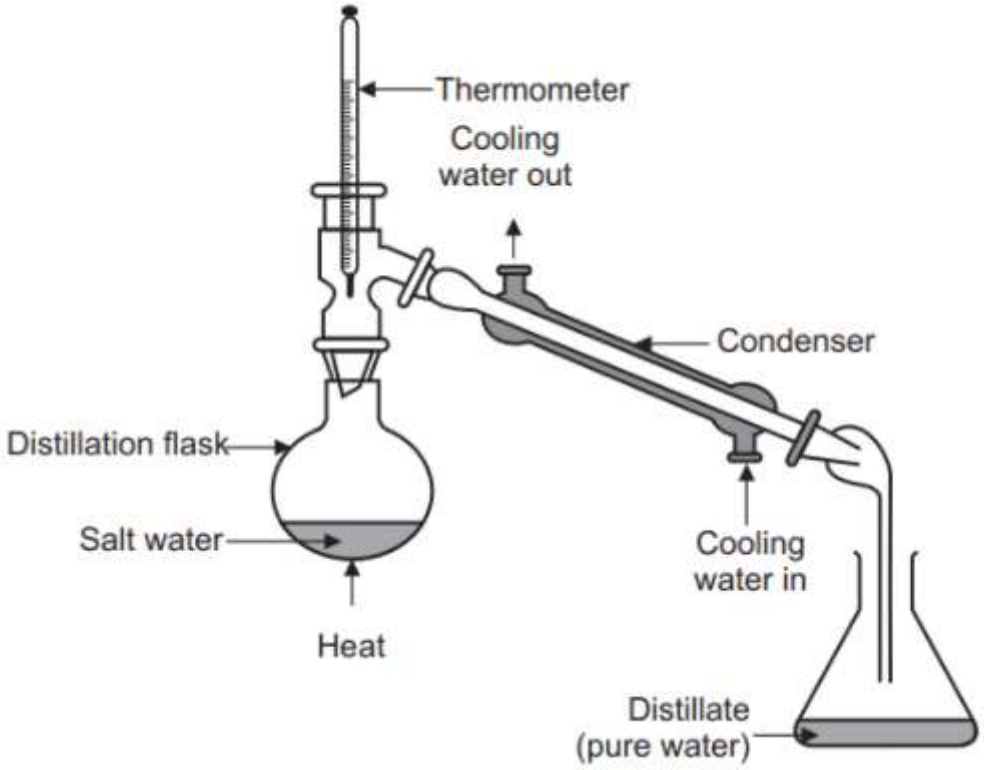
SNS COLLEGE OF PHARMACY AND HEALTH SCIENCES

COIMBATORE

UNIT 2 PUZZLES (PART II)
TOPIC: DISTILLATION
SUBJECT: PHARMACEUTICAL ENGINEERING

Case Study Puzzle 1: Purifying Ethanol-Water Mixture in a Lab A pharmaceutical lab needs to separate ethanol (BP 78°C) from water (BP 100°C) in a 50:50 mixture. Using a basic setup with a distillation flask, condenser, and receiver, they heat the mixture and collect the distillate at around 78°C.



