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# BORN-HABER CYCLES

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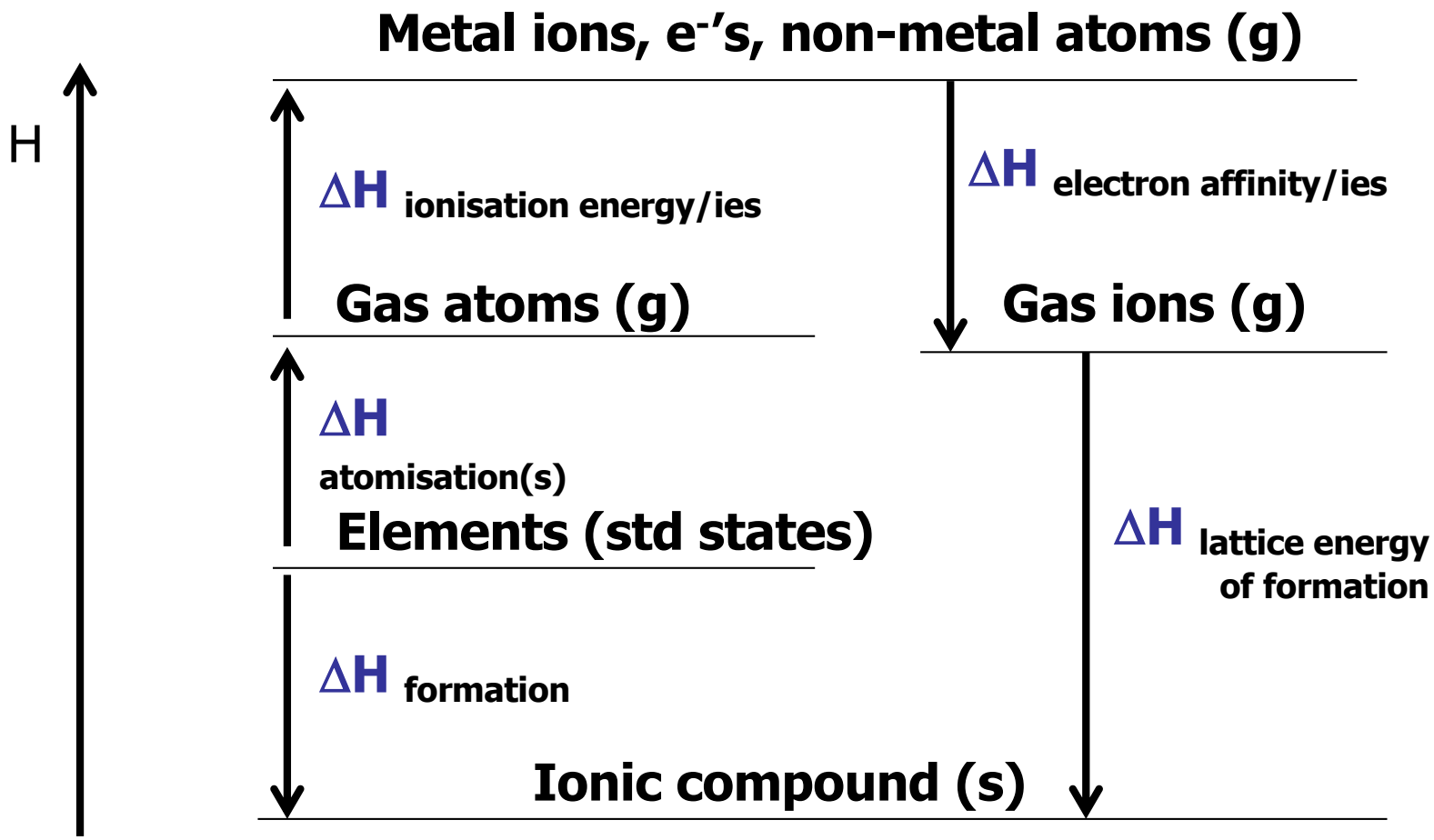
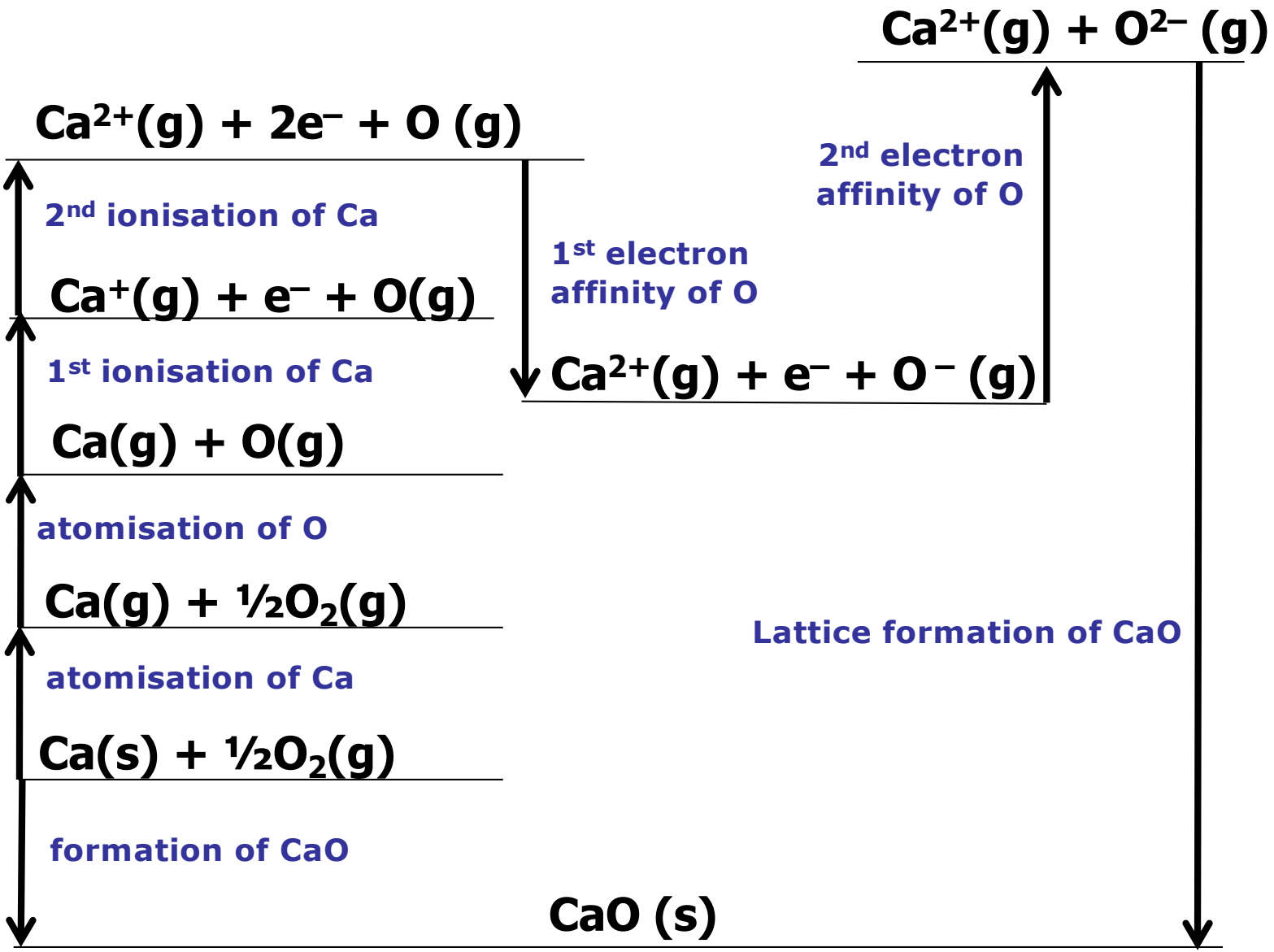



