<tr>
<th>CH₂⁻CH₂</th>
<th>CH₃CO₂H</th>
<th>HBr</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

CH₂⁻CH₂

<table>
<thead>
<tr>
<th>CH₂⁻CH₂</th>
<th>CH₃CO₂H</th>
<th>HBr</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

Rearrangement must take place in alkylhides.
Wednesday Nov. 8, 1901.

Alcohols are dyes in same manner as H2O.

\[
-\text{O} \quad \text{P-ON} \\
\text{HO-S} = \text{O}
\]

\[
\text{O}_{2} \text{P-O-} \quad \text{in H}_{n+1} \quad \text{can be oxidized}
\]

Primary alkyl sulfates.

\[
\text{ROSO}_3 \text{ON},
\]

Benzyl alcohol.

\[
\text{CH}_3 \text{C} = \text{CH}_2 \text{O} \text{SO}_2 \text{ON}.
\]

Polyurethane at 70°.

Tert. alcoh., don't form alkyl cation.

\[
\text{CH}_3 \text{C} - \text{O} \text{SO}_2 \text{ON}.
\]

\[
\text{Alkyl} \quad \text{alkyl} \quad \text{alkyl}
\]

Phosphorus tetraphosphates of terephthalic alcohols cannot be isolated.
\[
\ce{\text{HNO}_2 + \text{H}_2\text{SO}_4} \rightarrow \ce{\text{NO}_2^+ + \text{H}_2\text{O}}
\]

Reactions not higher than 200°C. Heating not advisable.

\[
\ce{\text{Cu} + \frac{1}{2}\text{H}_2\text{SO}_4} \rightarrow \ce{\text{CuSO}_4 + \text{H}_2}
\]

Start: combustion

\[
\ce{\text{CH}_3 - \text{CH}_2 - \text{OPO}_4^2-} \rightarrow \text{catalyst, pyrolysis}
\]

Ideal method for making derivatives of phenylacetic acid (Polymers)

Heat high catalysis, but by using strong base in combustion tube. You can get all alcohols to 20°C.

\[
\begin{align*}
\ce{\text{CH}_3 - \text{CH}_2 - \text{OH} + \text{H}_2\text{SO}_4} & \rightarrow \ce{\text{CH}_3 - \text{CH}_2 - \text{OSO}_3^+} + \text{H}_2\text{O} \\
\ce{\text{CH}_3 - \text{CH}_2 - \text{OH} + \frac{1}{2}\text{O}_2} & \rightarrow \ce{\text{CH}_3 - \text{CH}_2 - \text{O} - \text{O}}
\end{align*}
\]

Hydrolysis has tendency to react with alcohol.

80% reaction gives ethyl chloride oxide.

20% ethylene monoxide.

\[
\ce{\text{CH}_3\text{CH}_2\text{OH} + \text{H}_2\text{SO}_4} \rightarrow \ce{\text{CH}_3\text{CH}_2\text{OSO}_3H + \text{H}_2\text{O}}
\]
Tuesday Nov. 9, 1909

Annalen 172 and 318: allyl halides and reactions of olefins.

\[ \text{Rearranges} \]

\[ \text{active bis-methylenes} \]

Absorbs very rapidly.

Heat increases fast mole.

\[ \text{CH}_2 \text{CH}_3 \text{CH}_2 \rightarrow \text{CH}_3 \text{CH} \rightarrow \text{CH}_3 \]
Magne increases det ace mols

CH₃

CH₄

CH₂

CH

CH₃

\[ \text{Equilibrium} \]

CH₂⁺CH₃

CH₂⁺H⁺

\[ \text{Most at he HCl place} \]

CH₃CH₄

CH₂

CH₃

CH₃CH₃

CH₃CH₄
Wednesday, Nov 10, 1907

Cyclohexane  B.P.  73 "
Propylene  Boiling point goes up or another
is introduced.
150  2  can be separated by
130  3  different reagents.

Unsaturated compounds boiling point in 5th
place will decant.

Fischer chain depresses boiling pt.
Unsaturated compounds. Cleavage
CH2-CH...
Addition prod.

