1) Kinetic
2) Atoms & atomic structures
3) periodic table
4) Seperation methods
5) Bonding
6) Acid, base, salt, oxide
7) Identification
8) moles
9) reactivity

10th grade
→ First sem
1) redox
2) electrolysis
3) rate of reaction
4) energetic
5) reversible rxn
6) Industrial chemistry
7) air of water
8 organic chemistry

Q3) the sum of all oxide state in a compound = 0

$NaCl$) $+1+x=0$

$x=-1$

$HClO_2$) $+1+x+2(-2)=0$

$1+x-4=0$

$x=+3$

NO) $N+(-2)=0$

$N=+2$

NO_3^{-1}) $N+3(-2)=-1$

$N-6=-1$

$N=+5$

MnO_4^{-1}) $\underset{+8}{Mn-8}=\underset{+8}{-1}$

$Mn=+7$

$Cr_2O_7^{2-}$) $2Cr-14=-2$

$2Cr=+12$

$Cr=+6$

Rules for oxidation ~~state~~ state

1) the oxidation state for any free element = zero

monoatomic
Na, K, Li
Ne, Ca, Cu

diatomic
H_2, O_2, N_2
F_2, Cl_2, Br_2,
I_2

polyatomic
P_4
S_8

2) the oxide number of any atom in a compound from.

group 1 = +1
group 2 = +2
group 3 = +3
group VII = -1

3) the oxidation number of hydrogen (+1)
except with metal in metal hydride (-1)

4) the oxidation state of oxygen (-2)
except in peroxide (-1)
except in OF_2 (2+)

Redox

	Reduction	Oxidation
In term oxygen 1) oxygen	lose O_2	gain O_2
Hydlogen	gain H_2	lose H_2
Oxidation number	~~gain~~ Lose number	gain number ✓
election	gain e^-	- lose e^-

Q:- Fe^{2+} is a reducing agent

Fe^{3+} is an oxidising agent

record the observation in each of the following reaction

	Fe^{2+}	Fe^{+3}
①	$KMno_4$	$KMno_4$
	chang color from purple to colorless	stays purple

(Oxidising agent) "Oxidant"
the substance that it self reduced and causes the other substance to be oxidised.

(reducing agent) "reductant"
the substance that it self oxidised and causes the other substance to be reduced

$\overset{2+}{C}\overset{-2}{O} + \overset{2+}{Zn}\overset{2-}{O} \longrightarrow \overset{0}{Zn} + \overset{+4}{C}O_2^{-2}$

Oxidation: C^{2+}
reduction: Zn^{2+}

oxidising agent: ZnO
reducing agent: CO

- oxygen always reducing agent
- Mn always reducing agent

→ most common ~~reducing~~ Oxidising agent

most common reducting agent
① Hydrogen
② carbon and carbon monoxide
③ Iodide $2I^- \longrightarrow I_2 + 2e^-$
colorless → red brown
④

reducing agnt also:
acidified potassium manganate

Halogens

- writing balanced half ionic equations:

we look at:

1) Atoms

2) the charge by adding e^-'s to the side with greater charge

$\overset{0}{Na} + \overset{+}{H}\overset{-1}{Cl} \rightarrow \overset{+1}{Na}\overset{-1}{Cl} + \overset{0}{H_2}$

H.O.O). $Na \rightarrow Na^{+1} + 1e^-$

H.O.R). $2\overset{+}{H} + 2e^- \rightarrow H_2$

over all rxn: $2Na + 2H^+ \rightarrow 2Na^{+1} + H_2$

concentrated sodium chloride called brine solution

Nacl

Na^+ Cl^-

H^+ OH^-

cathod Anod

$2H^+ + 2e^- \rightarrow H_2$

$2Cl^- \rightarrow Cl_2 + 2e^-$

electrolyte NaOH

Electrolysis

Electricity
Analysis
(breaking down)

