Manufacturing ethanol: hydration

Student activity • observation and reasoning

YEAR 11 / LESSON 97 / CHEMISTRY ONLY

The question

Why does an industrial process need controlled conditions?

Model ethene hydration and label its industrial conditions. Connect the reaction equation to raw material use and recycling without building a pressure apparatus.

Equipment

• Booklet, pencil, periodic table and optional molecular model kit

Desk activity only; keep small model pieces away from mouths.

Course coverage: Chemistry only: 4.32C, hydration of ethene. Fermentation comparison follows in Lesson 98.

Plan, model or apparatus sketch

Draw a labelled structure or model to explain your reasoning for this lesson.

Method and reasoning

Read the whole sequence before starting

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1. Draw ethene and water, then construct ethanol while conserving atoms.

2. Write $C_2H_4(g)+H_2O(g) \rightleftharpoons C_2H_5OH(g)$.

3. Label the industrial reactor with about 300 °C, 60–70 atm and phosphoric acid catalyst.

4. Sketch feed, reactor, cooling/separation and recycle sections as a simplified flow diagram.

5. Explain why a catalyst speeds production without being consumed overall.

6. Evaluate a fossil-derived ethene feed against renewable sugar feed without claiming all ethene must be fossil-derived.

Cleanup

- Return shared equipment and retain corrected reasoning.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Syllabus hydration conditions: steam and ethene, phosphoric acid catalyst, about 300 °C and 60–70 atm. The process can operate continuously with separation and recycling. No numerical conversion or energy-use dataset is supplied.

Task	My structure / working	Reason / correction
Equation / structure		
Conditions		
Process evaluation		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. What reactants make ethanol by hydration?

2. Give the balanced equation.

3. State temperature and pressure.

4. Name the catalyst.

5. Why recycle unreacted feed?

6. Does hydration automatically mean a renewable feedstock?