INKCHEMISTRY FLASHCARDS

Carbonyls and carboxylic acids

Unit C20 · 49 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: Chiral centre.

OPTICAL ISOMERISM

DEFINITION

Define: Enantiomers.

OPTICAL ISOMERISM

DEFINITION

Define: Optical isomerism.

OPTICAL ISOMERISM

DEFINITION

Define: Stereoisomers.

OPTICAL ISOMERISM

DEFINITION

Define: Plane-polarised light.

OPTICAL ISOMERISM

DEFINITION

Define: Optically active.

OPTICAL ISOMERISM

DEFINITION

Define: Racemic mixture.

OPTICAL ISOMERISM

DEFINITION

Define: Chiral.

OPTICAL ISOMERISM

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DEFINITION

Stereoisomers that are non-superimposable mirror images of each other.

OPTICAL ISOMERISM

DEFINITION

A carbon atom bonded to four different atoms or groups of atoms.

OPTICAL ISOMERISM

DEFINITION

Molecules with the same structural formula but a different arrangement of atoms in space.

OPTICAL ISOMERISM

DEFINITION

Stereoisomerism that occurs when a molecule contains a chiral centre, giving two enantiomers.

OPTICAL ISOMERISM

DEFINITION

Able to rotate the plane of plane-polarised light; the two enantiomers rotate it by equal amounts in opposite directions.

OPTICAL ISOMERISM

DEFINITION

Light in which the vibrations occur in one plane only.

OPTICAL ISOMERISM

DEFINITION

Describes a molecule that cannot be superimposed on its mirror image, usually because it contains a chiral centre.

OPTICAL ISOMERISM

DEFINITION

A mixture containing equal amounts of two enantiomers, which is optically inactive because their rotations cancel.

OPTICAL ISOMERISM

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DEFINITION

Define: Inversion of configuration.

OPTICAL ISOMERISM

SPOT THE ERROR

Say what is wrong with this claim:

Two molecules with the same bonds in the same order are the same molecule, so a mirror image is just the original turned round.

OPTICAL ISOMERISM

DEFINITION

Define: Nucleophile.

ALDEHYDES AND KETONES

DEFINITION

Define: Nucleophilic addition.

ALDEHYDES AND KETONES

DEFINITION

Define: Tollens' reagent.

ALDEHYDES AND KETONES

DEFINITION

Define: Fehling's solution.

ALDEHYDES AND KETONES

DEFINITION

Define: Hydroxynitrile.

ALDEHYDES AND KETONES

DEFINITION

Define: Hydride ion.

ALDEHYDES AND KETONES

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SPOT THE ERROR

A carbon with four different groups has two arrangements that cannot be turned into each other, as a left hand cannot be turned into a right. The mirror image has the same bonds in the same order and is a different compound: it rotates plane-polarised light the opposite way.

OPTICAL ISOMERISM

DEFINITION

The reversal of the arrangement of groups around a chiral centre when a nucleophile attacks from the side opposite the leaving group, as in an SN2 reaction.

OPTICAL ISOMERISM

DEFINITION

A reaction in which a nucleophile attacks the δ+ carbon of a C=O bond and two molecules join to give one product.

ALDEHYDES AND KETONES

DEFINITION

An electron pair donor: a species with a lone pair that it uses to form a new covalent bond.

ALDEHYDES AND KETONES

DEFINITION

An alkaline solution of copper(II) ions that gives a brick-red precipitate of Cu_2O when warmed with an aldehyde but not with a ketone.

ALDEHYDES AND KETONES

DEFINITION

A solution of diamminesilver(I) ions, $[Ag(NH_3)_2]^+$, which is reduced to a silver mirror when warmed with an aldehyde but not with a ketone.

ALDEHYDES AND KETONES

DEFINITION

H^-, a hydrogen atom with an extra electron, which acts as a nucleophile through its lone pair; $NaBH_4$ is its source.

ALDEHYDES AND KETONES

DEFINITION

A compound containing a hydroxyl group and a nitrile group, formed by nucleophilic addition of HCN to an aldehyde or ketone.

ALDEHYDES AND KETONES

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DEFINITION

Define: 2,4-Dinitrophenylhydrazine.

ALDEHYDES AND KETONES

DEFINITION

Define: Derivative.

ALDEHYDES AND KETONES

DEFINITION

Define: Triiodomethane test.

ALDEHYDES AND KETONES

SPOT THE ERROR

Say what is wrong with this claim:

Hydride from $NaBH_4$ is just a hydrogen atom, so reduction is adding H_2 across the double bond as with an alkene.

ALDEHYDES AND KETONES

DEFINITION

Define: Weak acid.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

Define: Carboxylate ion.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

Define: Esterification.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

Define: Condensation reaction.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

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DEFINITION

A solid made from an unknown compound by a reaction of its functional group, whose melting point is compared with data to identify the compound.

ALDEHYDES AND KETONES

DEFINITION

A reagent that gives a yellow or orange precipitate with any aldehyde or ketone; the melting point of the purified precipitate identifies the compound.

ALDEHYDES AND KETONES

SPOT THE ERROR

A hydride ion is H^-, a hydrogen with two electrons, and it is a nucleophile. It attacks the δ+ carbon of the C=O, which the electron-rich C=C of an alkene would never accept, and pushes the π pair onto the oxygen; a proton from water then completes the alcohol. The mechanism is nucleophilic addition, and it does not touch a C=C at all.