CH2=CHCl on electrolysis CH2Cl2 and chloride

\[ CH_2=CHCl \text{ electrolysis} \]

\[ CH_2=CHCl \rightarrow CH_2=CHCl \text{ or CH2Cl2} \]

Things that can be taken up by
unsaturated compounds.
Olefins absorbs

1. \( X = \text{Cl}_2 \text{Br}_2 I_2 \)
2. \( \text{H}_2 \text{SO}_4 \)
3. \( \text{HX} \), \( \text{Cl}_2 \text{Br}_2 I_2 \) end absorption
4. \( \text{H} \)
5. \( 0 \text{ or (HOC)} \)
6. \( \text{H}^+ \)

\( \text{CH}_2 = \text{Cl} \)
\( \text{CH}_2 = \text{Cl} \)

Olefins does not react \( \text{H}_2 \text{O} \) apart. Then \( \text{H}_2 \text{O} \) must be dissolved to be absorbed.

\( \text{A}_7 \)
\( \text{C}_9 \text{H}_8 \)

\( \text{CH}_3 - \text{CH}_2 \text{Cl} \)

Phenyl chloride: \( \text{Cl} \)

Reactions: \( \text{Br} \text{Br} \), \( \text{H}_2 \text{O} \)

\( \text{CH}_3 \text{Cl} + \text{H} \rightarrow \text{C}_2 \text{H}_5 \text{Cl} \)

Acetyl chloride addition

\( \text{CH}_3 \text{Cl} \text{H} \rightarrow \text{CH}_3 \text{Cl} \)

Diazo: \( \text{H}_2 \text{N} \text{N}_2 \)

Ethylen halide in \( \text{C}_2 \text{H}_6 \)

Ethylen formation

Volatile products

\( \text{H} \rightarrow \text{H} \)
\( \text{FeCl}_3 \rightarrow \text{Cl}_2 \text{Br}_2 I_2 \)

Fuming \( \text{H}_2 \text{SO}_4 \) by chlorination. Parsons paper

\( \text{CH}_3 \text{Cl} \rightarrow 0 \text{SO}_2 \text{H}_2 \), exposure by furnace or

Heat evolution in absence of air, greatest

\( \text{CH}_3 \text{Cl} \text{H}_2 \text{O} \)

Determination of reaction:

Active mol \( \text{Cl}_2 \) is taken up and then the molecules fall apart afterwards.

With halogen acids the order is different.

\( \text{H} + \text{H} \rightarrow \text{H}_2 \)
\( 250\)°

This is complete at

\( \text{H} \rightarrow \text{H} \)
\( \text{Br} \rightarrow \text{Br} \) 150°

Temperatures given

\( \text{H} + \text{H} \)

\( \text{N}_2 \)

\( \text{CH}_4 \rightarrow \text{H}_2 \text{O} \)

Small yellow precipitate.
Case of addition

C H₃  C H₃
C H₂
C H₂

Dust absorb. absorbs readily

Volume too small

% active and must be above a certain

A Ha
C H₃  C H₃
C H₂
C H₂

Chloride

C H₂  C H₂
C H₂  C H₂

Chloride

C H₁  C H₁
C H₂  C H₂
C H₂  C H₂

Chloride

C H₂  C H₂
C H₂  C H₂
C H₂  C H₂

Chloride

Chlorides toward affinity alkaline.

C H₂  C H₂
C H₂  C H₂

Oxalic Acid.

Monday, Nov. 18, 1907.

Lucifer + Hz Cu Hz + 2.

Use P² 4. Methanol (n)

Fermentation.

C H₂  C H₂
C H₂  C H₂
C H₂  C H₂

C H₂  C H₂
C H₂  C H₂
C H₂  C H₂

C H₂  C H₂
C H₂  C H₂
C H₂  C H₂

C H₂  C H₂
C H₂  C H₂
C H₂  C H₂

C H₂  C H₂
C H₂  C H₂
C H₂  C H₂

C H₂  C H₂
C H₂  C H₂
C H₂  C H₂

Oxalic Acid.
Polymerization.

\[
\text{H}_2\text{SO}_4 \quad \text{H}_3\text{PO}_4
\]