$CuCl_2$

Cu^{+2} cathod
Cl^{-1} anod

$2e^- + Cu^{+2} \rightarrow Cu$

$2Cl^- \rightarrow Cl_2 + 2e^-$

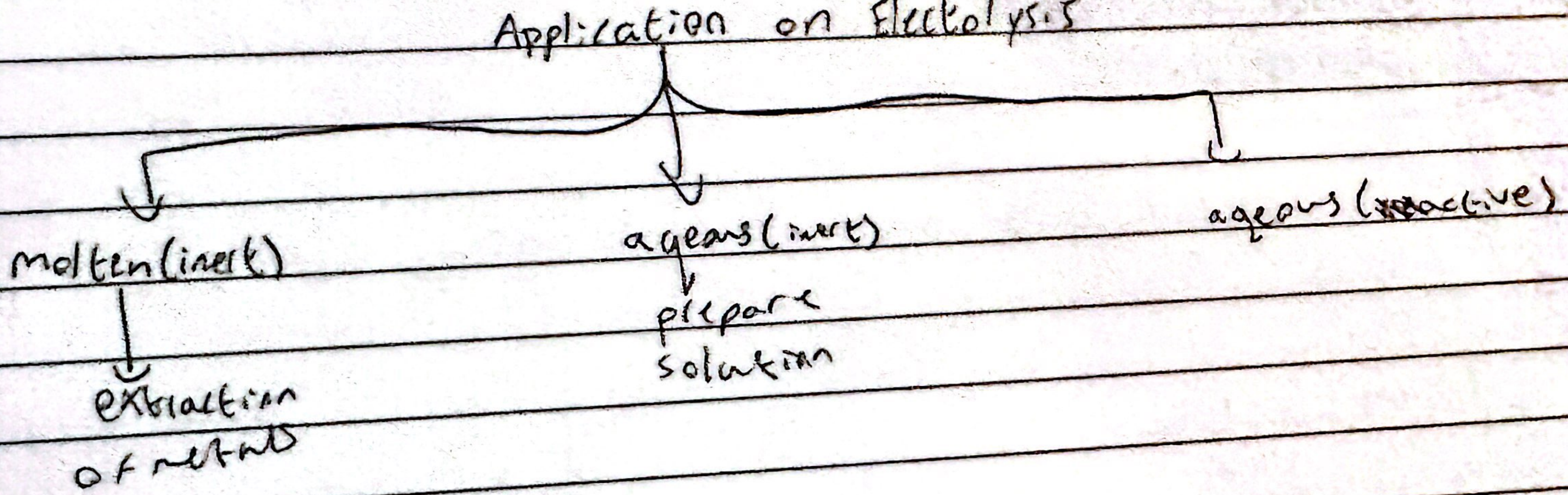
Aqeous

H^+
N

- concentrated NaCl / graphite

Na^+
H^+
cathod

Cl^-
OH^-
anod


Application on Electolysis
molten(inert)
extraction of metals
ageans(inert)
prepare solution
ageous (reactive)

conc. $KI_{(aq)}$ / graphite

K^+ $\boxed{I^-}$

$\boxed{H^+}$ OH^-

cathod Anode

H_2 I_2

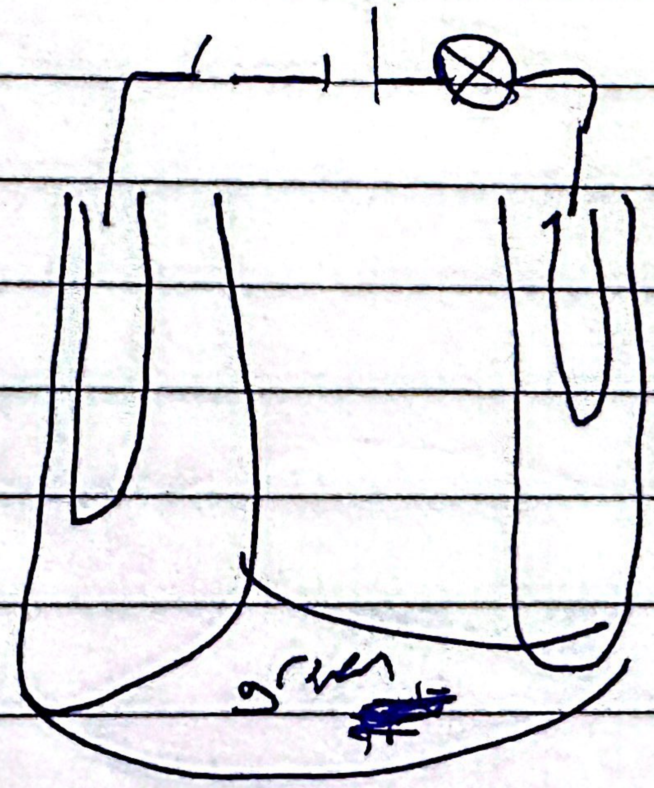
* * *

$CuSO_4$

$\boxed{Cu^{+2}}$ SO_4^{-2}

H^+ $\boxed{OH^-}$

Q3 Brine with universal indicator



Extraction of Aluminium

Ore :- Al_2O_3 Bauxite

method :- Electolysis for molten Al_2O_3 / graphite

* m.p of Al_2O_3 is about 2000°C

So we dissolve Al_2O_3 in a molten cryolite Na_3AlF_6

- to lower the m.p to 900°C So less cost
- to increase the electrical conductivity

