

A 2

CHEMISTRY

Nomenclature & Isomerism

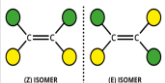
Question



Define racemic mixture.

▶ 2 marks

Answer



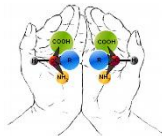
An equal mixture of enantiomers. The mixture is optically inactive.

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Nomenclature & Isomerism

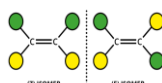
Question



Describe how optical isomers could be distinguished.

▶ 2 marks

Answer



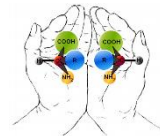
The plane of polarised light is rotated in opposite directions.

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Nomenclature & Isomerism

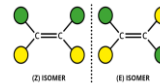
Question



What type of stereoisomerism does But-2-ene display?

▶ 1 mark

Answer



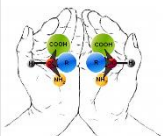
Geometric isomerism/ E-Z isomerism

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Nomenclature & Isomerism

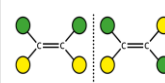
Question



Explain how you could distinguish between a racemate and a single enantiomer.

▶ 2 marks

Answer



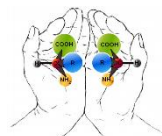
The plane of polarised light is rotated by the single enantiomer but is unaffected by the racemate.

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Nomenclature & Isomerism

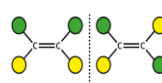
Question



Define nucleophile.

▶ 1 mark

Answer



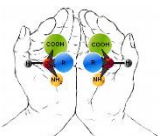
Electron pair donor.

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Nomenclature & Isomerism

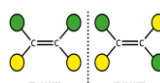
Question



Give two reasons why an organic product would not affect the plane of polarised light.

▶ 2 marks

Answer



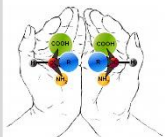
The product is a racemate or the product does not have a chiral centre/is optically inactive.

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Nomenclature & Isomerism

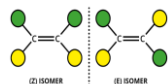
Question



Give the IUPAC name for glycerol.

▶ 1 mark

Answer



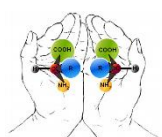
Propane-1,2,3-triol

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Nomenclature & Isomerism

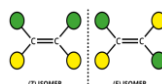
Question



Give the IUPAC name for lactic acid.

▶ 1 mark

Answer



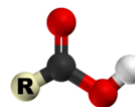
2-hydroxypropanoic acid

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CHEMISTRY

Carboxylic acids & esters

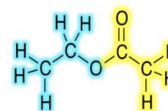
Question



Give a use for the salt formed when a triester reacts with excess NaOH.

▶ 1 mark

Answer



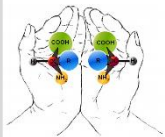
Soap(s)

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CHEMISTRY

Nomenclature & Isomerism

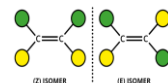
Question



Define stereoisomerism.

▶ 2 marks

Answer



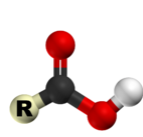
Molecules with the same structural formula but the atoms are arranged differently in space. (E/Z /geometric isomerism & optical isomerism are examples)

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CHEMISTRY

Carboxylic acids & esters

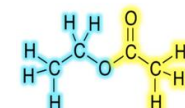
Question



Give a use for the mixture of methyl esters formed when a triester reacts with excess methanol.

▶ 1 mark

Answer



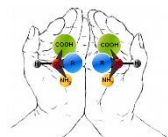
Biodiesel

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CHEMISTRY

Nomenclature & Isomerism

Question



Explain how E/Z isomerism arises.

▶ 2 marks

Answer



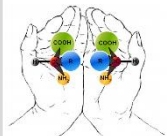
Due to the non-rotation around a C=C double bond and 2 different groups attached to each carbon in the C=C bond.

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CHEMISTRY

Nomenclature & Isomerism

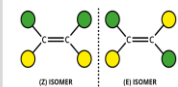
Question



Define chiral.

▶ 1 mark

Answer



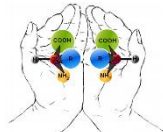
handed

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CHEMISTRY

Nomenclature & Isomerism

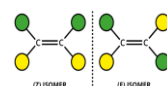
Question



Define optical isomers.

▶ 1 mark

Answer



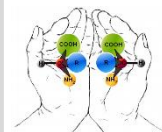
Molecules that are non-superimposable mirror images to each other.

