Equilibrium: temperature and pressure

Student activity • observation and reasoning

YEAR 11 / LESSON 89 / CHEMISTRY ONLY

The question

Which direction opposes the imposed change?

Use balanced gaseous equations and energy information to predict equilibrium shifts. Separate composition changes from changes in reaction speed.

Equipment

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

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

Course coverage: Chemistry only: 3.22C, changes in equilibrium position. Paper models only.

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

YEAR 11 / LESSON 89 / CHEMISTRY ONLY

1. Write $N_2(g)+3H_2(g) \rightleftharpoons 2NH_3(g)$, with forward reaction exothermic. Count gaseous amounts on each side.

2. Predict the effect of heating at fixed pressure, then cooling. Explain using the endothermic direction.

3. Predict compression at fixed temperature. Compare four gas amounts with two; do not count coefficients of solids.

4. Consider $H_2(g)+I_2(g) \rightleftharpoons 2HI(g)$. Explain why compression does not favour either side in the ideal-gas model.

5. Sketch how ammonia amount changes after cooling and re-establishing equilibrium; label a qualitative curve, not measured data.

6. Distinguish a greater final yield from a faster approach to equilibrium.

Cleanup

- Return shared equipment and retain corrected reasoning.

Record your evidence

Blank spaces are for your own work

YEAR 11 / LESSON 89 / CHEMISTRY ONLY

Reference and task data

Model equations: $N_2(g)+3H_2(g) \rightleftharpoons 2NH_3(g)$, forward exothermic; $H_2(g)+I_2(g) \rightleftharpoons 2HI(g)$, equal gaseous amounts. Assume closed equilibrium systems; pressure is changed by volume, not by adding reactant. No measured yield data are supplied.

Task	My structure / working	Reason / correction
Temperature change		
Pressure change		
Equal gas amounts		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

YEAR 11 / LESSON 89 / CHEMISTRY ONLY

1. What happens to ammonia yield on heating?

2. What happens on cooling?

3. What happens on compression at fixed temperature?

4. Why does the HI example show no pressure shift?

5. Does cooling necessarily speed production?

6. Why is a closed system required for a lasting equilibrium?