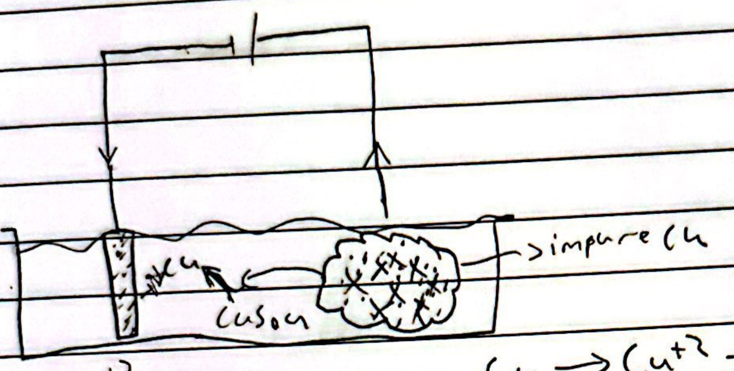
Al_2O_3

Al^{3+} Cathode O^{2-} Anode

$Al^{3+} + 3e^- \rightarrow Al$ $2O^{2-} \rightarrow O_2 + 4e^-$

Property	use
- low density	- Aircraft bodies
- ductile	- electrical wires
- malleable	- window Frame
- conduct electricity	- cooking utensils
- form an oxide layer which is non-toxic	- wires

② purifying Metals / Refing copper



$Cu^{+2} + 2\bar{e} \rightarrow Cu$

$Cu \rightarrow Cu^{+2} + 2\bar{e}$

extraction of metals from ores

★ the method of extraction depends on the position of metal in reactivity series.

K
Na
Li] Electrolysis / molten / graphite
Ca
Mg
Bauxite Al_2O_3 ← Al
C, Co
Zinc Blende ZnS ← Zn] reduction by C, Co
Hematite Fe_2O_3 ← Fe
Pb
H
Copper(II) sulphate CuS ← Cu] reduced by H_2
Ag
Au

Electro plating

coating a metal with another metal using electrolysis

Why?

1) to prevent rusting
2) make attractive

How to electroplate a metal spoon with silver?

Factors effect the position of equilibrium

① Temp

② pressure

↑ ... endo & exo

↑ temp shift to endo

↓ temp shift to exo

① Temperature

↑ temp ↑↑ rate of endothermic
↑ rate of exothermic

shifts to endo

↓ temp ↓↓ rate of endothermic
↓ rate of exothermic

shift to exo

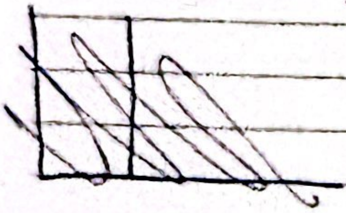
mixture of NO_2 and N_2O_4 at equal in a sealed tube

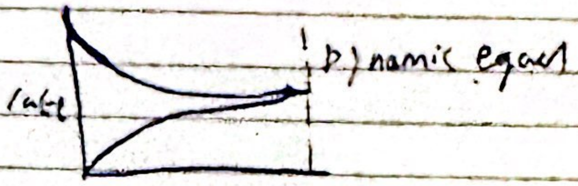
$$2NO_2(g) \rightleftharpoons N_2O_4(g)$$

dark brown — pale brown

if we put this sealed in a cold water bath the mixture becomes paler why?

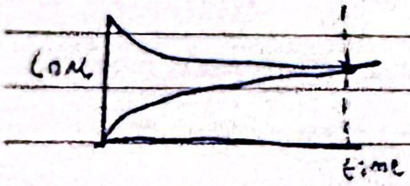
because the forward reaction is exothermic enhanced of cooling in terms of rate

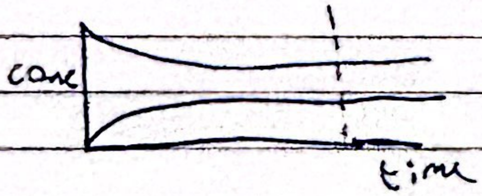


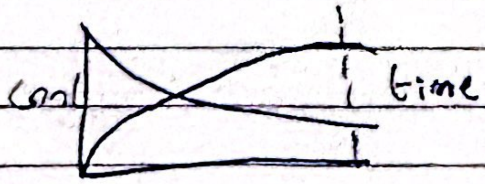


the rate of forward ↓
less reactants so
less particles so
less effective collisions per unit
the rate of backward ↑
more products
so more particles
so more effective collisions per unit time