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CHEMISTRY

Nomenclature & Isomerism

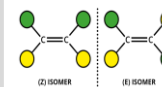
Question



Define chiral centre.

▶ 1 mark

Answer



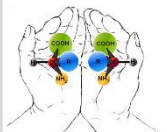
A carbon atom that is bonded to four different groups of atoms/atoms.

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Nomenclature & Isomerism

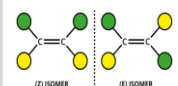
Question



Explain why amino acids made in nature are optically active.

▶ 1 mark

Answer



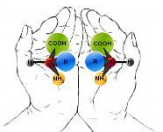
Amino acids made in nature are made by enzymes which are specific and only make one of the enantiomers.

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CHEMISTRY

Nomenclature & Isomerism

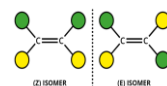
Question



Define enantiomer.

▶ 1 mark

Answer



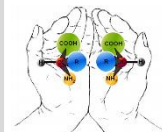
One of the two non-superimposable mirror image molecules/optical isomers.

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CHEMISTRY

Nomenclature & Isomerism

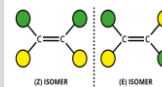
Question



Describe the problems associated with selling a racemate as a drug.

▶ 3 marks

Answer



Wasteful; double the dose is needed to be effective; one enantiomer might be very harmful.

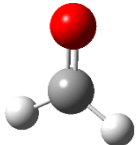
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CHEMISTRY

Carbonyl compounds

Question

Name the mechanism for the reaction of propanoyl chloride with ammonia.



1 mark

Answer

Nucleophilic addition-elimination.



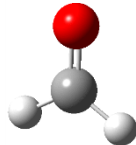
A 2

CHEMISTRY

Carbonyl compounds

Question

Identify the reducing agent used to change aldehydes into alcohols.



1 mark

Answer

NaBH_4 (aqueous) or LiAlH_4 in dry ether.



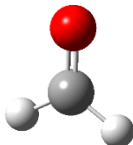
A 2

CHEMISTRY

Carbonyl compounds

Question

Name the mechanism for the reaction of an aldehyde or ketone with HCN.



1 mark

Answer

Nucleophilic addition.



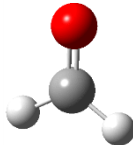
A 2

CHEMISTRY

Carbonyl compounds

Question

Name the organic product formed when methanol reacts with propanoyl chloride.



1 mark

Answer

Methyl propanoate.



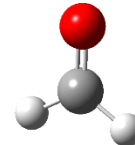
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CHEMISTRY

Carbonyl compounds

Question

Describe how HCN is prepared in the lab.



1 mark

Answer

$\text{NaCN/KCN} + \text{HCl}$



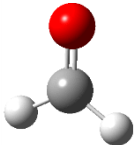
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CHEMISTRY

Carbonyl compounds

Question

Describe a chemical test to distinguish between propanone and propanal.



3 marks

Answer

Tollen's test: silver mirror produced with propanal and no change with propanone.
Fehling's: brick-red ppt formed with propanal; remains blue solution with propanone.
 $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+$: orange to green with propanal; no change with propanone



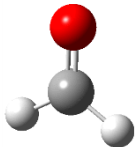
A 2

CHEMISTRY

Carbonyl compounds

Question

Explain why acyl chlorides react readily with nucleophiles.



2 marks

Answer

Large δ^+ charge at C atom due to it being bonded to O and Cl. C atom readily accepts electron pair donated by nucleophile.



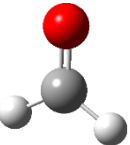
A 2

CHEMISTRY

Carbonyl compounds

Question

Give two advantages of using ethanoic anhydride instead of ethanoyl chloride in industry.



2 marks

Answer

Ethanoic anhydride is cheaper, less corrosive, does not produce HCl, is safer, reacts slower so the reaction can be controlled more easily.



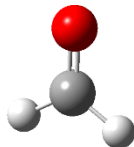
A 2

CHEMISTRY

Carbonyl compounds

Question

Name an electrophile which can readily react with butenedioic acid.



1 mark

Answer

Br_2 / HBr / H_2SO_4 / H^+
/ Br^+ / NO_2^+



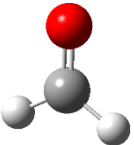
A 2

CHEMISTRY

Carbonyl compounds

Question

Give a reason for using acyl chlorides and acid anhydrides instead of carboxylic acids.



1 mark

Answer

Acyl chlorides and acid anhydrides react more vigorously and reactions go to completion so the yield is higher.



