

Lab 10: set up a closed GSE vessel

Guide page 1 | Worksheet D, p. 3 | Predict at slide 15, watch slide 16, rerun at slide 18.

[Open Lab 10: Solid equilibria](#)

The lesson uses the GSE part of Lab 10. The SLE equation is a hand calculation; the binary eutectic interface is optional. Select **Experiment → GSE · sublimation in a rigid vessel** first, because changing mode resets its synthetic defaults.

Field	Enter / check
Property sources	Synthetic teaching definitions; not experimental properties.
Temperature / K	300
Minimum / maximum valid T / K	250 / 350
Subliming component / inert carrier	Synthetic volatile solid / Synthetic inert gas
Fixed free gas volume / L	1
Total volatile inventory / mol	0.010 for case 10A
Inert gas inventory / mol	0
Reference temperature / K	300
Sublimation pressure at reference / kPa	10
Sublimation enthalpy / J mol ⁻¹	50000

Click **Calculate equilibrium →**. Read the phase label and results table. At $T=T_{ref}$, the supplied sublimation pressure equals P_{ref} . The entered ΔH_{sub} controls the temperature sweep; it does not change P_{sub} at that reference point.

Before changing anything

Record P_A , total pressure, volatile gas amount, remaining solid and the balance residual. Use $n_{cap}=P_{sub}V/(RT)$ to check the result independently. Name your run 10A in your worksheet and, if desired, in the workspace field **Label for the next captured case**.

Select **Export study JSON**. The file downloads and is also captured in the in-memory workspace. The worksheet is your explanation; the exported study is a reproducible input/result record. Neither is automatically submitted.

Lab 10: compare, save and reopen

Guide page 2 | Three controlled cases | Keep the same T, volume, property relation and declared range.

Case	Change from previous case	Record
10A	Start $n_A=0.010$ mol, $n_{\text{inert}}=0$	Phase, P_A , P_{total} , gas and solid
10B	Only $n_A \rightarrow 0.002$ mol	Same quantities; explain depletion
10C	Only $n_{\text{inert}} \rightarrow 0.002$ mol	Separate partial from total pressure

After every input change, click **Calculate equilibrium** → before recording or exporting. The interface clears old results when inputs change. A disabled export button or “Inputs changed” message means the current inputs have no fresh result.

Read both plots

Choose **Partial and total pressure**, then **Gas and solid amounts**. The horizontal axis is temperature across the declared range, not time. The selected 300 K result is in the table. Compare actual volatile partial pressure with sublimation pressure; total pressure also includes inert gas. In the amount plot, gas plus solid is the volatile inventory and excludes inert gas.

Where solid remains, $P_A=P_{\text{sub}}$. After the solid inventory is exhausted, P_A can be lower. A negative $(\mu_{\text{gas}}-\mu_{\text{solid}})/RT$ then refers to the hypothetical absent solid and is compatible with stable all-vapor equilibrium. Gaps can indicate a pressure guard; do not interpret a missing segment as zero.

Save and reopen an actual calculation

1. Export each fresh case. Open **Study workspace · reopen and compare cases** near the top of the page. Check the captured case labels.
2. Click **Download comparison**. Keep the JSON with your worksheet. It contains records from this Lab only; Lab 11 uses its own comparison file.
3. To verify a saved file, use **Load studies or a comparison JSON**. If necessary, download first and use **Clear comparison** to avoid duplicate cases or the eight-case limit. Clearing the in-memory list does not delete downloaded files.
4. Click **Restore** beside the intended case. Verify the mode, temperature, volume, inventories and property values. Click **Calculate equilibrium** → again. Compare the fresh result with the recorded values; imported results are evidence, not a fresh solve.

Raw JSON units: Lab 10 stores pressure fields in Pa and volume in m^3 : $\text{input.Pref}=10000$ means 10 kPa; $\text{input.volume}=0.001$ means 1 L. Workspace controls preserve the values entered in the labeled interface. Do not treat raw-field numbers as display units.

Keep one annotated plot, three records and an independent balance. Model assumptions: ideal gases, one pure solid, no adsorption or reaction, fixed free gas volume, and no liquid formation in the declared range.

