

Open, set up and predict

Guide page 1 | Video chapters 1-4 | Write your predictions before continuing past chapter 3.

[Watch the Lab 01 demonstration from the beginning](#)

[Open Lab 01 in a second browser tab](#)

This walkthrough supplements the completed Week 1 classroom lesson. It shows the ideal binary calculation and how to retain evidence. Work at your own pace; it is not a new three-hour assignment. No repeat exit-ticket or attendance submission is required. Keep page 4 closed until your independent attempt on page 3.

1. Select the defined teaching case

Control	Enter or select
Chemical system	Teaching binary · synthetic
Liquid model	Ideal solution (the first entry)
Temperature / K	350
Flash pressure / kPa	95
Feed fraction z_1	0.5
Diagram	P-x-y · fixed temperature

The lab uses a **1 mol feed basis**. Component 1 is Component A and component 2 is Component B. Under **Data, models & limits**, follow **Property records**: at 350 K, $P_1^{\text{sat}}=150$ kPa and $P_2^{\text{sat}}=60$ kPa. These are supplied synthetic definitions, not real-fluid measurements. Keep T fixed throughout this walkthrough.

Sliders update immediately. After typing, click **Calculate equilibrium** →. A changed-input message means the old result is not current. The page has several later-course model options; use only the ideal solution here.

2. Predict first: pause at chapter 3

At fixed T and z_1 , how should the vapor fraction change when pressure decreases? Select your prediction in **At fixed T and feed composition, lowering P...** Predict the phases at 95, 110 and 80 kPa.

For an ideal binary at fixed T, calculate the two boundaries before checking the display:

$$P_{\text{bubble}} = x_1 P_1^{\text{sat}} + (1-x_1) P_2^{\text{sat}}, \text{ using } x_1=z_1$$

$$1/P_{\text{dew}} = y_1/P_1^{\text{sat}} + (1-y_1)/P_2^{\text{sat}}, \text{ using } y_1=z_1$$

The boundary outputs answer two separate first-phase questions. They do not say that both coexisting compositions at 95 kPa equal z_1 . Continue at chapter 4 to compare your prediction with the displayed boundaries.

Calculate, check and compare pressures

Guide page 2 | Video chapters 5-11 | Save the 95 kPa baseline before changing only pressure.

3. Read the 95 kPa flash result

Click **Calculate equilibrium** →. Record the phase label, **Vapor fraction** · β , **Liquid** · x_1 and **Vapor** · y_1 . On the P-x-y diagram, a horizontal tie line joins liquid and vapor at the same pressure. The feed composition lies between them in a two-phase state.

Case	P / kPa	Present phases	x_1	y_1	β
01A	95				
01B	110				
01C	80				

4. Verify a balance by hand

On the 1 mol basis, $L=1-\beta$ and $V=\beta$ (mol). Calculate $x_2=1-x_1$ and $y_2=1-y_1$. Check both component balances using the values you recorded:

$$z_1 = (1-\beta)x_1 + \beta y_1$$

$$1-z_1 = (1-\beta)(1-x_1) + \beta(1-y_1)$$

Expand **Check the solution** to compare your residual with the reported balance. A small rounded hand residual is expected. It verifies this calculation, not real-property accuracy. For an absent phase, record “not present” instead of inventing its composition.

Chapter 7: select **Diagram** → **Rachford-Rice** · **vapor fraction**. Its zero determines β for the converged K values; the horizontal axis is vapor fraction, not composition. For this ideal example, $K_i=P_i^{\text{sat}}/P$. Return to **P-x-y** · **fixed temperature** before saving.

5. Save each calculation before the next change

Open **Study workspace** · **reopen and compare cases** near the top. Set **Label for the next captured case** to “01A - 95 kPa”. Write a short interpretation in **Your explanation**, then click **Export experiment** ↓ near the bottom. It downloads the JSON and adds the case to the in-memory comparison.

For 01B, change only **Flash pressure** to 110 kPa, calculate, record and export with its new label. For 01C, change only pressure to 80 kPa; repeat. Keep system, model, T and z_1 unchanged. Review the three recorded cases in Study workspace.

Curve CSV ↓ downloads the selected diagram curve; it does not contain the complete study or restore controls. **Copy link to these conditions** shares settings, but omits prediction and reflection. Use the experiment JSON and comparison to retain full evidence.

Reopen and try a new pressure

Guide page 3 | Chapter 12: restore a saved case. Chapter 13: pause for your own 90 kPa attempt.