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CHEMISTRY

Carbonyl compounds

Question

Describe a chemical test that will identify a carboxylic acid.



2 marks

Answer

Add NaHCO_3 or Na_2CO_3 or Na-effervescence (CO_2 with carbonates; H_2 with metal)



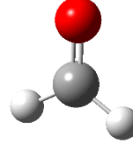
A 2

CHEMISTRY

Carbonyl compounds

Question

Name the mechanism when $\text{NaBH}_4(\text{aq})$ reacts with a carbonyl compound.



1 mark

Answer

Nucleophilic addition



A 2

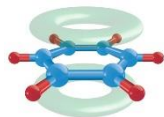
CHEMISTRY

Aromatic Chemistry

Question

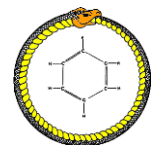
What reducing agent to you need to change nitrobenzene into phenylamine?

▶ 1 mark



Answer

Sn/Fe and HCl
or
H₂/Ni



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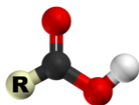
CHEMISTRY

Carboxylic acids & esters

Question

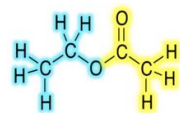
Explain why esters react with aqueous NaOH.

▶ 2 marks



Answer

The δ^+ C atom in the ester bond reacts with the OH⁻ from the NaOH.



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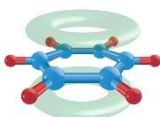
CHEMISTRY

Aromatic Chemistry

Question

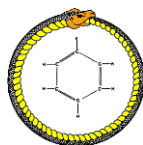
Identify the catalyst needed to react benzene with an acyl chloride.

▶ 1 mark



Answer

AlCl₃



A 2

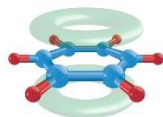
CHEMISTRY

Aromatic Chemistry

Question

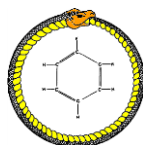
What is the name of the compound C₆H₅COCH₃?

▶ 1 mark



Answer

Phenylethanone.



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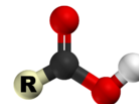
CHEMISTRY

Carboxylic acids & esters

Question

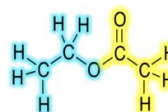
Name the type of reaction that occurs between an ester and aqueous NaOH.

▶ 1 mark



Answer

Hydrolysis/ nucleophilic addition-elimination/ saponification.



A 2

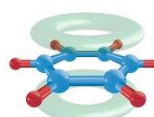
CHEMISTRY

Aromatic Chemistry

Question

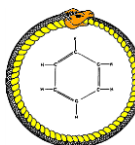
What reagents are needed to nitrate benzene?

▶ 1 mark



Answer

Concentrated nitric acid and concentrated sulfuric acid



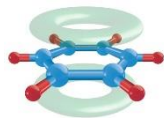
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CHEMISTRY

Aromatic Chemistry

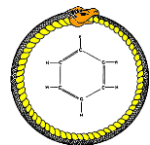
Question

Name the mechanism for the reaction of benzene with NO_2^+ .



1 mark

Answer



Electrophilic substitution.

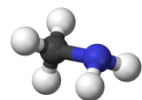
A 2

CHEMISTRY

Amines

Question

Name the type of compound produced when a large excess of CH_3Br reacts with CH_3NH_2 . Give a use for this type of compound.



2 marks

Answer



Quarternary ammonium salt.
Use: hair conditioner/
fabric softener.

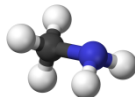
A 2

CHEMISTRY

Amines

Question

Name the compound $(\text{CH}_3\text{CH}_2)_2\text{NH}$



1 mark

Answer



Diethylamine.

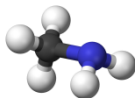
A 2

CHEMISTRY

Amines

Question

State the reagent and condition needed to ensure a primary amine is the major product.



2 marks

Answer



Reagent: ammonia
Condition: large excess
of ammonia.

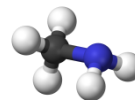
A 2

CHEMISTRY

Amines

Question

Name the mechanism for the reaction of methylamine with bromomethane.



1 mark

Answer



Nucleophilic substitution.

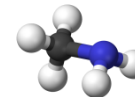
A 2

CHEMISTRY

Amines

Question

Explain why phenylamine is a weaker base than ammonia.



2 marks

Answer



In phenylamine the lone pair on the N atom is less available as it is delocalised into the ring.