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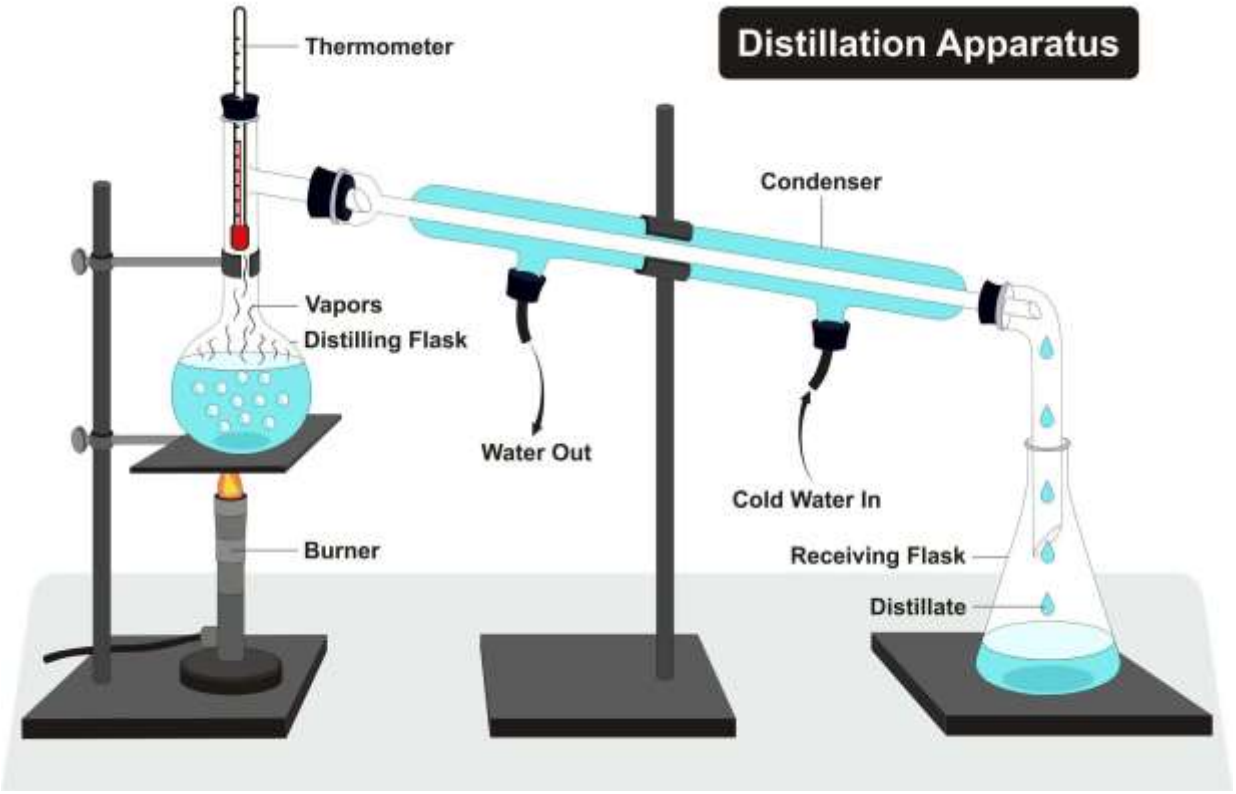

Questions:

1. Which distillation method is this, and what principle does it rely on?
2. Why can't pure ethanol be obtained if the mixture is near azeotropic composition?
3. What modification would allow better separation if components had closer boiling points?

Case Study Puzzle 2: Crude Oil Refining in a Petroleum Plant In an oil refinery, crude oil (mixture of hydrocarbons with BPs from 30°C to >400°C) is separated into gasoline, kerosene, diesel, etc. A tall column with trays allows vapors to rise and condense at different heights.

