

Semester - 3

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

Programme code :	∨	Programme Name :	B.Sc.
Faculty :	SCIENCE	Semesters :	III
Subject :	CHEMISTRY		
Effective from :	HGvZ_! # YL		

Sr.	Paper Code	Name of Paper	Credit
1	CC CH- 301	CORE COMPULSORY-CHEMISTRY-I	3
2	CC CH-302	CORE COMPULSORY-CHEMISTRY-II	3
3	SE CH- 301A	SUBJECT ELECTIVE; ENVIRONMENTAL POLLUTION	2
OR			
3	SE CH- 301B	SUBJECT ELECTIVE; CERAMICS	2
4	LC CH 301	LABORATORY COURSE-I	1.5
5	LC CH 302	LABORATORY COURSE-II	1.5

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Semester - 3**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

Programme code :	✓	Programme Name :	B.Sc.
Faculty :	SCIENCE	Semesters :	IV
Subject :	CHEMISTRY		
Effective from :	HGvZ_! # YL		

Sr.	Paper Code	Name of Paper	Credit
1	CC CH-401	CORE COMPULSORY-CHEMISTRY-I	3
2	CC CH-402	CORE COMPULSORY-CHEMISTRY-II	3
3 OR	SE CH-401A	SUBJECT ELECTIVE; NAME REACTIONS	2
3	SE CH-401B	SUBJECT ELECTIVE; GREEN CHEMISTRY	2
4	LC CH 401	LABORATORY COURSE-I	1.5
5	LC CH 402	LABORATORY COURSE-II	1.5

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Semester - 3

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B.Sc. Semester: III & IV

Chemistry Syllabus

(Effective from June-2013)

This syllabus is to be completed by assigning three periods of one hour each for core course, Two periods of one hour each for subject Elective course, and two practicals of three hours each per week.

The number of students in a practical batch should not exceed twenty five.

PATTERN OF EXAMINATION :

There will be two papers for core compulsory and one paper for subject elective theory and five hours/day for two days per batch practicals in the university examination. The pattern will be as follows.

written	Examination	Marks External	Marks Internal
Core course-I	3 hours	70	30
Core course-II	3 hours	70	30
Subject elective course	2 hours	50
Laboratory course-I	5 hours	50
Laboratory course-II	5 hours	50

Theory Examination Pattern:

Que. No : 1	(A) : Write any Two out of Three Questions (B) : Write any One out of Two Questions	14 Marks 06 Marks
Que. No : 2	(A) : Write any Two out of Three Questions (B) : Write any One out of Two Questions	14 Marks 06 Marks
Que. No : 3	(A) : Write any Two out of Three Questions (B) : Write any One out of Two Questions	14 Marks 06 Marks
Que. No : 4	Write any Ten out of Twelve (Four questions to be asked from each unit) Short question/MCQ/Short numerical/Diagram	10 Marks

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Total Marks: 70

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Semester : III

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Chemistry (CC CH – 301)

Unit:–I Wave Mechanics :

- Black Body Radiation & Quantum Theory.
- Photo electric effect : Wave particle duality of radiation.
- Compton effect.
- Basic postulates of quantum Mechanics.
- Operator : Definition, Algebra of operators, Addition, Multiplication, Commutative properties, Linear operator, Commutator operators, Laplассian operator.
- Free particle system.
- Particle in one dimension box.

Unit:–II Acid-Base Properties :

- Proton acids – Bases and Lewis acids - Bases.
- Scale of acidity - Basicity.
- Factors effecting on acidity and basicity of compounds.
 - Resonance effect (Drawing resonance structures and the conditions for resonance).
 - Inductive and electronic effects.
 - Effect of hybridization.
 - Steric effects.
 - Effects by hydrogen bonding.

Unit:–III Thermodynamics :

❖ Phase in Equilibrium.

- Clapeyron-clausius equation
- Integrated form of clapeyron-clausius equation.
- Application of clapeyron-clausius equation from various phase in equilibrium.

- Trouton's law.
- Raoult equation.
- Elevation in Boiling point.(K_b)
- Depression of freezing point. (K_f)

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❖ **Partial molar Properties.**

- Partial molar free energy.
- Concept of Chemical Potential.
- Gibbs-Duhem equation.
- Variation of chemical potential with temperature and pressure.
- Duhem-Margules equation.