in terms of concentration





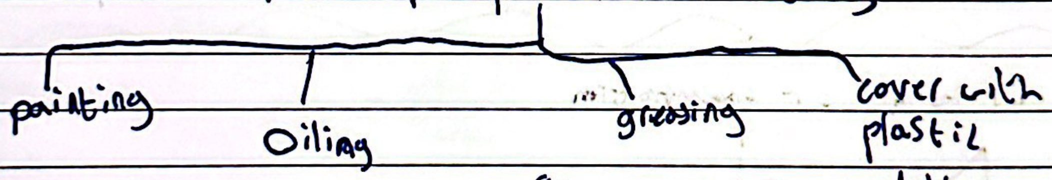


* plan an exp "to show which rust prevention solution is better.

- take a known mass of Iron nail ~~[illegible]~~ apply a known volume of the first solution.
- put them in a known volume of water for a week
- dry them them and measure the mass gain repeat the exp with 2nd solution.

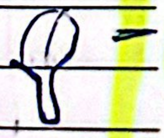
*Conclusion :- the exp which cause more mass increase in mass = worse solution.

How to prevent rusting



"to prevent O_2 and H_2O from reaching iron."

- Galvanizing
- sacrificial
- cathod protection
- electroplating



Q :- Reversible reaction below at equilibrium

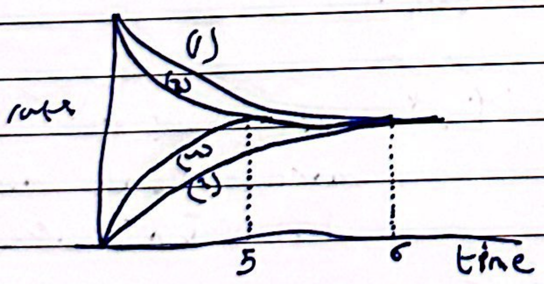
$Cr_2O_7^{-2} + Fe^{+2} + H^+ \rightleftharpoons Cr^{+3} + Fe^{+3} + H_2O$

orange   green

explain why adding HCl to rxn mixture the color of the mixture becomes green

HCl is an acid. (proton ~~acceptor~~ donor)
more H^+
shift forward
more Cr^{+3} more green
less $Cr_2O_7^{+2}$ less orange

A catalyst
has no ~~forward~~ effect on the position of equilibrium since it speed up the rate of ~~reaction~~ then forward and backward



1) rate of ~~rxn~~ forward rxn without catalyst
2) " " backward " " "
3) rate " forward " with "
4) " " backward " " "
5) time taken to reach equili. with catalyst
6) " " " " " without "

③ concentration

↑R } Shift
↓P } forward

↓R } shift
↑P } backward

$A + B \rightleftharpoons C + D$

↑ [A] shift forward ↓B ↑C ↑D
↓ [B] shift backward ↑A ↓C ↓D
↑ [C] shift backward ↑A ↑B ↓D
↑ [D] shift backward ↑A ↑B ↓C

Indicator (mythyl orange)

$HIn \rightleftharpoons H^+_{(aq)} + In^-_{(aq)}$
color 1 (red) — color 2 (yellow)

add HCl : proton donor ↑H^+. shift backward
more HIn more color 1
less In^-. less color 2

add NaOH : proton accepter ↓H^+. shift forward
more In^- more color 2
less HIn less color 1

~~② pressure~~

② pressure

As pressure increases

the equilibrmm shift to side with less pressure

with less gas mole

As the pressure decrease

$$\overset{4\text{ mole}}{3H_{2(g)} + N_{2}(g)} \rightleftharpoons \overbrace{2NH_{3}(g)}^{2\text{ mole}}$$