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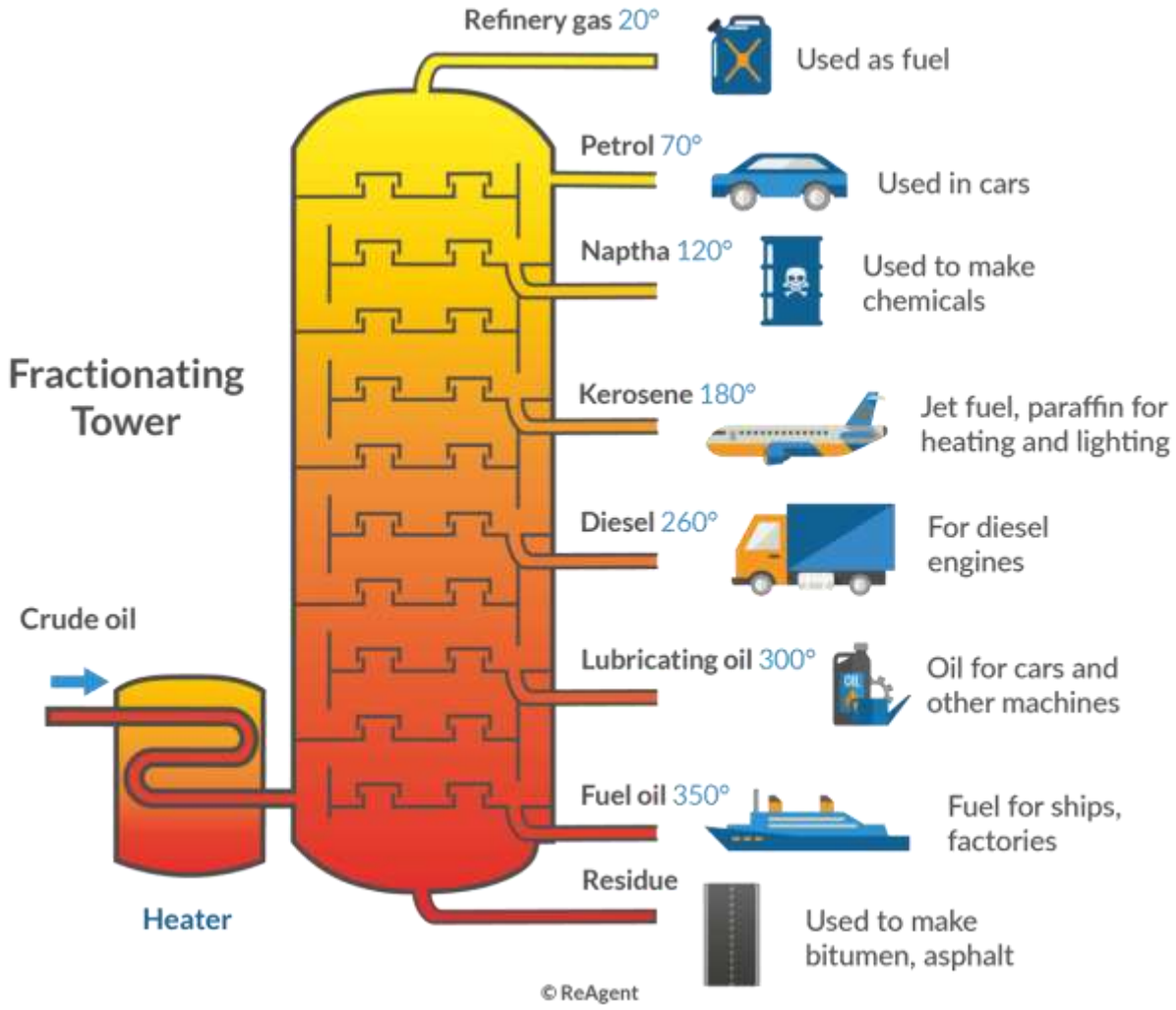