6. Download, load, restore, then recalculate

1. In **Study workspace · reopen and compare cases**, check that 01A, 01B and 01C are listed. Click **Download comparison** and keep the file **index-comparison.json** with this guide. The list is in memory; download it before leaving the page.
2. To verify your saved file, first confirm that the download exists. Then use **Clear comparison** to avoid duplicate cases. This clears the current list, not the downloaded file. The comparison holds up to eight cases.
3. Choose that file through **Load studies or a comparison JSON**. Click **Restore** beside the 95 kPa baseline. Verify the system, ideal model, $T=350\text{ K}$, $P=95\text{ kPa}$ and $z_1=0.5$.
4. Click **Calculate equilibrium** → again. Compare the fresh result with your saved 01A values. Loading retains recorded evidence; restoring inputs is not itself a fresh equilibrium calculation.

Raw JSON units: inputs.P and workspace.controls.P keep the displayed kPa value (95), but result.P and boundary result pressures use Pa ($95000\text{ Pa}=95\text{ kPa}$). Temperature is K; compositions and β are dimensionless. Check field meaning and units before comparing numbers.

7. Independent attempt: pressure = 90 kPa

Keep the same synthetic system, ideal model, $T=350\text{ K}$ and $z_1=0.5$. Pause at chapter 13 for about five minutes. Write your prediction and hand calculation before running the lab or opening page 4.

A. Compare 90 kPa with your bubble and dew boundaries. Which phases should be present?

B. Use $P=x_1P_1^{\text{sat}}+(1-x_1)P_2^{\text{sat}}$ to find x_1 . Then find $y_1=x_1P_1^{\text{sat}}/P$ and $\beta=(z_1-x_1)/(y_1-x_1)$. Calculate liquid and vapor amounts on the 1 mol basis.

C. Check both component balances. Explain the direction of the change in β from 95 to 90 kPa.

D. Now enter 90 kPa, calculate and compare. Save as “01D - 90 kPa practice” if you wish. Keep your first attempt and any correction. Continue to chapter 14 and page 4 only after the attempt.

Self-check after your attempt

Guide page 4 | Video chapter 14 | Compare methods and interpretation, not only the displayed digits.

Boundaries: two separate composition specifications

$$P_{\text{bubble}}(x_1=0.5)=0.5(150)+0.5(60)=\mathbf{105 \text{ kPa.}}$$

$$P_{\text{dew}}(y_1=0.5)=1/[0.5/150+0.5/60]=\mathbf{85.714286 \text{ kPa.}}$$

At this fixed feed composition, pressures between those boundaries give two phases. Above 105 kPa the feed is liquid; below 85.714286 kPa it is vapor. These statements apply to the specified synthetic ideal model at 350 K.

Case	Present phases	x_1	y_1	β
95 kPa	Liquid + vapor	0.388889	0.614035	0.493506
110 kPa	Liquid only	0.500000	Not present	0
80 kPa	Vapor only	Not present	0.500000	1

At 95 kPa: $x_1=(95-60)/(150-60)=0.388889$; $y_1=x_1(150)/95=0.614035$; $\beta=(0.5-x_1)/(y_1-x_1)=0.493506$. Thus $L=0.5064935 \text{ mol}$ and $V=0.4935065 \text{ mol}$. Both balances give 0.500000 mol of each component, up to rounding.

At 110 kPa all feed is liquid ($L=1$, $V=0 \text{ mol}$); at 80 kPa all is vapor ($L=0$, $V=1 \text{ mol}$). An absent phase has no bulk composition to report. A zero phase amount is meaningful; a missing composition is not zero.

Your 90 kPa attempt

Since $85.714286 < 90 < 105 \text{ kPa}$, the result is liquid + vapor.

$$x_1=(90-60)/(150-60)=\mathbf{1/3}$$

$$y_1=(1/3)(150/90)=\mathbf{5/9}$$

$$\beta=(1/2-1/3)/(5/9-1/3)=\mathbf{3/4=0.75}$$

$L=\mathbf{0.25 \text{ mol}}$, $V=\mathbf{0.75 \text{ mol}}$. Component 1: $(1/4)(1/3)+(3/4)(5/9)=1/12+5/12=\mathbf{1/2 \text{ mol}}$. Component 2: $(1/4)(2/3)+(3/4)(4/9)=1/6+1/3=\mathbf{1/2 \text{ mol}}$.

Lowering P from 95 to 90 kPa increases β from 0.493506 to 0.75 at fixed T and z . The tie-line compositions change as well. Do not confuse x_1 or y_1 (composition within a phase) with β (the fraction of the total feed that is vapor).

Retain a short, reproducible explanation

Check that you have: (1) your prediction and first 90 kPa attempt; (2) a labeled three-pressure comparison; (3) one hand balance; (4) downloaded experiment/comparison JSON; and (5) a restored case recalculated to the same result. Write one model assumption and explain the pressure trend. Your files remain local unless you choose to share them.

Use this demonstration to complete or revisit the original Week 1 practice. No repeat exit-ticket or attendance submission is required.

[Return to the Lab 01 video](#)