①

↑ temp shift to endo

↓ temp shift to ex

↑ temp rate ↑

↓ temp rate ↓

②

pressure

↑ pressure shift to less gas mole

↓ ~~less pressure~~ shift to more gas mole

↑ pressure ↑ rate of less gas mole

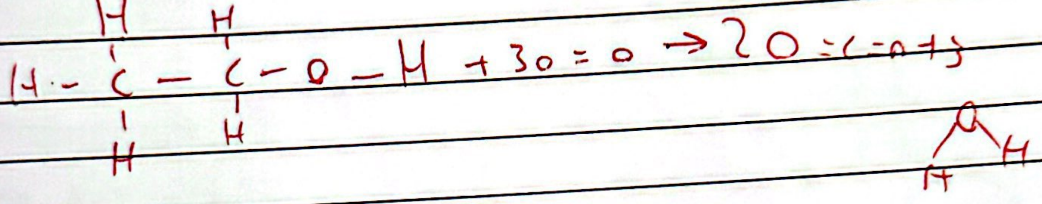
↑ rate of more gas mole

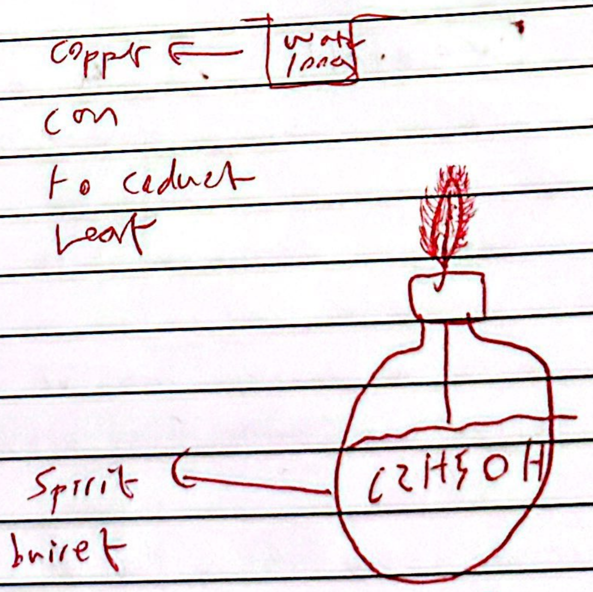
↓ pressure ↓ rate of less gas mole

↓ rate of more gas mole

finding ΔH (energy change) practically

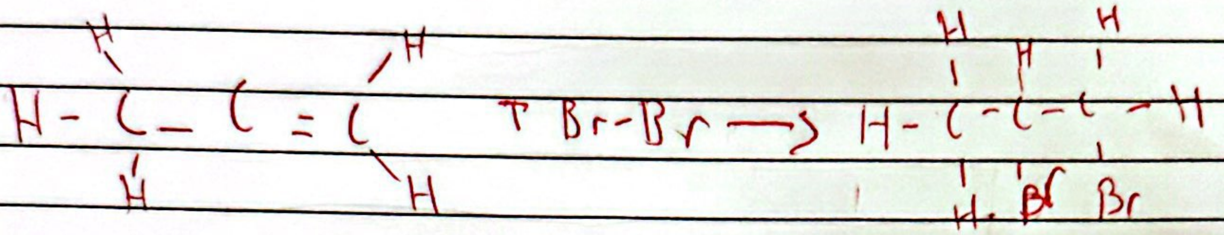
finding ΔH combustion.





$m1 = 200g$

$m2 = 198g$



bond broken

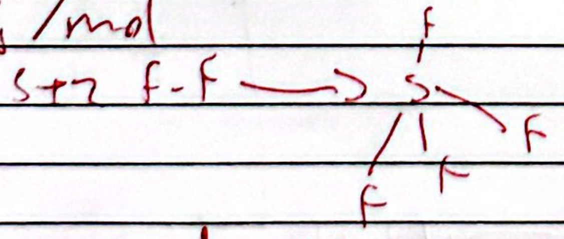
Br-Br · 193
c=C 614
807 kj

bond build
2xC -Br
C-C

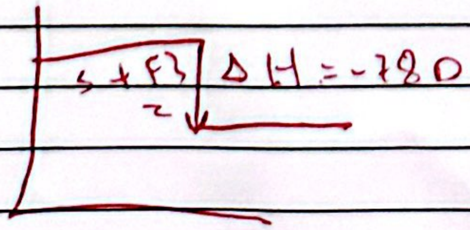
2×276
348
900 kj

ΔH = 807 - 900 = -93 kj/mol

When Sulfur react with Florine the reaction give
780 kj/mol



if the bond energy of F-F is 160 kj/mol
1) draw an energy level diagram
2) find the bond energy of S-F ?



ΔH = input - input
-780 = (2×160) - 4 S-F
-1100 = -4 S-F
S-F = 275
kj/mol

Bond	Bond Kj/mol energy
C-H	413
C-O	358
O=O	495
C=O	799
O-H	463

Bond broken

3xC-H

1xC-O

1xO-H

1.5xO=O

bond build

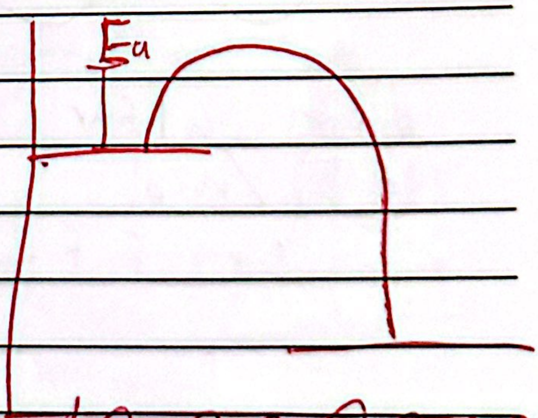
2xC=O

4xO-H

2x799 +

4x463

3450 Kj

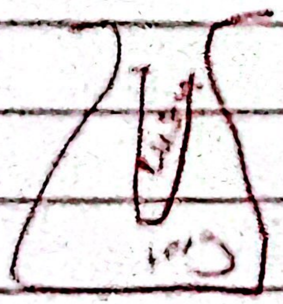


2.