❖ **Numericals.**

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Semester : III

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Chemistry (CC CH – 302)

Unit:–I Chemistry of Noble gases :

- Introduction
- Discovery of Noble gases: Occurrence, Isolation of Non-radioactive of Noble gases.
- Electronic configuration of Noble gases.
- Compound of Noble gases.
 - 1) Non real compounds prepared by different methods.
 - 2) True compounds: XeF_2 , XeF_4 , XeF_6 , XeOF_2 , XeO_3 , XeO_2F_2 , XeO_4 , XeOF_4 .

Unit:–II

(A) Amino acids & Peptides :

❖ **Amino acids.**

- Introduction.
- Classification and nomenclature.
- Dipolar ion structure and Isoelectric point.
- Synthesis of amino acids (Gabriel Phthalimide, Straker, Fisher-Malonic ester).
- Reactions of amino acid.

❖ **Peptides.**

- Geometry of peptide linkage.
- Synthesis of peptides (Bergmann Method, Shehan Method).
- Determination of structure of peptide by terminal residue analysis.

(B) Electrophilic Aromatic Substitution :

- Introduction.
- Effect of substituent groups.

- Determination of orientation. 02/07/2013
- Classification of substituent groups. HgVZ_! # YL
- Orientation in disubstituted benzenes.
- Orientation and synthesis.
- Mechanism of ...Nitration, Sulfonation, Friedal - craft alkylation and Helogenation.
- Electrophilic aromatic substitution (Two steps).
- Theory of reactivity.
- Theory of orientation.
- Electron release via resonance.

Unit:–III Physical Properties & Molecular Structure:

❖ The Vacancy Theory of Liquid.

- Vapor-Pressure
- Surface tension
 - 1) Measurement of surface tension by stalagmometer.
 - 2) Perachore and its applications.
- Viscosity
 - 1) Measurement of viscosity by Ostwald-viscometer
- Refractive index
 - 1) Specific refraction.
 - 2) Molar refraction.
 - 3) Measurement of Refractive index by Abbe's Refractometer.
- Optical activity
 - 1) Measurement of Optical activity by Polarimeter.
- Dipole moment and its measurements & its application.
- Numericals.

REF :

➤ Inorganic Chemistry

1. Quantum Chemistry by R.K.Prasad, Revised IIIrd Edition,
Page- 3,5,7,34-37,41,65-68. HgVZ_! # YL

2. Concise Inorganic Chemistry J.D.Lee, 4th edition, ELBS
publication. **02/07/2013**

➤ **Organic Chemistry**

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1. Organic Chemistry by Morrison and Boyd.4th ed. Pearson Education-2003
2. Organic Chemistry by pine, Hendrickson, Cram and Hammond 4th ed. By P.S.Kalsi.
3. Advance Organic Chemistry by Jerry March.
4. Advance Organic Chemistry by Arun Bahal and B.S.Bahal.
5. Organic Chemistry Vol. I & II by S.M.Mukherji, S.P.Sing, R.P.Kapoor.
6. Reaction mechanism and Reagents in Organic Chemistry by Gurdeep R.Chatwal 4th ed. Himalaya public House.
7. Text book of Organic Chemistry by Arun Bahal, B.S.Bhal, S.Chand.
8. Organic Spectroscopy by P.S.Kalsi.
9. Organic Chemistry by I.R.Finar.

➤ **Physical Chemistry**

1. Advance Physical Chemistry by Gurdeep Raj
2. Physical Chemistry (Question and Answers) by R.N.Madan, G.D.Tully, S.Chand.
3. Principal of Physical Chemistry by Puri, Sharma, Pathania.
4. Chemical Thermodynamics by R.P.Rastogy and R.R.Misra.
5. Essentials of Physical Chemistry by B.S.Bahal, Arun Bahal, G.D.Tully.
6. Physical Chemistry by P.W.Atkins, 5th ed. , Oxferd, 1994, 7th ed. ,2002
7. Physical Chemistry by R.A.Alberty and R.J.Silbey, John Wiley, 1995.
8. Physical Chemistry by G.H.Barrow, 5th ed. , Mac Graw Hill, 1998, 6th ed.
9. Physical Chemistry by W.J.Moore, 4th ed. , Orient Longmans, 1969.

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B.Sc.

