

Pharm.D - Year 1

Pharmaceutical Organic Chemistry

Complete subject manual: 16 practicals and activities. Each chapter includes a student observation or work record.

Use the PDF bookmarks to navigate. The table gives each practical's content-page count; the combined manual has continuous page numbers.

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Acetylation - Acetanilide and Aspirin

Experiment 1 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

Acetylation introduces an acetyl group at a suitable nitrogen or oxygen site. Acetanilide is an amide; aspirin is acetylsalicylic acid.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Complete the assigned quench, allow crystallisation and collect the solid by filtration. Wash as specified to remove soluble residual reagents.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Preparations and Reaction Scheme

Route / product	Starting material and change
Acetanilide	Aniline to an acetamide derivative.
Aspirin	Salicylic acid to its phenolic O-acetyl derivative.

Pharmaceutical Organic Chemistry

Observations and Record

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers**1. Which group is acetylated in aspirin?**

The phenolic hydroxyl group of salicylic acid.

2. What group is formed in acetanilide?

An amide group.

3. Why dry the crystals?

Residual solvent can falsely increase yield and alter melting behaviour.

Benzoylation - Benzanilide and Phenyl Benzoate

Experiment 2 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

Benzoylation introduces a benzoyl group. Amines form amide derivatives and phenols can form ester derivatives.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Separate the product using the assigned acid/base work-up, filter the solid and wash until the specified residual reagents are removed.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Preparations and Reaction Scheme

Route / product	Starting material and change
Benzanilide	Aniline to the corresponding benzamide derivative.
Phenyl benzoate	Phenol to a benzoate ester.

Pharmaceutical Organic Chemistry

Observations and Record

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers**1. Why does reaction-site identity matter?**

Nitrogen and oxygen give different derivative classes.

2. What is the purpose of work-up?

It separates the desired product from residual reagents and by-products.

Bromination - p-Bromoacetanilide and 2,4,6-Tribromoaniline

Experiment 3 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

Electrophilic aromatic substitution depends on the activating group and its protection. Protecting an amine changes its reactivity and substitution pattern.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Use the assigned residual-halogen treatment and isolate the solid without exposure to bromine vapour. Wash and recrystallise as directed.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Preparations and Reaction Scheme

Route / product	Starting material and change
p-Bromoacetanilide	Bromination of the assigned acetanilide substrate.
2,4,6-Tribromoaniline	Bromination of the assigned aniline substrate.

Pharmaceutical Organic Chemistry

Observations and Record

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers**1. Why is the protected amine useful?**

Protection moderates reactivity and assists control of substitution.

2. Does a melting range alone establish substitution pattern?

No. The reaction scheme and appropriate identity evidence are also needed.

Condensation - Dibenzylideneacetone

Experiment 4 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

An aldol-type condensation followed by dehydration produces a conjugated product from the assigned carbonyl reactants.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Collect the precipitated product after the prescribed reaction period; wash to remove residual alkaline solution and purify as assigned.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Preparations and Reaction Scheme

Route / product	Starting material and change
Dibenzylideneacetone	Condensation product from the assigned acetone and benzaldehyde route.

Pharmaceutical Organic Chemistry

Observations and Record

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers**1. Why is the product conjugated?**

Its carbon-carbon double bonds communicate with the carbonyl group.

2. What does dehydration remove?

The elements of water from the intermediate condensation product.

Diazotisation and Coupling - 1-Phenylazo-2-naphthol

Experiment 5 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

An aromatic diazonium intermediate couples with an activated aromatic partner to form an azo linkage and a strongly conjugated coloured product.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Keep the intermediate in its assigned solution; isolate only the final coupling product under the approved procedure, then wash and dry.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Pharmaceutical Organic Chemistry

Preparations and Reaction Scheme

Route / product	Starting material and change
1-Phenylazo-2-naphthol	Diazotisation of the assigned aromatic amine followed by coupling with the specified naphthol partner.

Observations and Record

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers

1. What gives the azo product its colour?

An extended conjugated system containing the azo linkage.

2. Why control the diazotisation stage?

Diazonium intermediates can decompose and must be handled only under the authorised method.