m

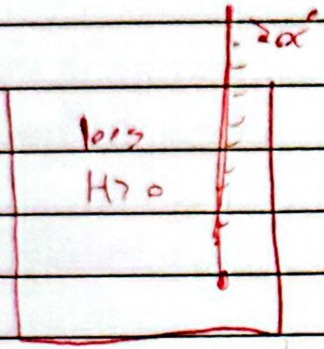
measuring ΔH displacement

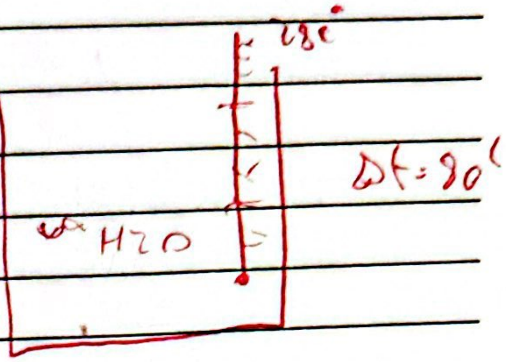
$Zn_{(s)} + CuSO_{4(aq)} \rightarrow ZnSO_{4(aq)} + Cu_{(s)}$

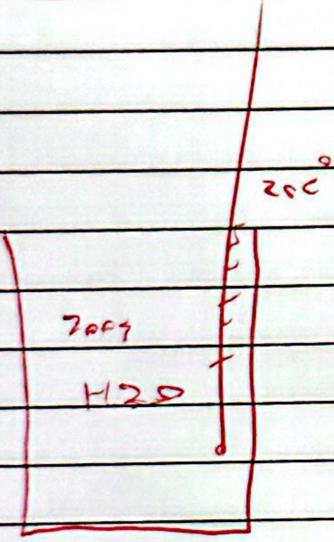


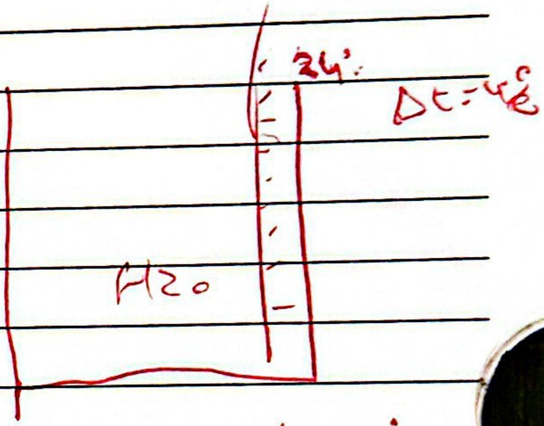
$T_1 = 29°C$

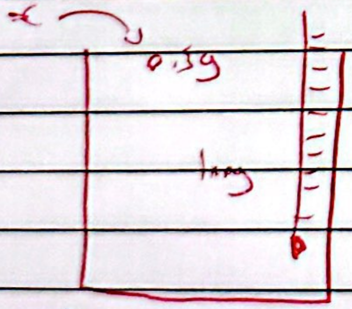
stir with thermometer

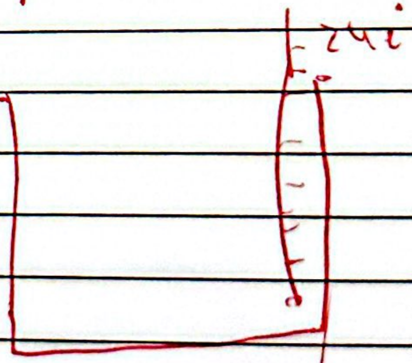

20°
100g
H2O

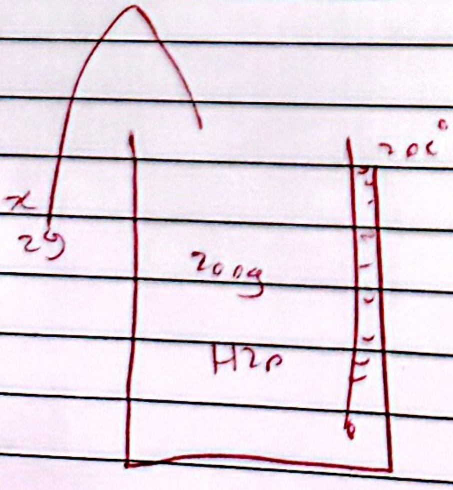

28°
H2O
Δt=8°

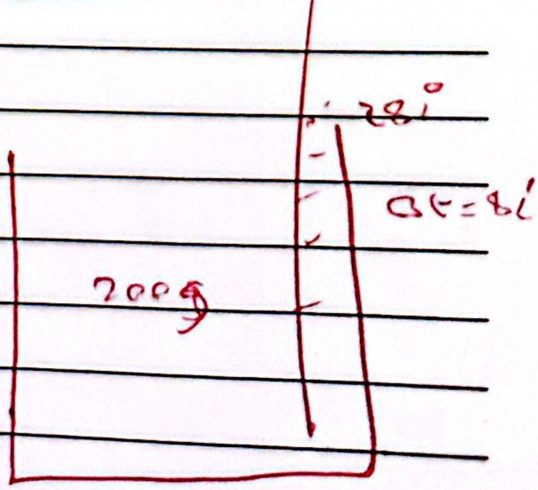

20°C
200g
H2O


24°
Δt=4°
H2O


x
0.5g
100g

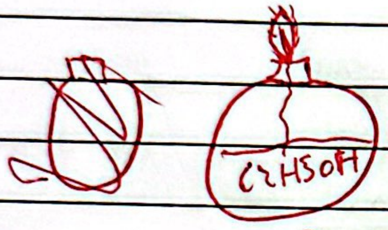

24°


x
2g
20°C
200g
H2O


28°
Δt=8°
200g

measuring ΔH combustion for ethanol

$C_2H_5OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{(l)}$



m1 = 200g
m2 = 198g

$Q = mc\Delta t$

energy transfer = 100 × 4.2 × 10
= 4200 ≈ 4.2 kJ

$4.2\ kJ \xrightarrow[\text{from}]{\text{produced}} 2g\ C_2H_5OH$

$96.6\ \frac{kJ}{mole} \longleftarrow$ 1 mole = 46 g C_2H_5OH

ΔH = 96.6 kJ/mole

Two fuels A and B
plan an exp to show which on produce more energy?