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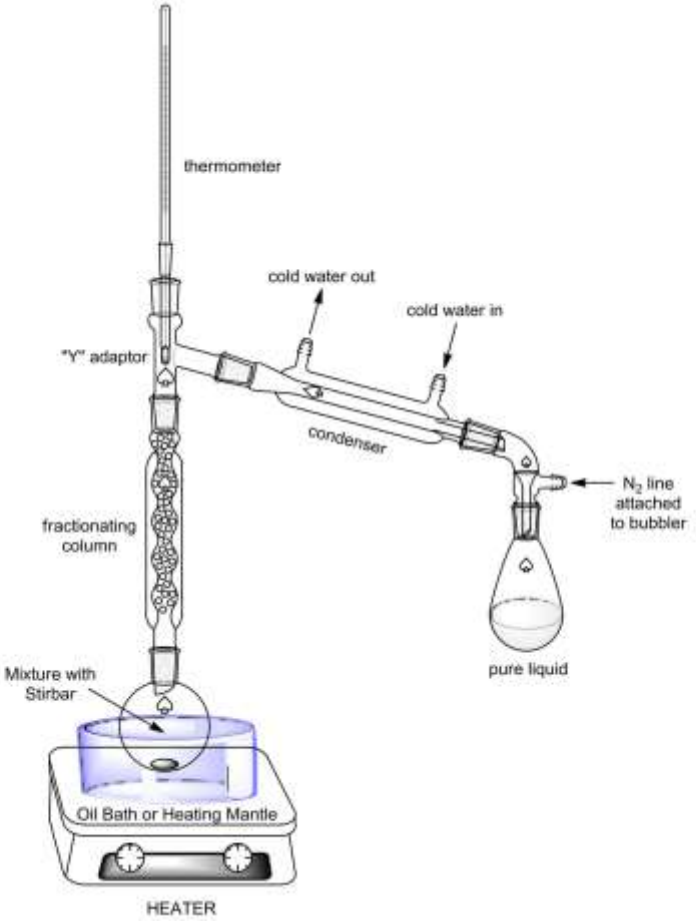
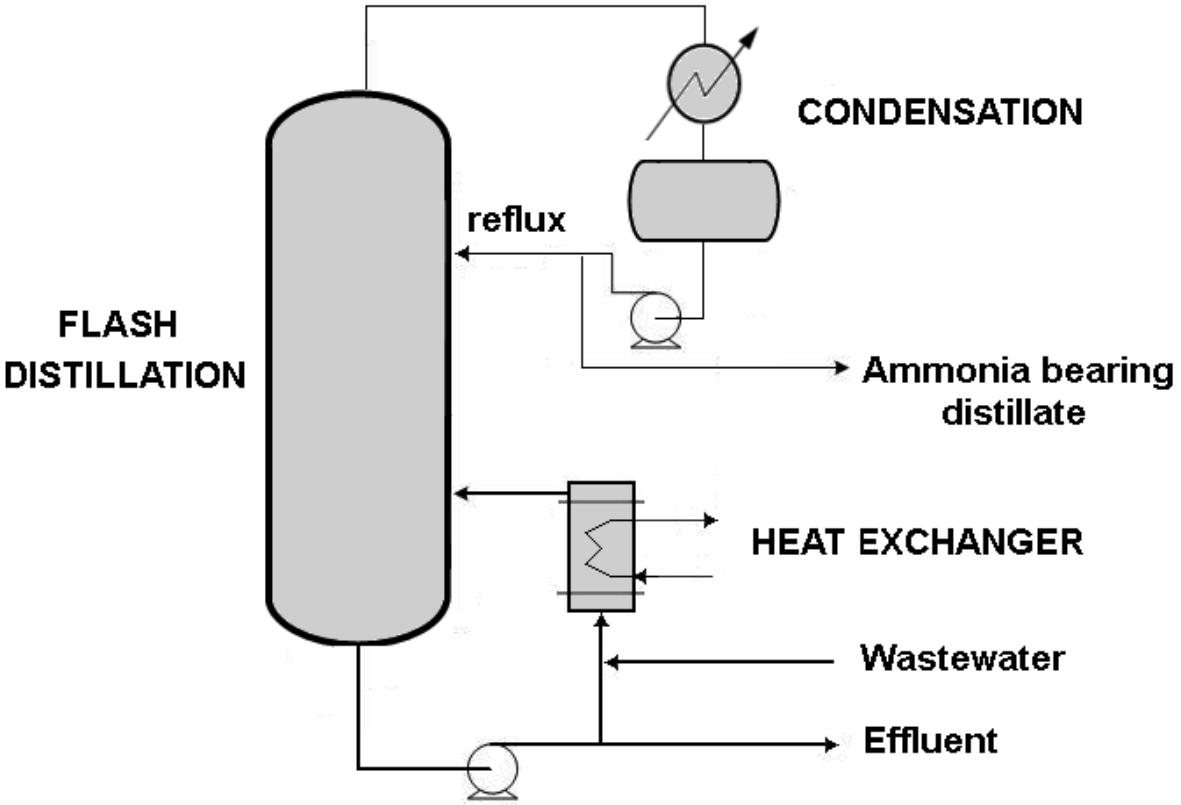


Questions:

1. Identify the method and why it's preferred over simple distillation here.
2. Why do lighter fractions (e.g., gasoline) collect at the top?
3. What role do theoretical plates play in efficiency?

Case Study Puzzle 3: Rapid Separation in Desalination Emergency During a field operation, a team needs to quickly separate saltwater partially by suddenly reducing pressure on heated seawater in a single-stage vessel, producing vapor and concentrated brine instantly.



Questions:

1. What is this continuous, single-stage process called?
2. Why is it faster than simple distillation?
3. Limitation: Why is separation incomplete?

