GCSE CHEMISTRY PAPER 2

RATES

"HOW QUICKLY A REACTION HAPPENS".

ANY RATE = SOMETHING / AMOUNT
TIME

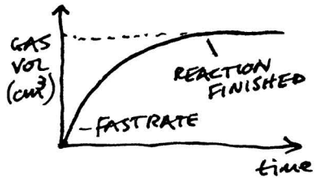
COLLECT IN SYRINGE → GAS / COLOUR CHANGE

*FACTORS THAT INCREASE RATE OF REACTION:

- SURFACE AREA → IF GROUND UP, MORE PARTICLES EXPOSED TO OTHER REACTANT: MORE FREQUENT COLLISIONS.
- CONCENTRATION/PRESSURE → MORE FREQ COLLISIONS.
- TEMPERATURE → PARTICLES MOVE FASTER: MORE FREQ COLLISIONS AND HIGHER CHANCE OF THEM BEING SUCCESSFUL.
- CATALYST → 'MIDDLE MAN' FOR REACTANTS, NOT USED UP. LOWERS ACTIVATION ENERGY, SO COLLISIONS MORE LIKELY TO BE SUCCESSFUL

*PRAC: SODIUM THIOSULPHATE + HCl
MAKE DIFF CONCENTRATIONS OF HCl e.g. GIVEN 0·2 mol/dm³: MAKE SOLUTIONS, DILUTE WITH DISTILLED H_2O e.g. 0·04 mol/dm³ = 20% HCl 80% H_2O.
TIME HOW LONG IT TAKES FOR CROSS TO DISAPPEAR (TURBIDITY = CLOUDY)

GRAPH



*REVERSIBLE REACTION. IN CLOSED SYSTEM, WILL REACH EQUILIBRIUM: RATE OF FORWARD = RATE OF BACKWARD REACTIONS.
- LE CHATELIER'S PRINCIPLE: "IF A DYNAMIC EQM IS DISTURBED BY CHANGING CONDITIONS, THE REACTION MOVES TO COUNTERACT THE CHANGE" i.e. IT WILL ALWAYS REACH EQM (OR TRY)
- ADD REACTANTS? EQM SHIFTS TO RIGHT, GET USED QUICKER, MORE PRODUCTS MADE (OR... REMOVE PRODUCTS!)
- PRESSURE: EQM SHIFTS TO SIDE WITH FEWEST MOLECULES.

*HABER PROCESS: MAKES AMMONIA FOR e.g. FERTILISER.

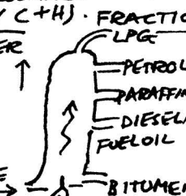
$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

- HIGH PRESSURE = HIGH YIELD + FAST RATE, BUT EXPENSIVE. COMPROMISE: 200 atm.
- LOW TEMP = HIGH YIELD, BUT SLOW RATE. COMPROMISE: 450°C.
- IRON CATALYST HELPS.

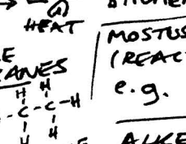
ORGANIC

- CARBON-BASED MOLECULES.
- e.g. HYDROCARBONS (ONLY C+H).

FRACTIONAL DISTILLATION



EVAPORATED, RISE, RECONDENSE AT DIFF HEIGHTS, TAPPED OFF. TOP = SHORTEST

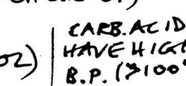


(TRIPLE)

*ALKENE + H_2 → ALKANE

*ALKENE + HALOGEN →

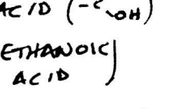
*ALKENE + H_2O → ALCOHOL (-OH GROUP)

e.g. 

CARB. ACIDS HAVE HIGH B.P. (>100°C), AND ARE WEAK ACIDS.

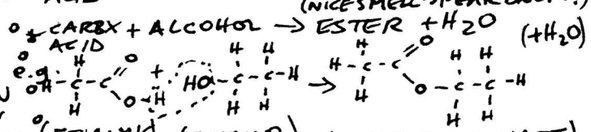
*ALCOHOL + Na → SODIUM ETHOXIDE + H_2

*ALCOHOL → CARBOXLYIC ACID (-COOH)
OXIDISING AGENT

e.g. 