take a known mass of water with a known initial temp in a copper jar
take a known mass of fuel A.
ignite the ~~flame~~ fuel and record final mass and final temp of water
- repeat exp using fuel B
- the fuel which cause more temp rise per gram of fuel produce energy

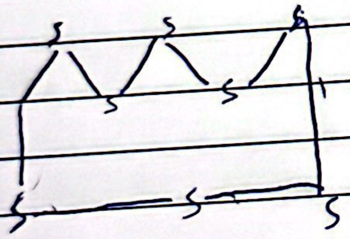
(Industry of H_2SO_4) contact process

$S \xrightarrow[+O_2]{(1)} SO_2 \underset{O_2}{\overset{(2)}{\rightleftharpoons}} SO_3 \xrightarrow{(3)} \underset{\text{oleum}}{H_2S_2O_7} \xrightarrow{(4)} H_2SO_4$

(Roasting) (contacting process)

- group (VI)
- valency (2)
- yellow solid
- S_8

SO_2 cause acid rain



$SO_3 \xrightarrow{H_2O} 2H_2SO_4$

- Highly exothermic
- produce low yeild of H_2SO_4

H_2SO_4

$H_2S_2O_7$

H_2O

uses: * medicine
* match
* rubber

ore: * Zinc blend ZnS
* from fossile fuel

Industrial

Industry of Ammonia "haber process"

$$\overset{4}{3H_2 + N_2} \rightleftharpoons \overset{2}{2NH_3} \qquad \Delta H = -ve$$

How to obtain

① Nitrogen :- fractional distillation of liquid air
⇓ different B.P ↓ cooling under pressure