Ester Hydrolysis - Benzoic Acid and Salicylic Acid

Experiment 6 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

Hydrolysis cleaves an ester into the corresponding acid or carboxylate and alcohol. Acidification of a carboxylate solution can isolate the free acid.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Complete the authorised hydrolysis, cool and apply the prescribed pH adjustment. Collect the acid product, wash and recrystallise as assigned.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Preparations and Reaction Scheme

Route / product	Starting material and change
Benzoic acid	Hydrolysis of the assigned benzoate ester.
Salicylic acid	Hydrolysis of the assigned salicylate ester.

Pharmaceutical Organic Chemistry

Observations and Record

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers**1. What functional group is cleaved?**

The ester linkage.

2. Why acidify a carboxylate solution?

It can convert the soluble salt to the free acid for isolation.

Nitration - m-Dinitrobenzene

Experiment 7 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

The existing nitro group deactivates the aromatic ring and directs further electrophilic substitution mainly to the meta position.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Use only the supervised assigned work-up for nitrating reagents, then isolate and purify the final product using the approved method.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Preparations and Reaction Scheme

Route / product	Starting material and change
m-Dinitrobenzene	Further nitration of the assigned nitroaromatic starting material.

Pharmaceutical Organic Chemistry**Observations and Record**

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers**1. What directing effect does a nitro group have?**

It is deactivating and meta directing in electrophilic aromatic substitution.

2. Why is temperature control needed?

Nitration is exothermic and the authorised procedure controls reaction rate and safety.

Oxidation - Anthraquinone and Benzoic Acid

Experiment 8 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

Oxidation changes the substrate oxidation state; an aromatic side chain or fused-ring system can form different carbonyl-containing products.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Separate residual oxidant and inorganic products using the prescribed method. Isolate the desired organic product and record the acid/base state used for separation.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Preparations and Reaction Scheme

Route / product	Starting material and change
Anthraquinone	Assigned oxidation route from anthracene.
Benzoic acid	Assigned oxidation route from toluene or benzaldehyde.

Pharmaceutical Organic Chemistry

Observations and Record

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers**1. Why record the chosen starting material?**

Different starting materials have different stoichiometry and by-products.

2. What determines theoretical yield?

The balanced reaction and the limiting amount of reagent.

Reduction - m-Phenylenediamine and Aniline

Experiment 9 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

Reduction converts an aromatic nitro group to an amino group. Product isolation may require conversion from a protonated salt to the free amine.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Remove the reducing-system residues and obtain the assigned amine form under the supervised work-up. Record physical state and the authorised identity test.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Preparations and Reaction Scheme

Route / product	Starting material and change
m-Phenylenediamine	Assigned reduction route from m-dinitrobenzene.
Aniline	Assigned reduction route from nitrobenzene.

Pharmaceutical Organic Chemistry

Observations and Record

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers**1. What is the functional-group change?**

Nitro to amino.

2. Why does pH affect amine isolation?

Amines and their protonated salts have different solubility and partitioning behaviour.

Benzophenone Oxime

Experiment 10 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

An oxime forms when the assigned ketone reacts with hydroxylamine; the carbonyl oxygen is replaced in the derivative by an oxime group.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Cool and isolate the derivative as directed, wash and recrystallise; record the dry mass and melting range.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Preparations and Reaction Scheme

Route / product	Starting material and change
Benzophenone oxime	Oxime derivative of benzophenone.

Pharmaceutical Organic Chemistry

Observations and Record

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers**1. Why prepare an oxime?**

A suitable crystalline derivative can support identification of a carbonyl compound.

2. What limitation remains?

Derivative identity must be supported by the assigned physical or analytical comparison.

Nitration of Salicylic Acid

Experiment 11 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

Substituents on an aromatic ring influence orientation and rate. Nitration of salicylic acid must be evaluated against the specific product defined by the assigned route.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Complete the supervised work-up and isolate the assigned product; avoid assuming that every nitration condition gives the same isomer.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Preparations and Reaction Scheme

Route / product	Starting material and change
Assigned nitrosalicylic acid	Nitration product stated in the instructor-approved reaction scheme.

Pharmaceutical Organic Chemistry

Observations and Record

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers**1. Why state the intended isomer?**

Substitution pattern is part of the product identity.

2. Why is a broad melting range significant?

It can indicate impurities, mixed material or measurement limitations.

Picric Acid - Reaction Concept and Hazard Assessment

Experiment 12 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To explain the product class, recognise energetic-material hazards and complete a conceptual preparation record.

