INKCHEMISTRY FLASHCARDS

Alkanes and halogenoalkanes

Unit C17 · 41 cards · fronts and backs

Print double-sided, flipping on the long edge, and each answer lands behind its question. Cut along the card borders.

Definitions to learn and misconceptions to correct. These cards, and a check-yourself question for every lesson, run on the website with spaced-repetition scheduling, at inklearning.co.uk/chemistry/flashcards.

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DEFINITION

Define: Hydrocarbon.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Define: Saturated.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Define: Homologous series.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Define: Fraction.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Define: Fractional distillation.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Define: Cracking.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Define: Complete combustion.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Define: Incomplete combustion.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

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DEFINITION

Containing only single bonds between carbon atoms, so that no more atoms can be added to the molecule.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

A compound that contains hydrogen and carbon atoms only.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

A mixture of hydrocarbons with similar chain lengths, and so with boiling points in a narrow range.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

A family of compounds with the same functional group and general formula, in which each member differs from the next by CH_2.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

The breaking of C–C bonds in long-chain alkanes to form shorter alkanes and alkenes.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Separation of a mixture into fractions by boiling point, in a column with a temperature gradient that is hottest at the bottom.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Burning in a limited supply of oxygen, giving carbon monoxide or carbon as well as, or instead of, carbon dioxide.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Burning in a plentiful supply of oxygen, in which the carbon in a fuel is oxidised to carbon dioxide and the hydrogen to water.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

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DEFINITION

Define: Greenhouse gas.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Define: Reforming.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Define: Photochemical smog.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

SPOT THE ERROR

Say what is wrong with this claim:

Longer alkanes boil at higher temperatures because there are more covalent bonds to break.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

Define: Radical.

FREE-RADICAL SUBSTITUTION

DEFINITION

Define: Homolytic fission.

FREE-RADICAL SUBSTITUTION

DEFINITION

Define: Free-radical substitution.

FREE-RADICAL SUBSTITUTION

DEFINITION

Define: Fishhook arrow.

FREE-RADICAL SUBSTITUTION

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DEFINITION

The conversion of straight-chain alkanes into branched alkanes and cyclic hydrocarbons, over a platinum catalyst, to give fuels that burn more efficiently.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

A gas whose molecules absorb infrared radiation emitted by the Earth's surface and re-emit it, warming the lower atmosphere.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

SPOT THE ERROR

Boiling breaks no covalent bonds; the molecules leave the liquid whole. A longer alkane has more electrons and more surface contact, so the induced dipole–dipole forces between its molecules are stronger and more energy is needed to separate them. Branching lowers the boiling point by reducing contact.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

A haze formed when nitrogen oxides and unburnt hydrocarbons react in sunlight, containing ground-level ozone and PAN.

ALKANES: FRACTIONAL DISTILLATION, CRACKING AND COMBUSTION

DEFINITION

The breaking of a covalent bond in which each atom takes one electron from the bonding pair, forming two radicals.

FREE-RADICAL SUBSTITUTION

DEFINITION

A species with an unpaired electron.

FREE-RADICAL SUBSTITUTION

DEFINITION

A curly arrow with half a head, showing the movement of a single electron.

FREE-RADICAL SUBSTITUTION

DEFINITION

A reaction in which an atom in a molecule is replaced by another, by way of a chain of steps involving radicals.

FREE-RADICAL SUBSTITUTION

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DEFINITION

Define: Chain reaction.

FREE-RADICAL SUBSTITUTION

DEFINITION

Define: Initiation.

FREE-RADICAL SUBSTITUTION

DEFINITION

Define: Propagation.

FREE-RADICAL SUBSTITUTION

DEFINITION

Define: Termination.

FREE-RADICAL SUBSTITUTION

SPOT THE ERROR

Say what is wrong with this claim:

The ultraviolet light breaks the C–H bonds in methane, and the chlorine then joins on where the hydrogen was.

FREE-RADICAL SUBSTITUTION

DEFINITION

Define: Halogenoalkane.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

Define: Heterolytic fission.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

Define: Nucleophile.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

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DEFINITION

The step in which radicals are first formed, here by homolytic fission of Cl_2 in ultraviolet light.

FREE-RADICAL SUBSTITUTION

DEFINITION

A reaction in which each propagation step regenerates a radical, so that one initiation step leads to many cycles of reaction before termination.