② Hydrogen
① cracking of ~~alkenes~~ alkanes (organic
② $CH_4 + H_2O \longrightarrow CO + 2H_2$

essential conditions
1) temp 400-500°

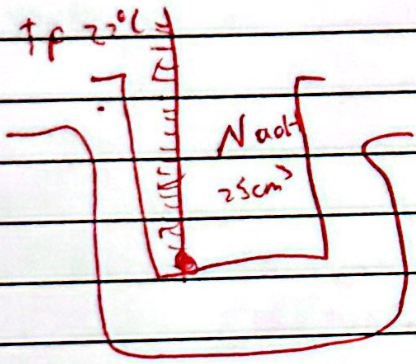
2) pressure 200 Atm

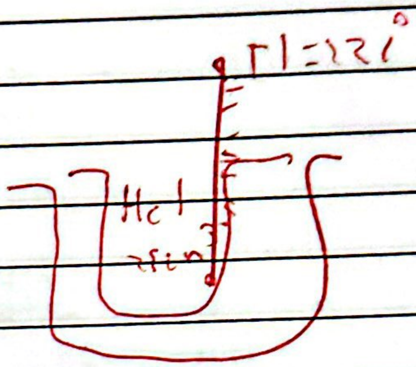
3) Fe catalyst

uses of ammonia
1- fertilizers
2- cleaning detergents
3- smelling salts

measuring ~~[illegible]~~ ΔH neutralization

$NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H2O_{(l)}$





$Q = mc\Delta t$

Q = 6)

Electrolysis for ageous electrolyte using Active rod

* the rod must be the same metal ion in the electrolyte

$CuSO_{4(aq)} \xrightarrow{using} Cu$ rod

$AgNO_{3(aq)} \xrightarrow{using} Ag$ rod

Electrolysis for ageous $CuSO_4$ using Cu rod

$CuSO_4$ (aq)

Cu^{+2} SO_4^{2-}
H^+ OH^- } the Anod itself oxidise
Cathod Anode

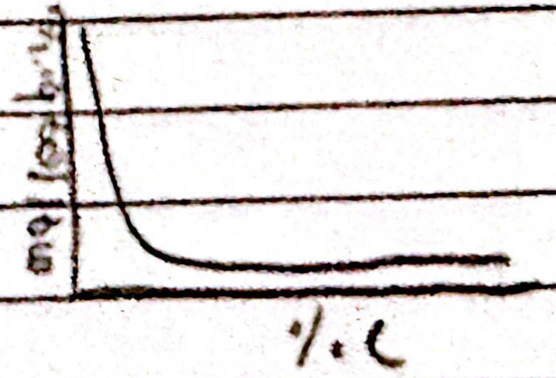
$Cu^{2+} + 2\dot{e} \rightarrow Cu$

$Cu^{2+} + 2\dot{e}$

Scanned with CamScanner

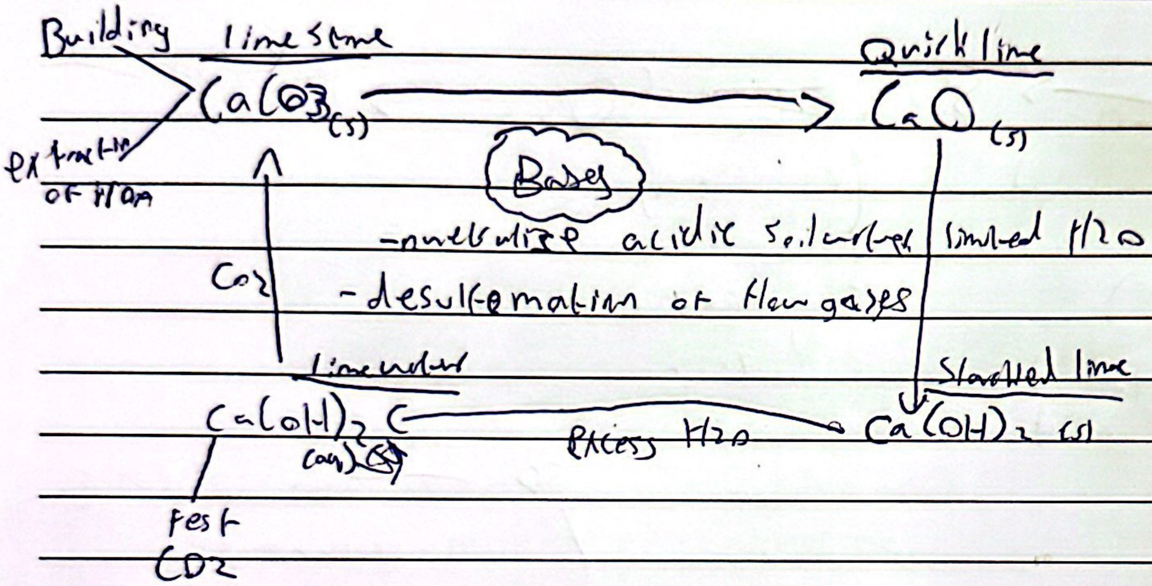
Steel making "oxygen base process.

cast iron



steel

Carbonate cycle.



-neutralize acidic soil water
-desulfomation of flew gases

extraction of Iron