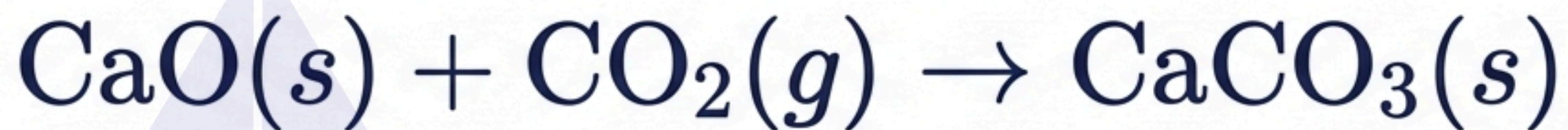


# Standard Enthalpy of Formation | $\Delta_f H^\circ$



$$\Delta_r H^\circ = -178.3 \text{ kJ mol}^{-1}$$

**IS THIS REALLY A FORMATION REACTION?**

Calcium carbonate is being formed... but does this represent its Standard Enthalpy of Formation ( $\Delta_f H^\circ$ )?

# The Strict Thermodynamic Definition

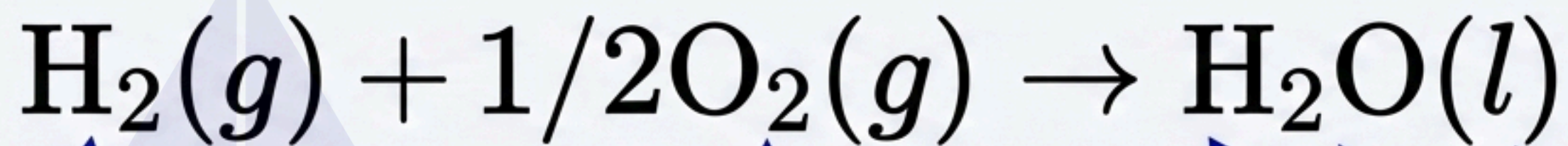
## Standard Enthalpy of Formation ( $\Delta_f H^\circ$ )

The enthalpy change for the formation of exactly 1 mole of a compound from its constituent elements in their reference states.

1. **The 'What':** Exactly 1 mole of the product compound is formed.
2. **The 'How':** Formed exclusively from constituent elements (not other compounds).
3. **The 'Condition':** Elements must be in their standard reference states (most stable aggregation at 1 bar).

*If any of these three conditions fail, the reaction is just a generic enthalpy of reaction ( $\Delta_r H^\circ$ ), not a formation reaction ( $\Delta_f H^\circ$ )*

# The Diagnostic Checklist in Action



$$\Delta_f H^\circ = -285.8 \text{ kJ mol}^{-1}$$

no compounds

1 mole ✓

elements ✓

reference states ✓



# You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
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# The Baseline Axiom: Reference States

$$\Delta_f H^\circ = 0$$

*For an element in its reference state.*

## Reference State vs. Other States

### Reference States ( $\Delta_f H^\circ = 0$ )

Carbon: C(graphite, s)

Oxygen: O<sub>2</sub>(g)

Sulphur: S(rhombic, s)

### Non-Reference States ( $\Delta_f H^\circ \neq 0$ )

C(diamond, s)

O<sub>3</sub>(g) [Ozone]

S(monoclinic, s)

# Calculating Reaction Enthalpy

$$\left[ \Delta_r H^\circ = \sum \nu \Delta_f H^\circ (\text{products}) - \sum \nu \Delta_f H^\circ (\text{reactants}) \right]$$

$\Delta_r H^\circ$  = Standard Enthalpy of the overall Reaction

$\Sigma$  = Summation

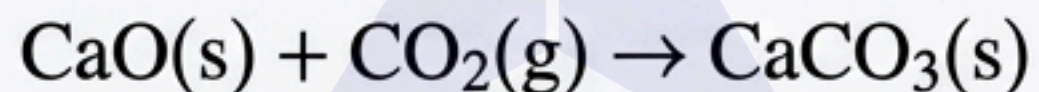
$\nu$  = Stoichiometric coefficients from the balanced equation (crucial step: do not forget to multiply!)

# JEE Trap Checklist

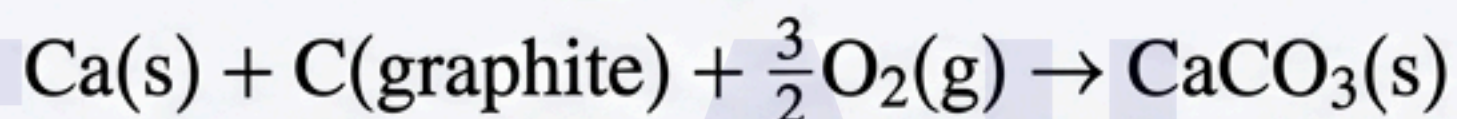
## JEE Trap Alert

### Trap 1: Starting from compounds

**✗ Wrong**

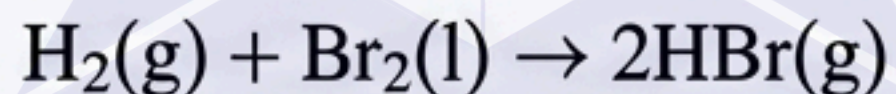


**✓ Right**

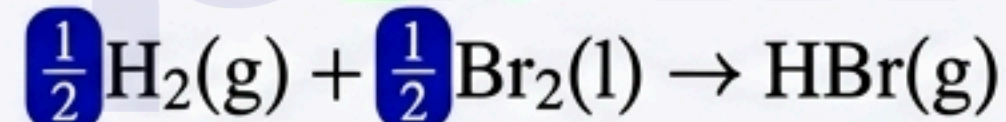


### Trap 2: Forming >1 mole of product

**✗ Wrong**

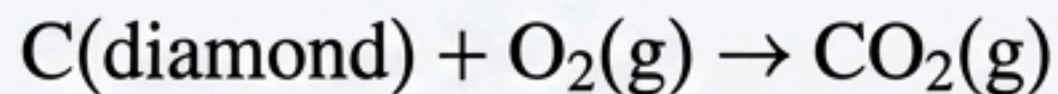


**✓ Right**



### Trap 3: Using a non-standard allotrope

**✗ Wrong**



**✓ Right**



Examiners will manipulate stoichiometry and physical states. Always run the 3-point diagnostic check.



# You've Learned the Theory.

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