*CARBX ACID + CARBONATE → SALT + H_2O

*CARBX ACID + ALCOHOL → ESTER + H_2O (NICE SMELL → PEAR DROPS!) (+H_2O)

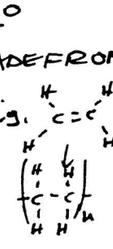
e.g. 

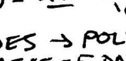
*CARBX ACID + METAL → SALT + H_2

" HYDROXIDE → " + H_2O

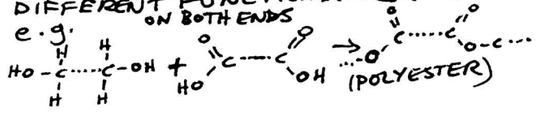
POLYMERS

- BIG MOLECULES MADE FROM SMALLER ONES (MONOMERS).

*ADDITION POLYMERISATION: e.g. 

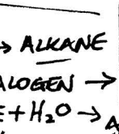
- AMINO ACIDS JOIN TO MAKE PEPTIDE, POLYPEPTIDES (MAKE UP PROTEINS).
- HAVE  ON EITHER END.
- NUCLEOTIDES → POLYNUCLEOTIDES, THIS IS BASIS OF DNA.
- CARBOHYDRATES ANOTHER POLYMER.

*CONDENSATION POLYMERISATION:
- JOINING OF MOLECULES WITH DIFFERENT FUNCTIONAL GROUPS ON BOTH ENDS

e.g. 

CO_2 MADE IF LOTS OF O_2 → COMPLETE COMB.
IF NOT, CO (CARBON MONOXIDE) OR JUST C (SOOT) MADE. CO DEADLY → BINDS TO RED BLOOD CELLS, STOPS O_2 BINDING.

MOST USED AS FUEL: COMBUSTION (REACT W/ O_2 = BURN!)
e.g. $CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$ (ALWAYS)

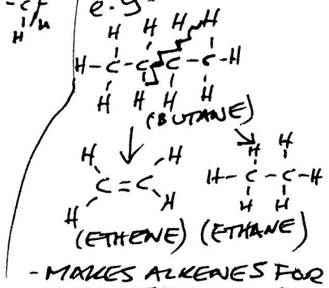
ALKENES (HAVE DOUBLE BOND)
e.g. 

UNSATURATED. ATOMS CAN BOND TO MAKE SOMETHING - "ALKANE"

e.g. BROMINE → (NOW SATURATED)
THIS IS TEST FOR ALKENE
WILL TURN BROMINE WATER ORANGE → COLOURLESS.

CRACKING

CATALYST +550°C: ALKANE → SHORTER ALKANE + ALKENE

e.g. 

- MAKES ALKENES FOR POLYMERISATION.
- MEETS BIGGER DEMAND FOR SHORTER ALKANES

CHEMICAL ANALYSIS

*FORMULATION: MIXTURE MADE FOR SPECIFIC PURPOSE e.g. FUELS, INKS etc.

*CAN IDENTIFY COMPOUNDS/ELEMENTS USING:
- CHROMATOGRAPHY (PAPER 1)
- GAS TESTS:
  - H_2 POPS WITH LIT SPLINT
  - O_2 RELIGHTS GLOWING SPLINT
  - CO_2 TURNS LIMEWATER CLOUDY
  - Cl_2 TURNS DAMP BLUE LITMUS PAPER WHITE.