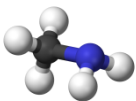
A 2

CHEMISTRY

Amines

Question

Explain why propylamine is a stronger base than ammonia.



▶ 2 marks

Answer

The R group in propylamine has a positive inductive effect and increases the electron density on the N atom so that the lone pair on N is donated more readily.



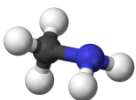
A 2

CHEMISTRY

Amines

Question

Amines are Brønsted-Lowry bases. Define Brønsted-Lowry base.



▶ 2 marks

Answer

Proton acceptors.



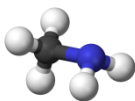
A 2

CHEMISTRY

Amines

Question

Explain why a mixture of amines is produced when bromoethane is reacted with ammonia.



▶ 1 mark

Answer

Because further substitution reactions take place between the 1° amine formed and bromoethane. As a result 2°, 3° amines are also produced.



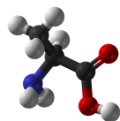
A 2

CHEMISTRY

Amino acids

Question

Describe how chromatography can be used to separate a mixture of amino acids.



▶ 3 marks

Answer

The eluent/solvent is the mobile phase; silica is the stationary phase; amino acids travel at different speeds as they dissolve to different extents in the solvent.



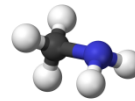
A 2

CHEMISTRY

Amines

Question

Explain why phenylamine cannot be produced by reacting bromobenzene with ammonia.



▶ 1 mark

Answer

Because the benzene ring repels nucleophiles (NH_3 is a nucleophile).



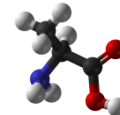
A 2

CHEMISTRY

Amino acids

Question

Name the process by which a peptide link is split.



▶ 1 mark

Answer

Hydrolysis.

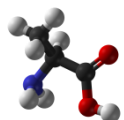


A 2

CHEMISTRY

Amino acids

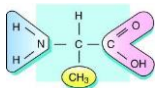
Question



What type of interaction is holding protein chains in a helix shape?

▶ 1 mark

Answer



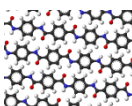
Hydrogen bonding.

A 2

CHEMISTRY

Polymers

Question



What type of polymer is a polyester?

▶ 1 mark

Answer



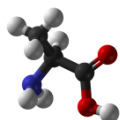
Condensation polymer.

A 2

CHEMISTRY

Amino acids

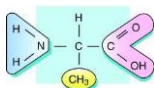
Question



Name a method that could be used to separate a mixture of amino acids.

▶ 1 mark

Answer



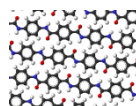
Chromatography.

A 2

CHEMISTRY

Polymers

Question



Explain why addition polymers cannot be broken down by hydrolysis.

▶ 1 mark

Answer



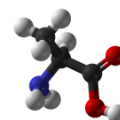
The C-C bonds are too strong.

A 2

CHEMISTRY

Amino acids

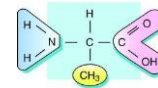
Question



Explain why the melting point of aminoethanoic acid is higher than that of hydroxyethanoic acid.

▶ 2 marks

Answer



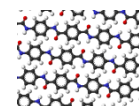
There is ionic bonding present in the amino acid whereas the strongest type of interaction in hydroxyethanoic acid is hydrogen bonding.

A 2

CHEMISTRY

Polymers

Question



Explain why Kevlar has a higher melting point than Terylene.

▶ 2 marks

Answer



Hydrogen bonding in Kevlar is stronger than the dipole-dipole forces in Terylene.

A 2

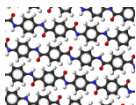
CHEMISTRY

Polymers

Question

Describe an experiment that compares the biodegradability of a polyamide and a polyalkene.

▶ 3 marks



Answer

Reflux with aqueous NaOH. The polyalkene will not react whereas the polyamide is hydrolysed to form an acid salt and alcohol.



A 2

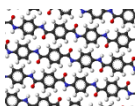
CHEMISTRY

Polymers

Question

Explain why polyesters can be hydrolysed by aqueous NaOH whereas polyethene cannot.

▶ 3 marks



Answer

The δ^+ C atom in the ester bond reacts with the OH^- from the NaOH. Polyethene is non-polar.



A 2

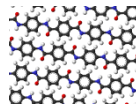
CHEMISTRY

Polymers

Question

Give an advantage and disadvantage of burning polyalkenes.

▶ 2 marks



Answer

Advantage: produces heat energy
Disadvantage: poisonous CO may be released.