ALDEHYDES AND KETONES

DEFINITION

Warming with iodine and aqueous alkali; a pale yellow precipitate of CHI_3 shows a CH_3CO- group, or a $CH_3CH(OH)-$ group that is oxidised to one.

ALDEHYDES AND KETONES

DEFINITION

The anion $RCOO^-$ formed when a carboxylic acid loses the hydrogen ion from its COOH group.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

An acid that is only slightly dissociated into ions in aqueous solution.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

A reaction in which two molecules join together with the loss of a small molecule such as water.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

The reaction of a carboxylic acid with an alcohol, catalysed by a strong acid, to form an ester and water.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

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DEFINITION

Define: Hydrolysis.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

Define: Triglyceride.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

Define: Biodiesel.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

Define: Saponification.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

Define: Transesterification.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

SPOT THE ERROR

Say what is wrong with this claim:

In an ester the alcohol loses its OH and the acid loses an H, because that is how an acid and an alkali make water.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

Define: Acyl chloride.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

Define: Acid anhydride.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

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DEFINITION

An ester formed from propane-1,2,3-triol (glycerol) and three fatty acid molecules.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

The splitting of a molecule by reaction with water, here giving a carboxylic acid or its salt and an alcohol from an ester.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

The alkaline hydrolysis of a fat or oil, giving glycerol and the salts of the fatty acids, which are soap.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

A mixture of methyl esters of long-chain carboxylic acids, made by transesterification of vegetable oils with methanol.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

SPOT THE ERROR

It is the other way round. The acid loses its OH and the alcohol loses the H from its OH, so the oxygen that bridges the two halves of the ester came from the alcohol. Labelling the alcohol with ^{18}O puts the label in the ester, not the water. The alcohol's oxygen attacks the acid's carbonyl carbon.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

The exchange of the alcohol part of an ester for another alcohol, as when methanol replaces glycerol in making biodiesel.

CARBOXYLIC ACIDS, ESTERS AND BIODIESEL

DEFINITION

A compound with two acyl groups joined through one oxygen atom, $(RCO)_2O$.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

A compound containing the functional group –COCl, in which the OH of a carboxylic acid is replaced by a chlorine atom.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

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DEFINITION

Define: Acylation.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

Define: Acyl group.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

Define: Leaving group.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

Define: Amide.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

Define: N-substituted amide.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

Define: Nucleophilic addition–elimination.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

SPOT THE ERROR

Say what is wrong with this claim:

An acyl chloride reacts like a chloroalkane, so the nucleophile simply pushes the chlorine off in one step.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

Define: Condensation polymerisation.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

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DEFINITION

The RCO– group: a carbonyl carbon bonded to an alkyl or aryl group, left when the OH is removed from a carboxylic acid.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

The substitution of an acyl group, RCO–, for a hydrogen atom on an O or N atom of a nucleophile.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

A compound containing the group $–CONH_2$, formed when an acyl chloride or anhydride reacts with ammonia.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

An atom or group that departs with the bonding pair of electrons when its bond breaks, such as Cl^- from an acyl chloride.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

A mechanism in which a nucleophile adds to the carbonyl carbon of an acyl compound and a small molecule such as HCl is then eliminated, reforming the C=O bond.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

An amide in which one or both hydrogens on the nitrogen are replaced by alkyl groups, formed from a primary or secondary amine.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

DEFINITION

The joining of monomers, each with two functional groups, into a polymer with the loss of a small molecule such as water or HCl at each link.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

SPOT THE ERROR

The nucleophile attacks the carbonyl carbon and the C=O π bond breaks first, giving a tetrahedral intermediate that still holds the chlorine. The C=O then re-forms and pushes Cl^- out, and a proton is lost: nucleophilic addition–elimination. A chloroalkane has no C=O to open, so its substitution is a single step.

ACYLATION: ACYL CHLORIDES AND ACID ANHYDRIDES

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DEFINITION

Define: Polyester.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

Define: Polyamide.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

Define: Addition polymerisation.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

Define: Amide link.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

Define: Ester link.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

Define: Repeating unit.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

Define: Biodegradable.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

Define: Photodegradable.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

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DEFINITION

A condensation polymer in which the monomer residues are joined by amide links, –CONH–.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

A condensation polymer in which the monomer residues are joined by ester links, –COO–.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

The –CONH– group joining monomer residues in a polyamide, formed from a carboxylic acid group and an amine group with loss of water.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

The joining of many monomers containing C=C bonds into a polymer, with no other product.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

The smallest section of a polymer chain that, repeated, gives the whole chain, drawn with an open bond at each end.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

The –COO– group joining monomer residues in a polyester, formed from a carboxylic acid group and an alcohol group with loss of water.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

Able to be broken down by absorbing light, usually ultraviolet, which breaks bonds in the polymer chain.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

DEFINITION

Able to be broken down into smaller molecules by microorganisms in the environment.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

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SPOT THE ERROR

Say what is wrong with this claim:

Condensation polymers give off water because they are made in water, and all plastics last for centuries in the ground.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

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SPOT THE ERROR

The water is made, not supplied: each ester or amide link forms by joining an OH from one monomer to an H from the other, and that H_2O is the molecule lost. The same link can be hydrolysed, so polyesters and polyamides are broken down by acids, alkalis and enzymes. Addition polymers, with only C–C and C–H bonds, are the ones that persist.

CONDENSATION POLYMERS AND THE DISPOSAL OF POLYMERS

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