Lab 11: compare uptake models

Guide page 3 | Worksheet E-F, p. 4; G, p. 5 | Predict at slide 29, watch slide 30, rerun at slide 32.

[Open Lab 11: Adsorption equilibrium](#)

Work in **Explore isotherms**. Select **Reset synthetic parameters** if you need the defined starting point. The experimental fitting section below is optional and is not required for this lesson.

Field	Value
Adsorbate / adsorbent	Synthetic gas / Synthetic adsorbent
Parameter source	Synthetic definitions at 300 K
Parameter and vessel temperature / K	300
Minimum / maximum model pressure / kPa	0 / 100
Model to edit and use in the vessel	Langmuir initially
Capacity q_s / mol kg ⁻¹	2
Affinity b / kPa ⁻¹	0.1
Henry K / mol kg ⁻¹ kPa ⁻¹	0.2 (select Henry to inspect/edit)
Closed vessel: free gas volume / L	1
Dry adsorbent mass / g	10 initially
Total adsorbate inventory / mol	0.010
Nonadsorbing inert gas / mol	0

Expand **Closed vessel** to inspect its inputs. Return the selected model to Langmuir and click **Compare & solve vessel** →. The isotherm plot shows all four independently specified models, but the vessel table uses only the selected model.

Pressure is adsorbate partial pressure in kPa. Uptake is absolute mol/kg of dry adsorbent, numerically equal to mmol/g. The interface takes mass in g and volume in L; use kg in your hand balance. Temperature labels supplied parameters; changing T alone does not predict new adsorption parameters.

Lab 11: balance and retain evidence

Guide page 4 | Finish G before the unseen H attempt | No experimental data upload or fitting is required.

Case	Selected model	Dry mass / g	Other inputs
11A	Langmuir	10	Fixed as guide p. 3
11B	Henry	10	Only model changes
11C	Langmuir	20	Compare with 11A

For each case, click **Compare & solve vessel** →, record PA, q, gas adsorbate amount and adsorbed amount, and click **Export model study**. Input changes invalidate the previous result. Save each completed case before changing a control.

Calculate the independent balance

$$n_A = PA V_g / (RT) + m_s q(PA)$$

Use $R=8.314462618 \text{ kPa L mol}^{-1} \text{ K}^{-1}$, $V_g=1 \text{ L}$ and $m_s=0.010$ or 0.020 kg . With no inert gas, total gas pressure equals PA. Check the separate gas and adsorbed amounts, not only the small residual reported by the solver. Rounded display values can create a small hand residual; JSON preserves additional digits.

Matching $KH=q_s b$ gives the same zero-pressure slope. It does not make Henry and Langmuir equivalent at finite pressure. For a larger adsorbent mass at fixed total inventory, distinguish lower uptake per kg from the total amount adsorbed on all of the solid.

Reopen and recalculate

Open **Study workspace** • **reopen and compare cases**. Download the Lab 11 comparison, then load it through **Load studies or a comparison JSON**. Restore a chosen case, check the selected model and all vessel inputs, and click **Compare & solve vessel** → for a fresh solve. Keep the comparison and worksheet together. Do not mix Lab 10 and Lab 11 files in one workspace.

Raw JSON units: Lab 11 stores volume in m^3 and adsorbent mass in kg: $0.001 \text{ m}^3=1 \text{ L}$ and $0.010 \text{ kg}=10 \text{ g}$. Its pressure and isotherm parameters retain the labeled kPa basis. Workspace control strings retain the original display units.

If a result is unavailable

Read the reported reason. The vessel root must lie inside the declared pressure range and model window. Expand a range only when supported by the model/property source, not merely to force an answer. Absolute and excess uptake have different balances; do not substitute excess adsorption without its correction. No kinetics or energy balance is solved.

Attempt H1-H4 on worksheet p. 6 before opening solutions. At slide 39 complete the existing anonymous Session 4 exit ticket and feedback; include numerical evidence from both Labs and actual study time. Submit once, wait for "Response received," then verify the receipt on slide 40. No separate attendance identity is collected.

[Return to the complete lesson route](#)