Principle

The syllabus lists this preparation. Picric acid is an energetic nitroaromatic compound; this chapter is a conceptual reaction and hazard-assessment exercise, with no synthesis procedure.

Requirements

- Instructor-provided labelled diagrams, traces or data for this activity.
- Calculator, graph paper or spreadsheet, and the activity record.

Procedure

1. Identify the product

Draw the supplied product structure and identify its phenolic and nitro functional groups.

2. Discuss reaction classification

Classify the transformation from the instructor-provided reaction overview without planning quantities, addition conditions or a preparative route.

3. Assess hazards

Explain why drying, unsuitable storage and contact with incompatible materials require specialist control. Do not prepare or handle the substance for this exercise.

4. Compare evidence

Review supplied identity data and distinguish product identity from purity and yield.

5. Record the conclusion

Enter a conceptual scheme classification, assigned identity evidence and the reason for using a non-preparative exercise.

Pharmaceutical Organic Chemistry

Observations and Record

Record item	Entry
Activity / material identifier	_____
Measurement or visible feature	_____
Comparison / calculated outcome	_____
Interpretation and limitation	_____

Result

The recorded finding is ____; the supporting observation or calculation is _____. The main limitation is _____.

Precautions

- Use the supplied teaching material; distinguish a measured observation from an assumed value.
- Keep units, axes, labels and measurement conditions consistent.
- Record limitations and seek instructor review before applying a conclusion to a live case.

Viva Questions and Answers**1. Why is no synthesis performed?**

The preparation concerns an energetic material and is covered through a conceptual exercise.

2. What does the structure show?

A phenolic aromatic ring bearing nitro groups; the assigned identity must be confirmed using suitable evidence.

o-Chlorobenzoic Acid from o-Chlorotoluene

Experiment 13 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

Oxidation of an alkyl side chain can produce a carboxylic acid while retaining the ring substitution pattern in the assigned route.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Remove oxidant residues, obtain the acid form using the assigned pH work-up and collect and purify the product.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Preparations and Reaction Scheme

Route / product	Starting material and change
o-Chlorobenzoic acid	Assigned side-chain oxidation of o-chlorotoluene.

Pharmaceutical Organic Chemistry

Observations and Record

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers**1. Which group changes?**

The methyl side chain is converted to a carboxyl group.

2. Does yield confirm preservation of the ring substituent?

No. Identity evidence must confirm the intended product.

Cyclohexanone from Cyclohexanol

Experiment 14 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To study the specified organic preparation, isolate the assigned product and calculate its yield.

Principle

Oxidation of a secondary alcohol gives a ketone under a suitable assigned oxidising method.

Requirements

- Instructor-approved reaction scheme, reagent quantities and laboratory procedure for the selected route.
- Reaction glassware, suitable ventilation, separation apparatus, balance and melting-point apparatus.

Procedure

1. Plan the selected route

Write the balanced reaction and identify the functional-group change, limiting reagent, expected product and hazards. Use the assigned supervised method for the selected option.

2. Carry out the assigned reaction

Measure the prescribed reagents and follow the authorised addition sequence and temperature controls. Record actual reaction observations and the method used.

3. Isolate the product

Separate the product using the approved extraction or distillation method. Record the collected fraction and the assigned physical or derivative identity finding.

4. Purify and dry

Apply the assigned recrystallisation or purification method. Record solvent, observations, dry mass and melting range where appropriate.

5. Assess the product

Calculate theoretical and percentage yield. Compare the measured physical properties and assigned identity test; explain that yield alone does not prove purity.

Preparations and Reaction Scheme

Route / product	Starting material and change
Cyclohexanone	Oxidation of cyclohexanol.

Pharmaceutical Organic Chemistry

Observations and Record

Record	Student entry
Selected route / balanced equation	_____
Limiting reagent and molar mass	_____
Theoretical product mass	_____
Dry product mass / melting range	_____
Percentage yield / identity finding	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Theoretical product mass = moles of limiting reagent $\times$ stoichiometric product ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.
- Illustration: 0.020 mol of a limiting reagent gives 0.020 mol of a 150 g/mol product. The theoretical mass is 3.00 g; 2.40 g isolated product gives 80.0% yield.

Result

Product: _____. Route: _____. Dry mass: _____. Yield: _____. Physical property / identity evidence: _____.

