

Acetone (propan-2-one): structure, formula, properties, uses and safety

The simplest ketone: a carbonyl group (C=O) between two methyl groups, CH₃COCH₃ or (CH₃)₂CO. Molecular formula C₃H₆O, molar mass 58.08 g/mol (PubChem CID 180). The carbonyl carbon is trigonal planar, bond angles about 120°; the C=O bond is strongly polar. IUPAC name propan-2-one: three carbons, a ketone on carbon 2.

Property	Value	Source
Molecular formula; molar mass	C ₃ H ₆ O; 58.08 g/mol	PubChem
Boiling point	329.3 K = 56.2 °C	NIST WebBook (117 values)
Melting point	178.7 K = -94.5 °C	NIST WebBook
Density	about 0.79 g/cm ³ at 20 °C	handbook
Solubility in water	miscible in all proportions	
Flash point	about -20 °C: highly flammable (GHS category 2)	safety data sheets
Vapour pressure	about 24 kPa at 20 °C: evaporates fast	handbook
Polarity; acidity	polar aprotic; very weak acid (pK _a about 19-20)	

Why the numbers are what they are

[] Low boiling point for a polar molecule: no O-H, so no hydrogen bonding with itself; only dipole-dipole forces. Propan-1-ol (60 g/mol) boils at 97 °C because it does hydrogen-bond

[] Miscible with water: the carbonyl oxygen accepts hydrogen bonds from water; the methyl groups mix with oils. Mixes with both, hence a solvent for almost everything

[] Dissolves nail polish, lacquer and some plastics (polystyrene, ABS, acetate): never store it in a polystyrene cup

Made and used

Made	cumene process (benzene + propene -> cumene -> phenol + acetone), millions of tonnes a year; lab: oxidise propan-2-ol with acidified dichromate
Largest uses	making methyl methacrylate (acrylic glass) and bisphenol A (polycarbonate, epoxy)
Solvent uses	nail polish remover, paint and resin thinner, brush and fibreglass cleaning, degreasing, laboratory glassware rinse, dry-ice cooling baths (-78 °C)
Other	dissolved acetylene in welding cylinders; a process solvent in pharmaceuticals
In the body	a ketone body made when fat is burned; leaves on the breath (fasting, keto diets, diabetic ketoacidosis)

From sciencewithshobha.com/blog/acetone-structure-formula-c3h6o-properties-uses-and-safety-the-simplest-ketone-explained/ · 1-on-1 online physics, chemistry and biology, KS3 to A level, Grades 6 to 12, free 30-minute first class.

The ketone family, safety, the curriculum, and a practice set

Ketone	Formula	Boiling point	Note
Propanone (acetone)	CH ₃ COCH ₃	56 °C	the first ketone; the position number is unnecessary
Butanone (MEK)	CH ₃ COC ₂ H ₅	80 °C	industrial solvent
Pentan-2-one	CH ₃ COC ₃ H ₇	102 °C	position number needed from five carbons
Pentan-3-one	C ₂ H ₅ COC ₂ H ₅	102 °C	isomer of pentan-2-one

[] General formula C_nH_{2n}O (same as aldehydes). Ketones have two carbons on the carbonyl carbon; aldehydes have a hydrogen there

[] Test: aldehydes give a silver mirror with Tollens' reagent and a brick-red precipitate with Fehling's; ketones give neither (no hydrogen to oxidise)

[] Reduction (NaBH₄ or LiAlH₄) gives a secondary alcohol: propanone → propan-2-ol. Nucleophilic addition at C=O (e.g. HCN → hydroxynitrile) is the A-level mechanism

Safety

[] Highly flammable: vapour ignites at room temperature and is heavier than air; keep from flames, hobs, pilot lights; closed metal or glass container

[] Irritant to eyes, nose and throat; dries skin. Vapour in a closed room causes headache and drowsiness: open a window

[] Low toxicity (the body makes it; not a carcinogen); swallowing is still a poison-control call

Curriculum	Where
England	A-level Chemistry: carbonyl compounds, nucleophilic addition, reduction, Tollens'/Fehling's, oxidation of secondary alcohols
US	High-school chemistry functional groups; AP intermolecular forces; college organic
Australia	Year 11-12 Chemistry organic
CBSE	Class 12 Aldehydes, Ketones and Carboxylic Acids
Ontario	Grade 12 SCH4U organic

Practice

1. Draw the displayed formula of acetone and state the bond angle at the carbonyl carbon.
2. Give the IUPAC name and explain each part.
3. Acetone (58 g/mol) boils at 56 °C; propan-1-ol (60 g/mol) at 97 °C. Explain.
4. Why is acetone miscible with water while hexane is not?
5. Name the alcohol that oxidises to acetone and the reagent.
6. A student stores acetone in a polystyrene cup near a Bunsen burner. What is wrong?

Answers

1. CH₃ - C(=O) - CH₃ with all hydrogens drawn; about 120°.
2. Propan-2-one: propan = three carbons, -one = ketone, 2 = the carbon carrying C=O.
3. Propan-1-ol has an O-H and hydrogen-bonds; acetone has only dipole-dipole forces.
4. The C=O accepts hydrogen bonds from water; hexane is non-polar with no such attraction.
5. Propan-2-ol; acidified potassium dichromate (orange to green).
6. Acetone dissolves polystyrene, so the cup leaks; its vapour is highly flammable near the flame.