Semester : III

Chemistry (SE CH – 301A)

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SUBJECT ELECTIVE PAPER

(Environmental Pollution)

Unit -I

- Introduction
- Classification of pollutant
- Types of pollution
- What is air pollution
- Source of air pollution
- Acid Rain
- Emissions of major industrial air pollutant
- What is water pollution
- Types of water pollution -Physical & Chemicals, Biological and Physiological
- Source of Water Pollution

Unit-II

- What is soil pollution
- Sources of soil pollution
- Effect of Modern Agro-Technology on Soil
- What is Noise Pollution
- What is Thermal Pollution
- What is Radio Active Pollution
- Prevention of pollution

REF:-

1. Industrial Chemistry by B.K.Sharma.

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Semester : III

Chemistry (SE CH – 301B)

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SUBJECT ELECTIVE PAPER

(Ceramics)

Unit : I

❖ Ceramics :

- Introduction of Ceramics, History-Definition- Domestic and Industrial uses of Ceramics - Modern Ceramics - Hi-tech ceramics - Sub-division in Ceramics.
- Ceramic bodies,
- Procedures of body preparation,
- Quality testing of raw material,
- Grinding,
- Sieving and demagnetizing,
- Filter pressing,
- Dearing pug mill,
- Slip casting,
- Slip Parameters,
- Finishing,
- Glazing,
- Firing,
- Type of kiln

UNIT - II :

(A) Ceramic Properties Measurements :

- Common physical test in ceramics.
- Moisture measurement,
- Grit content,

- Specific density,
- Water of plasticity(WOP),
- Viscosity,
- Dry shrinkage,
- Porosity,
- Water absorption,
- Fired shrinkage,
- Loss of ignition (LOI),
- Module of rapture(MOR),
- Crazing test,

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(B) Refractories :

- Classification of refractories,
- Properties and application of refractories,
- Manufacturing process of silica bricks.

REF :

1. Industrial ceramics -Felix singer and Sonja s. singer
2. Ceramic technology and processing - Alan G. king
3. Source book of Ceramics,Part-1 - S.kumar
4. Source book of Ceramics,Part-2 - S.kumar

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Semester: III

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Laboratory Course -I (Chemistry)

Organic Chemistry

(4 hours per practical)

- Separation of Organic Mixture. (Any 7 out of 10)
Mixture Containing Two Compounds (Only Water Insoluble Solid
Compounds taken)
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Semester: III

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Laboratory Course -II (Chemistry)

Physical Chemistry.(Any 7 out of 10) (4 hours per practical)

- 1) Conductometric titration:- HCl / CH₃COOH Vs NaOH
- 2) Conductometric titration:- HCl Vs NH₄OH
- 3) pH- metric titration:-
 - a. Calibration of pH - meter by 4 - pH buffer
 - b. HCl Vs NaOH
- 4) Determine the Dissociation constant of the acid of mixtures of CH₃COONa and CH₃COOH by determine the PH
- 5) Determine the specific refraction and molar refraction of the given liquid A, B and mixture C (A+B) and calculate the percentage composition of A and B in the mixture C by Abbe's Refractometer.
- 6) Determine the molar refraction CH₃COOC₂H₅ ,CH₃COOC₃H₇ and CH₃COOC₄H₉ and show the constancy of reaction equivalent of -CH₂ – Group by Abbe's Refractometer.
- 7) To determine the viscosity of a different mixture of liquid A and B and determine the percentage composition of unknown mixture by graphical method.
- 8) To determine the surface tension and compare cleaning-efficiency of two samples of a detergent or soap with stalagmo meter.
- 9) To study kinetic reaction of decomposition of H₂O₂ catalysis by iodine ion (Clock reaction)
- 10) Find the solubility and heat of solution of the given organic acid at two different temperatures

University Exam Pattern: (Two Days per Batch)

Name of Practical	Day	Marks
Lab. Course-I		
Organic Separation	One day (5 hours)	40+5(viva) = 45

Lab. Course-II		
Physical Chemistry	One day (5 hours)	40+5(viva) = 45
Journal		10
Total		100

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Semester : IV

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Chemistry (CC CH – 401)

Unit:–I

(A) Application of CFT :

- Application of C.F.T.
 - 1) For determination of color of complex.
 - 2) Use of C.F.S.E. value.
- Limitation of C.F.T.
- Isomerism in complexes.

(B) Magnetic properties of Co-Ordination Compound :

- Type of magnetic behavior.
- Method of determining magnetic susceptibility.
- Spin only formula.
- Magnetic properties for 3rd metal complexes.