Precautions

- Use the specific supervised procedure and facilities for corrosive, toxic, oxidising or flammable reagents.
- Record the selected preparation option rather than combining different reaction routes.
- Use dry product mass for yield and the stated test conditions for comparison.

Viva Questions and Answers**1. Why is the product a ketone?**

The oxidised carbon bears two carbon substituents in the secondary alcohol.

2. Why record a collected fraction?

It identifies the material assessed and supports a meaningful yield calculation.

Qualitative Identification of Organic Compounds

Experiment 15 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To identify an assigned organic compound through a systematic, supervised qualitative examination.

Principle

A combined pattern of solubility, functional-group evidence and an appropriate derivative is more useful than a single colour reaction.

Requirements

- Coded instructor-issued compound, assigned test reagents, clean test tubes and authorised laboratory identification scheme.

Procedure

1. Preliminary record

Enter the code, physical state and visible appearance; do not taste or directly smell an unknown.

2. Solubility assessment

Use the prescribed small-scale solubility and acid/base classification scheme and record the actual result.

3. Choose functional-group tests

Select tests based on the solubility class and preliminary evidence. Use controls and avoid testing every reagent indiscriminately.

4. Confirm a candidate

Combine the assigned results with a suitable derivative or instrumental/physical identity comparison.

5. Report

List supporting and conflicting evidence and state the confidence and limitation of the identification.

Pharmaceutical Organic Chemistry

Observations and Record

Compound class	Evidence to record
Phenols / carboxylic acids	Acid-base behaviour and assigned selective test
Amines / amides / anilides	Basicity or assigned hydrolysis/derivative evidence
Aldehydes / ketones	Carbonyl test and distinguishing assigned evidence
Alcohols / esters	Assigned hydroxyl or hydrolysis evidence
Carbohydrates	Assigned carbohydrate reactions and solubility
Hydrocarbons / nitro compounds	Assigned classification and confirmation results

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Use only the coded compound and prescribed supervised identification scheme.
- A negative test is meaningful only if the method and control worked.
- Use an assigned safe derivative; never improvise a hazardous synthesis to identify a compound.

Viva Questions and Answers**1. Why are multiple tests used?**

Individual tests can lack specificity or be affected by interfering compounds.

2. Why use a derivative?

A suitable derivative provides additional identity evidence when compared under stated conditions.

Stereochemical Models of Organic Molecules

Experiment 16 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To construct and compare the stereochemical models listed in the syllabus.

Principle

Molecular geometry and restricted rotation determine three-dimensional arrangement. Models help distinguish connectivity, conformation and configuration.

Requirements

- Instructor-provided labelled diagrams, traces or data for this activity.
- Calculator, graph paper or spreadsheet, and the activity record.

Procedure

1. Build simple molecules

Construct methane, ethane, ethene and ethyne. Record bond geometry and explain single-bond rotation versus multiple-bond restrictions.

2. Compare substituted alkenes

Use a suitable alkene with two different groups on each double-bond carbon. Build the specified cis and trans models and compare spatial arrangement.

3. Apply priority rules

For an assigned alkene, label the higher-priority group on each carbon and assign E or Z; do not assume cis/trans and E/Z are always equivalent.

4. Study tetrahedral inversion

Build the supplied stereocentre and its inverted configuration. Distinguish inversion from rotation of the whole model.

5. Record

Draw labelled models and state which pairs are identical, conformers or configurational isomers.

Pharmaceutical Organic Chemistry

Observations and Record

Record item	Entry
Activity / material identifier	_____
Measurement or visible feature	_____
Comparison / calculated outcome	_____
Interpretation and limitation	_____

Result

The recorded finding is ____; the supporting observation or calculation is _____. The main limitation is _____.

Precautions

- Use the supplied teaching material; distinguish a measured observation from an assumed value.
- Keep units, axes, labels and measurement conditions consistent.
- Record limitations and seek instructor review before applying a conclusion to a live case.

Viva Questions and Answers**1. Why is methane tetrahedral?**

Four bonding regions are arranged about carbon in a tetrahedral geometry.

2. Why is alkene rotation restricted?

Rotation disrupts the pi-bond overlap.

3. What is inversion at a stereocentre?

A change in the stereochemical arrangement at that centre, distinct from rotating the entire model.

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