FREE-RADICAL SUBSTITUTION

DEFINITION

A step in which two radicals combine to form a molecule, removing both radicals from the chain.

FREE-RADICAL SUBSTITUTION

DEFINITION

A step in which a radical reacts with a molecule to give a product and another radical, so the number of radicals is unchanged.

FREE-RADICAL SUBSTITUTION

DEFINITION

A compound in which one or more hydrogen atoms of an alkane have been replaced by halogen atoms.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

SPOT THE ERROR

Ultraviolet light breaks the Cl–Cl bond, which is weaker, not the C–H bond. Homolysis gives two chlorine radicals, and it is a chlorine radical that takes a hydrogen from methane, making HCl and a methyl radical. The methyl radical then attacks a Cl_2 molecule to give chloromethane and a new chlorine radical, so the chain continues.

FREE-RADICAL SUBSTITUTION

DEFINITION

An electron pair donor: a species with a lone pair of electrons that attacks an electron-deficient atom to form a new covalent bond.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

The breaking of a covalent bond in which one atom takes both electrons of the bonding pair, forming two ions.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

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DEFINITION

Define: Nucleophilic substitution.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

Define: Primary halogenoalkane.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

Define: Hydrolysis.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

Define: Nitrile.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

Define: Amine.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

Define: SN2.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

Define: SN1.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

SPOT THE ERROR

Say what is wrong with this claim:

The C–F bond is the most polar, so fluoroalkanes react with nucleophiles fastest.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

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DEFINITION

A halogenoalkane in which the carbon bonded to the halogen is bonded to only one other carbon atom.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

A reaction in which a nucleophile attacks an electron-deficient carbon and replaces an atom or group attached to it.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

A compound containing the C≡N group, named from the whole carbon chain including the carbon of the C≡N.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

The splitting of a bond in a molecule by reaction with water or hydroxide ions.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

Nucleophilic substitution in one step, with two species, the halogenoalkane and the nucleophile, in the rate-determining step.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

A compound in which one or more hydrogen atoms of ammonia have been replaced by alkyl groups.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

SPOT THE ERROR

The rate is set by the bond that has to break, not by the size of the δ+. C–F is the strongest carbon–halogen bond, 467 kJ mol^{-1}, and C–I the weakest, 228 kJ mol^{-1}, so iodoalkanes hydrolyse fastest and fluoroalkanes hardly at all. Silver nitrate gives a yellow precipitate from an iodoalkane in seconds and nothing from a fluoroalkane.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

DEFINITION

Nucleophilic substitution in two steps, in which the C–X bond breaks to form a carbocation in the rate-determining step, with one species in that step.

HALOGENOALKANES: NUCLEOPHILIC SUBSTITUTION AND RATES OF HYDROLYSIS

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DEFINITION

Define: Elimination.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

Define: Base.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

Define: Position isomers.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

Define: E/Z isomers.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

Define: Ozone layer.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

Define: CFC.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

Define: HFC.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

Define: Catalyst.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

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DEFINITION

A proton acceptor: a species that accepts an H^+ ion using a lone pair.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

A reaction in which a small molecule is removed from a larger one, leaving a double bond.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

Stereoisomers that exist because rotation about a C=C bond is restricted and each carbon of the double bond carries two different groups.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

Structural isomers with the same carbon skeleton and the same functional group at a different position on the chain.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

A chlorofluorocarbon: a halogenoalkane containing only carbon, chlorine and fluorine.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

The region of the stratosphere where ozone is concentrated, which absorbs most of the ultraviolet radiation from the Sun.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

A substance that increases the rate of a reaction without being used up, by providing an alternative route with a lower activation energy.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

DEFINITION

A hydrofluorocarbon: a compound of hydrogen, fluorine and carbon with no chlorine, used to replace CFCs.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

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SPOT THE ERROR

Say what is wrong with this claim:

Potassium hydroxide turns a halogenoalkane into an alcohol, whatever it is dissolved in.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

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SPOT THE ERROR

The solvent chooses the reaction. In water, warmed, the hydroxide ion acts as a nucleophile and substitution gives the alcohol. In ethanol, heated under reflux, it acts as a base, takes a hydrogen from the carbon next to the C–halogen carbon, and elimination gives an alkene. Tertiary halogenoalkanes eliminate most readily.

ELIMINATION FROM HALOGENOALKANES, AND CFCS AND THE OZONE LAYER

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