Unit:–II

(A) Heterocyclic Compound :

- Introduction.
- Nomenclature.
- Molecular orbital picture and aromatic characteristics of Pyrrole, Furan, Thiophene and Pyridine.
- Methods of synthesis for Pyrrole, Furan, Thiophene and Pyridine.
- Chemical reactions for Pyrrole, Furan and Thiophene.
- Electrophilic and Nucleophilic substitution reactions of pyridine.
- Basicity of Pyridine, Piperidine and pyrrole.

(B) Carbohydrates :

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- Introduction
- Definition.
- Classification of Mono Sacharides.
- Nomenclature.
- Reactions of Glucose and Fructose.
(Methylation, Acetylation, Oxidation with Br₂ water and Conc.HNO₃,
Reaction with HCN, NH₂OH, Osazone formation and Epimerisation.)
- Lengthening of carbon chain of aldoses.
- Shortening of carbon chain of aldoses.

Unit:–III Ionic Equilibrium:

- Only Introduction.
Electrolysis, Ionic Equilibrium, Resistance, Conductance, Specific conductance, Equivalent Conductance, Molar Conductance, Equivalent Conductance at Infinite Dilution.
- Type of Conductrometric Titration.
Acid-Base Titration.
 - 1) Strong Acid Vs Strong Base.
 - 2) Strong Acid Vs Weak Base
 - 3) Weak Acid Vs Strong Base
 - 4) Weak Acid Vs Weak Base
 - 5) Strong Acid + Weak Acid Vs Strong Base.
- Transport number.
Determination of Transport Number.
 - 1) Hittorf's Method.
 - 2) Moving Boundary Method.
- Hydrolysis of Salt.
Classification of Salt.
 - 1) Strong Acid & Strong Base.
 - 2) Strong Acid & Weak Base.
 - 3) Weak Acid & Strong Base.
 - 4) Weak Acid & Weak Base.
- Numericals.

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Semester : IV

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Chemistry (CC CH – 402)

Unit:–I Boron Hydride :

- Introduction.
- Classification of hydrides.
- Preparation, properties structure and use of Diborane.
- Bridge bonding in B_2H_6 (M.O. and sp^3 approach.).
- Structure of higher Boranes : B_4H_{10} , B_5H_9 , B_5H_{11} , B_6H_{10} , $B_{10}H_{14}$.

Unit:–II Ultraviolet Spectroscopy :

- Type of electronic transitions.
- Effect of conjugation.
- Concept of Chromophore and Auxochrome.
- Bathochromic, Hypsochromic, Hyperchromic, and Hypochromic shifts.
- Woodward –fisher rules.
- Problems of conjugated enes, enones and aromatic ketones, aldehydes, acids and esters using empirical rules.

Unit:–III Electro Chemistry:

- Introduction of terms.
- Oxidation, Reduction, Redox, Anode, Cathode, Electrode, Half Cell, Oxidation & Reduction Potential.
- Electrochemical cell (Galvanic Cell) & Representation cell.
- Electrochemical Series and its Significance.

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- Nernst Equation of Cell EMF and single electrode potential.
- Describe the Electrode.
 - 1) Metal-Metal ion Electrode.
 - 2) Standard Hydrogen Electrode.
 - 3) Calomel Electrode.
 - 4) Weston standard Electrode.
 - 5) Glass Electrode.
 - 6) Quienhydron Electrode.
- Application of cell potential.
 - 1) Equilibrium constant.
 - 2) Free energy.
 - 3) pH.
- Numerical.

REF:-

❖ **Inorganic Chemistry**

1. Advance Inorganic chemistry – Satya Prakash . G.D.Tuli, S.K.Basu, R.D.Madan, S.Chand Voll-II.
2. Advance Inorganic chemistry – Satya Prakash, S.Chand Voll-I. Page No-819-828.

❖ **Organic Chemistry**

1. Organic Chemistry by Morrison and Boyd.4th ed. Pearson Education-2003
2. Organic Chemistry by pine, Hendrickson, Cram and Hammond 4th ed. By P.S.Kalsi.
3. Advance Organic Chemistry by Jerry March.
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5. Organic Chemistry Vol. I & II by S.M.Mukherji, S.P.Sing, R.P.Kapoor.
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7. Text book of Organic Chemistry by Arun Bahal, B.S.Bhal, S.Chand.
8. Spectroscopy of Organic Compounds 6th ed. by P.S.Kalsi.