**$\Delta H_{formation}$ = sum of all other $\Delta H$'s**

# CaO

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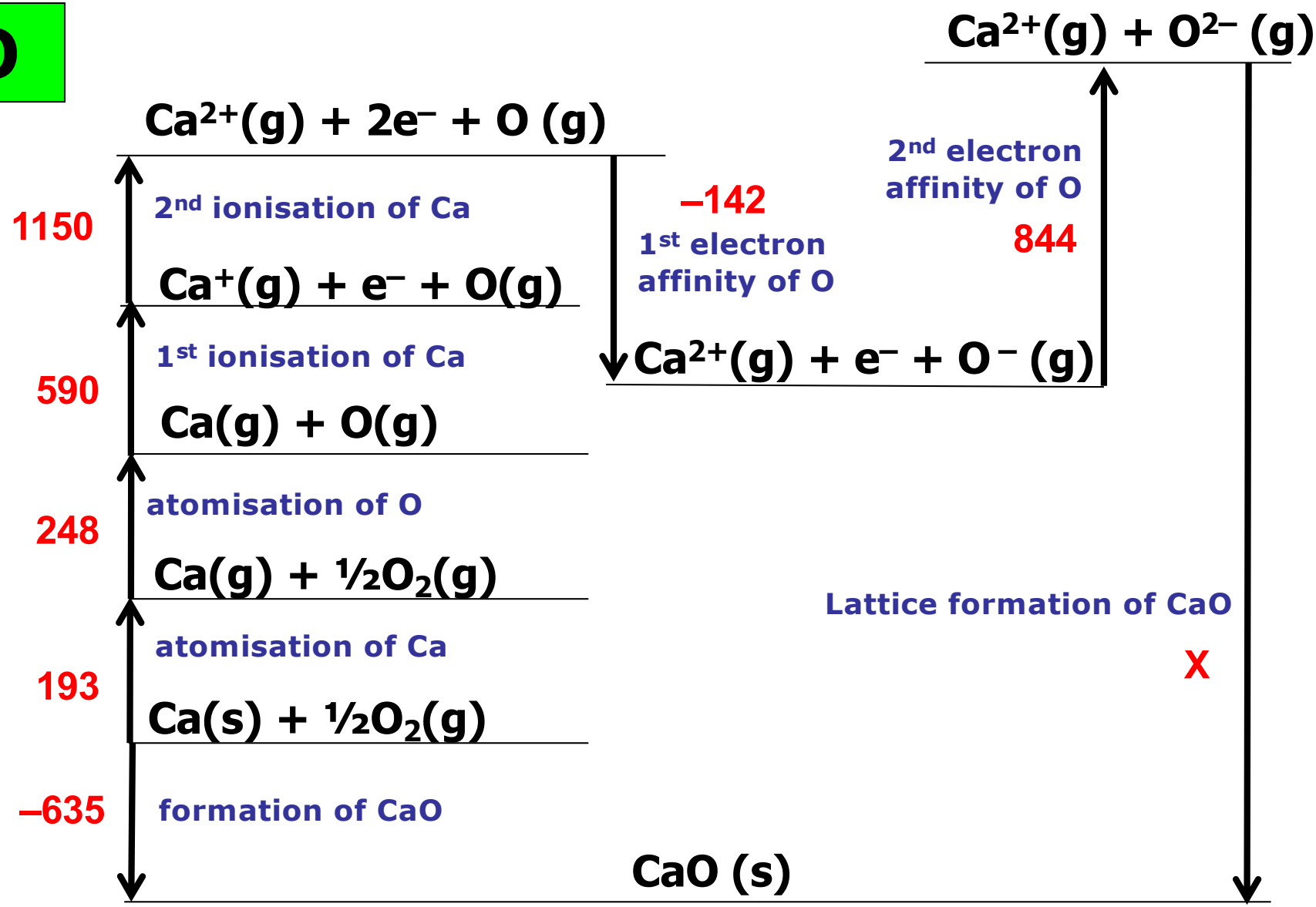
# CaO