A 2

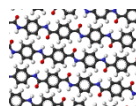
CHEMISTRY

Polymers

Question

What is Kevlar made from?

▶ 2 marks



Answer

Benzene-1,4-dicarboxylic acid and benzene-1,4-diamine.



A 2

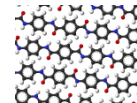
CHEMISTRY

Polymers

Question

Explain why polyesters are biodegradable.

▶ 1 mark



Answer

Because they can react with water and be hydrolysed.



A 2

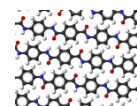
CHEMISTRY

Polymers

Question

What is Nylon-6,6 made from?

▶ 2 marks



Answer

1,6-diaminohexane and hexane-1,6-dicarboxylic acid.

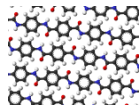


A 2

CHEMISTRY

Polymers

Question



What is Terylene made from?

▶ 2 marks

Answer



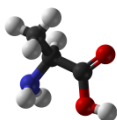
Ethane-1,2-diol and benzene-1,4-dicarboxylic acid.

A 2

CHEMISTRY

Amino acids

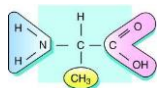
Question



Define zwitterion.

▶ 1 mark

Answer



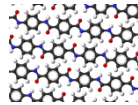
Ions that have both a permanent positive and negative charge but are overall neutral in charge.

A 2

CHEMISTRY

Polymers

Question



What type of polymers are Kevlar and Nylon-6,6 and Terylene?

▶ 1 mark

Answer



Condensation polymers.

A 2

CHEMISTRY

Organic Synthesis

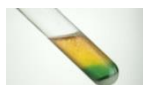
Question



How do you distinguish between a primary and tertiary alcohol?

▶ 2 marks

Answer



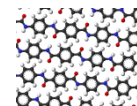
Add acidified potassium dichromate. Colour changes from orange to green with primary alcohol. No change with tertiary alcohol.

A 2

CHEMISTRY

Polymers

Question



What type of polymer are polyalkenes?

▶ 1 mark

Answer



Addition polymers.

A 2

CHEMISTRY

Organic Synthesis

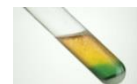
Question



How do you test for a haloalkane?

▶ 2 marks

Answer



Add NaOH followed by acidified AgNO_3 ; a white precipitate will form.

A 2

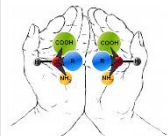
CHEMISTRY

Nomenclature & Isomerism

Question

Give an advantage of using a racemate in medicines rather than a single enantiomer.

▶ 2 marks



Answer

Cheaper. It is difficult to separate enantiomers and the separation process is expensive.



A 2

CHEMISTRY

Organic Synthesis

Question

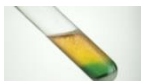
Describe a test you could carry out to identify an alkene.

▶ 2 marks



Answer

Add bromine water.
Colour change from orange to colourless.



A 2

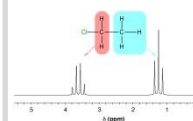
CHEMISTRY

Structure determination

Question

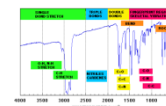
Identify a solvent that can be used to dissolve samples in before obtaining a ^1H NMR spectrum.

▶ 1 mark



Answer

CDCl_3 or CD_2Cl_2 or C_6D_6 or CCl_4



A 2

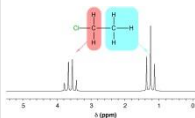
CHEMISTRY

Structure determination

Question

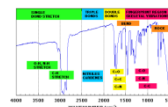
Explain why CDCl_3 , CD_2Cl_2 , C_6D_6 and CCl_4 are all suitable solvents for ^1H NMR spectroscopy.

▶ 1 mark



Answer

They all are proton free.



A 2

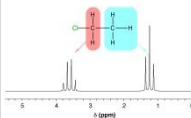
CHEMISTRY

Structure determination

Question

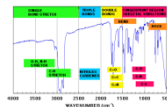
Give two reasons (other than non-toxic/inert) for using TMS as a standard in recording NMR spectra.

▶ 2 marks



Answer

It produces one single peak to the right of all other peaks and does not interfere with other peaks; it is volatile



A 2

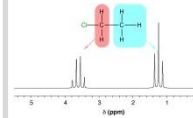
CHEMISTRY

Structure determination

Question

Give the formula of the standard reference compound used in recording ^1H NMR spectra.

▶ 1 mark



Answer

$\text{Si}(\text{CH}_3)_4$