9. Organic Chemistry by I.R.Finar.
10. Organic Spectroscopy by Williams and Kemp.
11. Spectroscopic Methods in Organic Chemistry by Dudley H. Williams and Ian Fleming.

❖ **Physical Chemistry**

1. Advance Physical Chemistry by Gurdeep Raj
2. Physical Chemistry (Question and Answers) by R.N.Madan, G.D.Tully, S.Chand.
3. Principal of Physical Chemistry by Puri, Sharma, Pathania.
4. Chemical Thermodynamics by R.P.Rastogy and R.R.Misra.
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6. Physical Chemistry by P.W.Atkins, 5th ed. , Oxferd, 1994, 7th ed. ,2002
7. Physical Chemistry by R.A.Alberty and R.J.Silbey, John Wiley, 1995.
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B.Sc.

Semester : IV

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Chemistry (SE CH – 401A)

SUBJECT ELECTIVE PAPER

(Name Reactions)

Unit:–I Mechanism and Synthetic applications of following Name Reactions :

- Arndt- Eistert Reaction.
- Hofmann Rearrangment.
- Aldol Condensation.
- Diels - Alder Reaction.

Unit:–II Mechanism and Synthetic applications of following Name Reactions :

- Dieckmann Condensation.
- Mannich Reaction.
- Clemmensen Reduction.
- Dakin Oxidation .

REF:-

1. Name Reaction by Prof.G.S.Kapadia, Uni.Granth Nirman Board.
2. Name Reaction by Jie Jack Li, Springer International Edition.
3. Reaction Mechanism and Reagents in Organic Chemistry by G.R.Chatwal.

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B.Sc. Semester : IV

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Chemistry (SE CH – 401B)

SUBJECT ELECTIVE PAPER

(Green Chemistry)

UNIT : I

Basics of Green Chemistry

- The need for green chemistry
- Eco-efficiency- environmental protection laws
- Challenges --pollution control and pollution
- Green methods, green products, recycling of waste
- Twelve principles of green chemistry
- Inception of green chemistry--awards for green chemistry
- International organizations promoting green chemistry.

UNIT : II.

Designing Green Synthesis

- Choice of starting materials, choice of reagents, choice of catalysts
- Bio catalysts, polymer supported catalysts, choice of solvents
- Synthesis involving basic principles of green chemistry
- Examples –adipic acid, catechol, methyl methacrylate, urethane, aromatic amines (4-aminodiphenylamine), benzyl bromide, acetaldehyde, citral, ibuprofen, paracetamol,

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REF :

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1. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).
2. V. Kumar, An Introduction to Green Chemistry, Vishal Publishing CO. Jalandhar, 2007.
3. Sanghi A Shrivastav Green Chemistry

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B.Sc.**

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Semester: IV
Laboratory Course-I (Chemistry)

Section: A Inorganic Chemistry (4 hours per practical)

- Inorganic qualitative analysis: (Any 7 Mixture out of 10)
Mixture Containing 4 Radicals
(Except PO_4^{-3} , BO_3^{-3} , ASO_4^{-3} , ASO_3^{-3} , O^{-2})
-

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Semester: IV

Laboratory Course-II (Chemistry)

Analytical Chemistry (4 hours per practical)

A. Volumetric Analysis of Cu, Zn, Ni (Any Three)

1. To determine the amount of Zn by EDTA Method.
2. To determine the amount of Ni by EDTA Method.
3. To determine the amount of Cu by Iodometry Method.
4. To determine the amount of Cu by EDTA titration.

B. Estimation of Glucose/Aniline/Phenol (Any Two)

1. To determine the amount of Aniline by Brominating Method.
2. To determine the amount of Phenol by Brominating Method.
3. To determine the amount of Glucose by oxidation Method.

C. Paper Chromatography 1st & 3rd Group Radicals

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❖ **University Exam Pattern:** (Two Days per Batch). HJGVZ_! # YL

Name of Practical	Day	Marks
Laboratory Course-I Inorganic Qualitative Analysis	One day (5 hours)	40+5(viva) = 45
Laboratory Course-II Analytical Chemistry	One day (5 hours)	40+5(viva) = 45
Journal		10
Total		100

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