Case Study Puzzle 4: Isolating Heat-Sensitive Antibiotic from Broth A biotech firm purifies a thermolabile compound (decomposes at 150°C atmospheric BP) from impurities. They use a setup with vacuum pump to lower pressure, distilling at 80°C without degradation.

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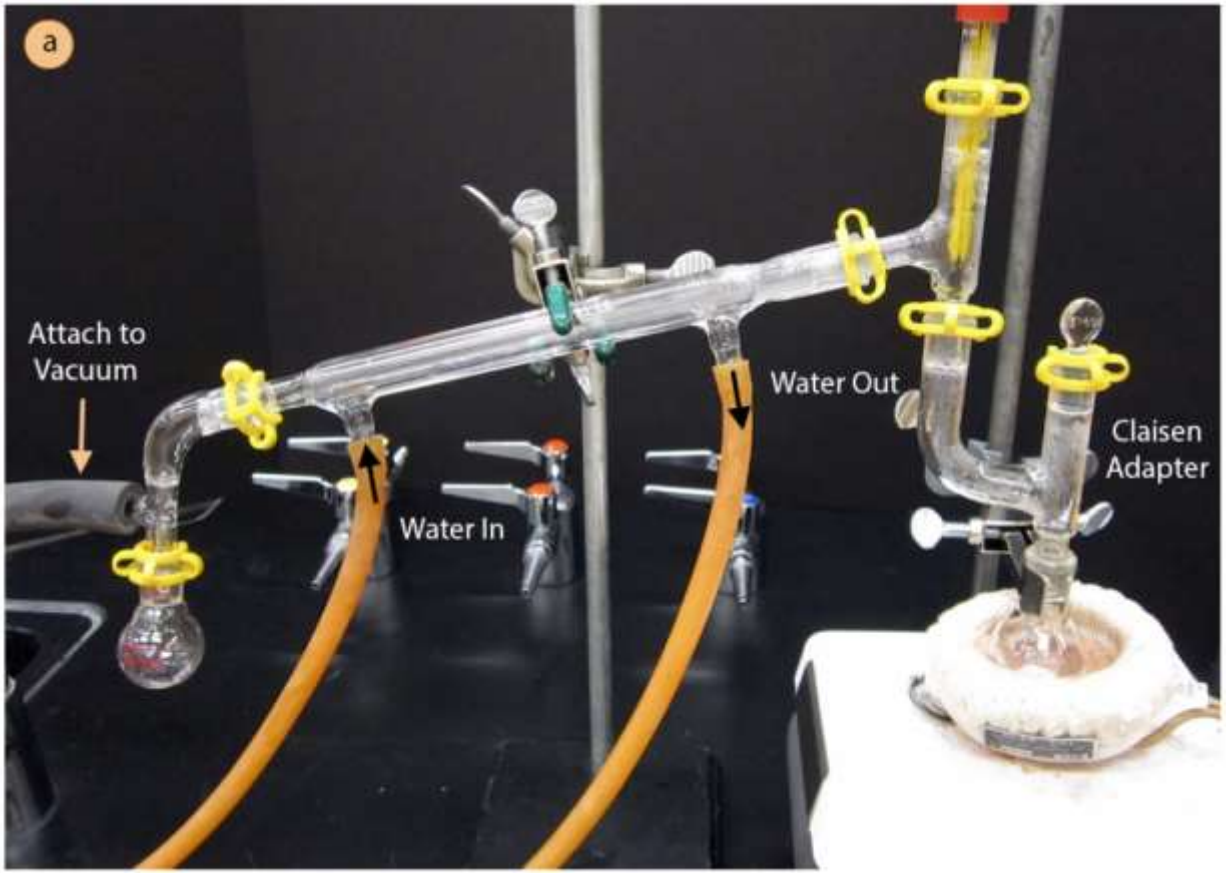

Questions:

1. Name the method and its key principle.
2. Why suitable for high-BP or heat-sensitive drugs?
3. Risk if pressure drops too low suddenly?