(TRIPLE)

*FLAME TESTS (METAL IONS):
- Ba: PALE GREEN
- Ca: ORANGE/RED
- Cu: GREEN/BLUE
- Li: CRIMSON RED
- Na: ORANGE
- K: LILAC

*PRECIPITATES: ADD EXCESS NaOH AND A SOLID, INSOLUBLE PRECIPITATE WILL BE FORMED. (METAL IONS)
- Al^{3+}: WHITE
- Mg^{2+}: "
- Ca^{2+}: "
- Fe^{2+}: GREEN
- Fe^{3+}: BROWN

*NON-METAL IONS:
- CO_3^{2-}: ADD ACID → CO_2 BUBBLES MADE
- Cl^-, Br^-, I^-: ADD NITRIC ACID, THEN SILVER NITRATE ($AgNO_3$)
  - WHITE PRECIPITATE
  - CREAM "
  - YELLOW "

*INSTRUMENTAL METHODS: CAN USE MORE ACCURATE MEANS TO IDENTIFY ATOMS/IONS USING INSTRUMENTS e.g.
- SPECTROSCOPY: MEASURE WHAT WAVELENGTHS OF LIGHT/IR ARE ABSORBED BY COMPOUND.
- FLAME EMISSION SPECTROSCOPY: COMPOUND BURNED → PARTICLES IN FLAME EXCITED BY EM RADIATION → THEY THEN EMIT EM, WAVELENGTHS ARE ANALYSED.

ATMOSPHERIC + RESOURCES

- WE NEED RESOURCES FOR: WARMTH, SHELTER, FOOD/WATER, TRANSPORT.
- FINITE RESOURCES (NON-RENEWABLE) e.g. CANNOT BE REPLACED ONCE USED (FOSSIL FUELS)
- RENEWABLES CAN (WIND, SUNLIGHT, TREES...?)

- POTABLE WATER: CAN BE DRUNK SAFELY.
- DESALINATION: REMOVAL OF SALT (SEA).
- DISTILLATION: EVAPORATE, RECONDENSE FOR PURE WATER (EXPENSIVE!)

*TREATMENT: FILTRATION TO REMOVE BIG INSOLUBLES (e.g. SAND PARTICLES).
→ STERILISATION: TO KILL MICROBES (CHLORINE/UV).

*LCA: LIFE CYCLE ASSESSMENT: IDENTIFIES IMPACT OF PRODUCT.
RAW MATERIALS → MANUFACTURE → DISTRIBUTION → USE → DISPOSAL

*LIMIT ECOLOGICAL IMPACT BY: REDUCE, REUSE, RECYCLE
- CONSERVES RESOURCE
- REDUCES ENERGY REQUIRED.
- LESS WASTE IN LANDFILL

(TRIPLE) *ALLOY: MIXTURE OF METALS (CAN BE CARBON → STEEL (IRON + C))
- GOLD (JEWELLERY): Au, Ag, Cu, Zn
- BRONZE: Cu + Sn (TIN).

*CORROSION: REACTION W/ O_2/H_2O.
- RUST → IRON OXIDE.

*MOST GLASS = SODA LIME GLASS

*CERAMICS: BRITTLE. INSULATORS.

POLYETHENE
*HDPE/LDPE: HIGH/LOW DENSITY
e.g. BOTTLES, BAGS

*THERMOSETTING: HARDENS WHEN HEATED → CROSSLINKS (PERMANENT)
- THERMOPLASTIC: SOFTENS WHEN HEATED.

*COMPOSITES: NON-METAL 'ALLOYS' e.g. FIBREGLASS.

*EXTRACT METALS FROM ORE: REDUCTION REACTIONS/ELECTROLYSIS.
- CAN USE DISP. REACTIONS TO GET FROM SCRAP.
- BIOLEACHING: BACTERIA PRODUCE LEACHATES, CONTAIN METAL COMPOUNDS.
- PHYTOMINING: PLANTS ABSORB METALS: HARVEST, BURN → ASH.

*ATMOSPHERE: EARLY: H_2 + He ESCAPED (?)
VOLCANOES → H_2O, CO_2, NH_3, CH_4.
- PLANTS: $CO_2 \rightarrow O_2$
- SEA: CO_2 ABSORBED
- LOCKED IN CARBONATES.

*NOW: N_2: 78%, O_2: 21%, CO_2: 0·04%, Ar: ~1%

*GREENHOUSE EFFECT:

- SHORT WAVELENGTHS (λ) GO THROUGH GREENHOUSE GASES.
- REFLECTED AS LONGER λ, ABSORBED BY GASES, WARMS PLANET.

- CARBON FOOTPRINT: NET CO_2 EMITTED. 'OFFSET' BY TREES etc.

Video