Enzyme \( \text{CH}_3 - \text{C} = \text{CH} - \text{C} = \text{CH} - \text{C} = \text{CH} - \text{C} = \text{CH} - \text{CH}_3 \)

\[
\text{CH} = \text{CH} \quad \text{Acetylene}
\]

\[
\text{R} \quad \text{RC} = \text{C} \quad \text{RC} \quad \text{Acetylene}
\]

\[
\text{RC} = \text{R} \quad \text{RC}
\]

\[
\text{H}_2\text{O}
\]

Sulfuric acid adds and then drops off again, and the fines are scattered by the other molecule.

\[
\text{Na}_2 \quad \text{Acetate}
\]

\[
\text{Na} + \text{Ac} \quad \text{Heat}
\]

\[
\text{Na} + \text{CN} \quad \text{It exist above 450°C}
\]

\[
\text{CaCO}_3 + \text{C} \quad \text{At 300°C these salts form}
\]

\[
\text{CaCl}_2 + \text{Na}_2 \quad \text{C} = \text{C} + \text{H} \rightarrow \text{Na}_2 \ \text{C} = \text{C} + \text{H}
\]

Tuesday, Feb. 6, 1908.

\[
\text{C}_4\text{H}_4\text{O}_2 + 2 \text{H}_2 \quad \text{Double bond}
\]

\[
\text{C}_4\text{H}_4 + \text{O} 
\]

\[
\text{C}_4\text{H}_4\text{O}_2 \quad \text{Propylene}
\]

\[
\text{C}_4\text{H}_4\text{O}_2 \quad \text{Acetylene}
\]

\[
\text{RC} = \text{R} \quad \text{RC}
\]
Acetylene has been difused but is monof
forbidden.

Fe: Ni: Co
Difused and
This explodes when X is taken away.
This explodes downward. Shock again.

Cr + X + C2 gives while Cr2C2 applied.

Cr + Br2 + C6H6 -> C6H5Br + 5X + Br2.

Brown ninyhydrin.

Proceed in stages.

Oxid:

Acetylene

Poisonous:

Cl2 + CHBr + CBr3

R + O = + POCl3 + CCl + POCl3

React with Al.
Wednesday Nov 22 1909.

Methyl acetylene

CH \(_3\) \(\equiv\) C

Methyl ethyl

Both without any apparent to C10. There may be
15 mm. or so.

Triple bond increase of refractive power.

\(\text{N} - \text{C} \equiv \text{C} \text{R}\)

\(\text{N} - \text{C} \equiv \text{C} \text{R}\) Vansw acid

\(\text{H} - \text{C} \equiv \text{C} \text{N}\). Tit. . .

\(\text{R} \rightarrow \text{C} \rightarrow \text{H} \equiv \text{R}\)

\(\text{C} \rightarrow \text{H} \equiv \text{C} \text{R}\)

\(\text{H} - \text{C} \equiv \text{C}\). Act.

\(\text{H} - \text{C} \equiv \text{C}\) act with less

\(\text{H} - \text{C} \equiv \text{C}\) in quantity.

\(\text{H} - \text{C} \equiv \text{C}\) in distillation.

\(\text{H} - \text{C} \equiv \text{C}\) with \(\text{Cl}\).

\(\text{H} - \text{C} \equiv \text{C}\) with \(\text{Cl}\).

\(\text{H} - \text{C} \equiv \text{C}\) mean get a diethyl.
Acetals from succinic acid.

- COOH - C\_4
- COOH - C\_4

Diss acetals to diacetyl succinic acid.

HOO - C
COOH - C\_4

N\_2 C\_8

Crystalline HN\_2 C\_8

KCOOC = C\_4

K\_2 COOC = C\_4

Highly explosive.

H\_2 C\_8

Explosive

Carbonic acid vinylidene

Must saturate this

Linear compounds stable.

Bonds:

Polymerization: high temperature.

Electrical discharge:

- COOH - C\_4
- COOH - C\_4

Polymer only (Le COOH) is too active. H\_2 COOH peeled off by water polymer.

On contact with sunlight.
Continue to get the polymers.

\[\text{Actinic HBr is } 50\%
\text{ (6S026H)}\text{ gives some result,}
\text{(CS026H)}\]