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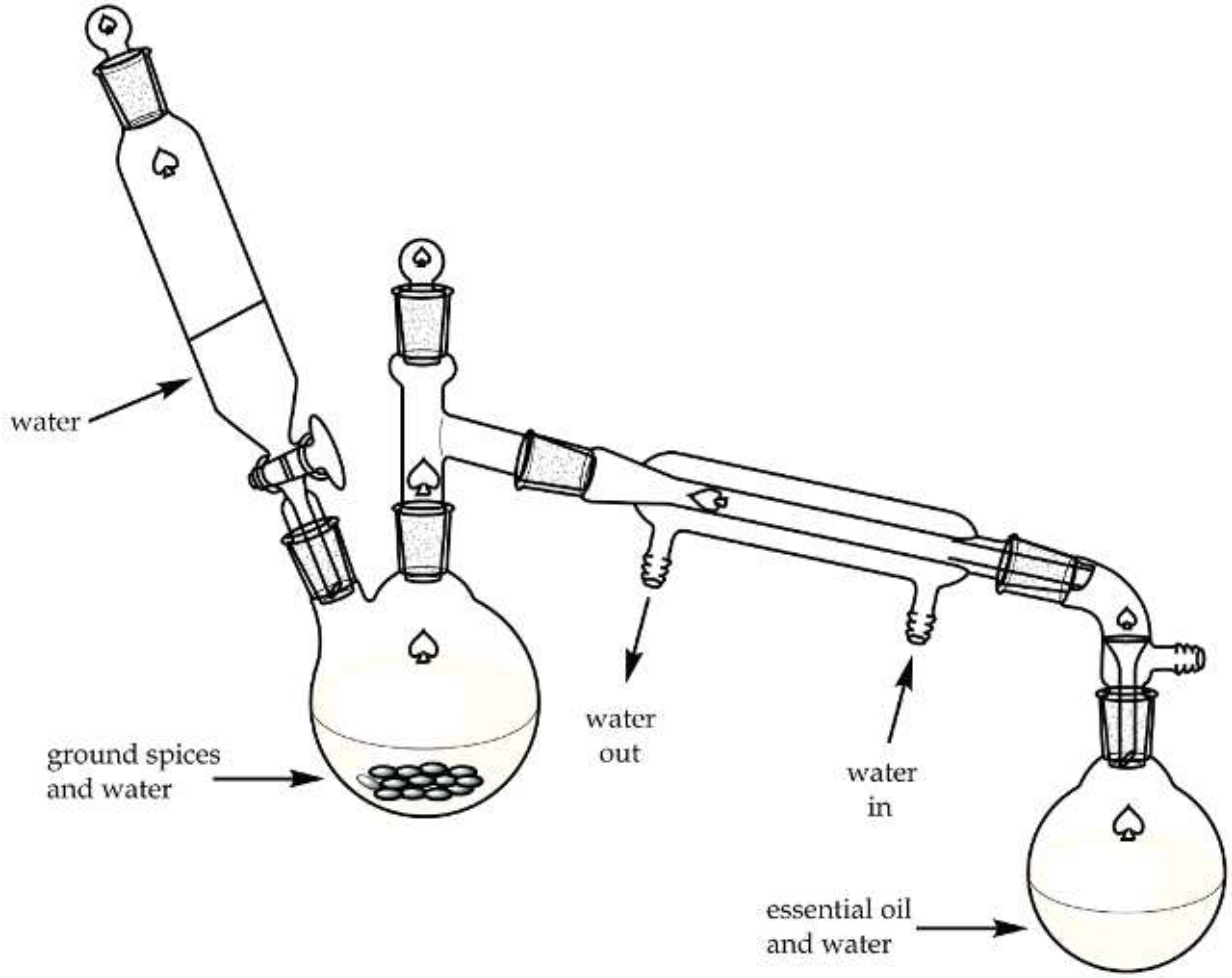
Case Study Puzzle 5: Extracting Lavender Essential Oil An herbal company extracts immiscible, high-BP volatile oils from lavender flowers. They pass steam through plant material; distillate separates into oil and water layers.



Questions:

1. Which method, and why does it work for steam-volatile but water-immiscible compounds?
2. Advantage over direct heating?
3. Why co-distills at <100°C despite oil BP >200°C?