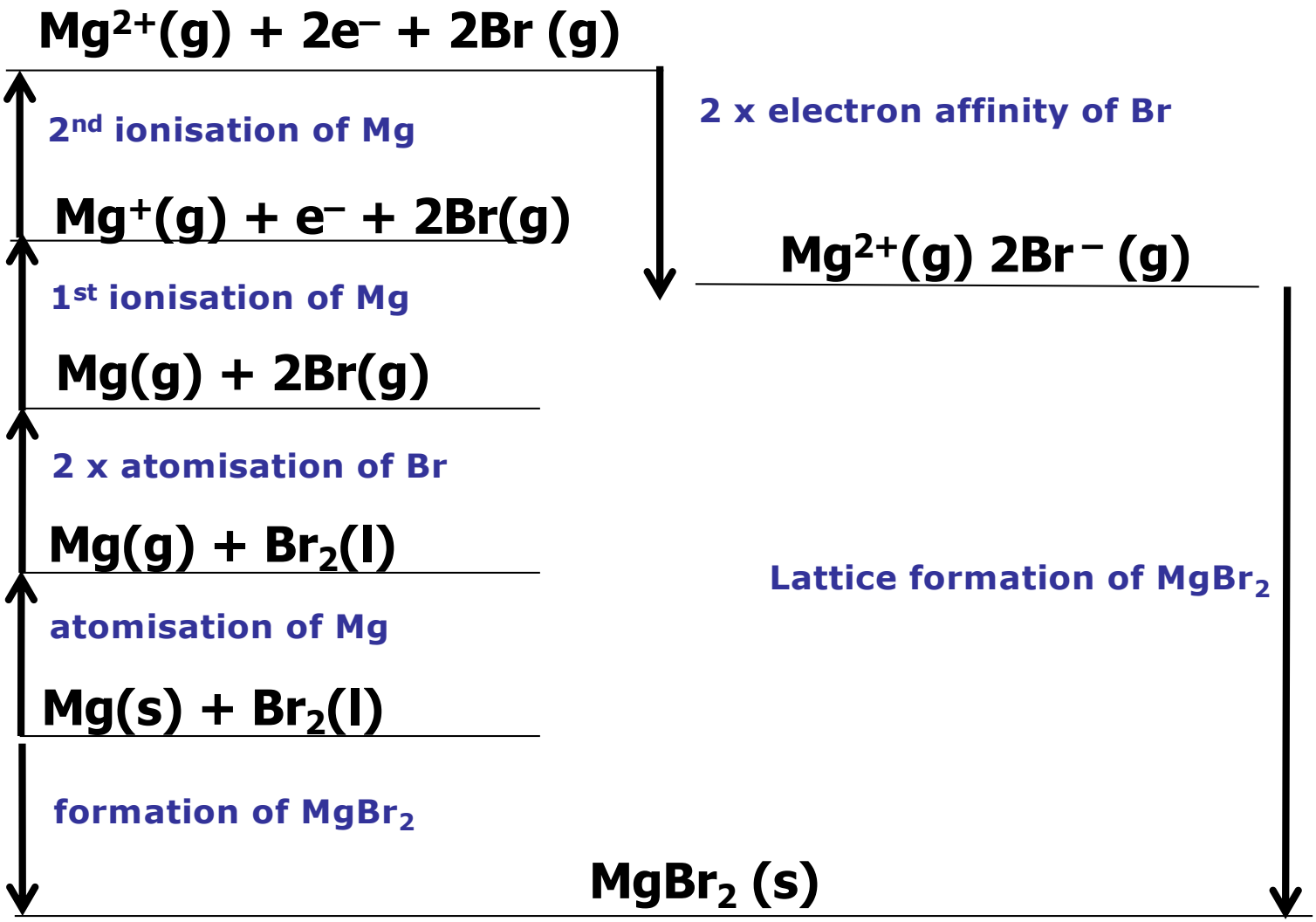



$$-635 = 193 + 248 + 590 + 1150 - 142 + 844 + \Delta H_{lattice}$$

$$\Delta H_{lattice} = -635 - 193 - 248 - 590 - 1150 + 142 - 844$$

$$= \underline{-3518 \text{ kJ mol}^{-1}}$$

# $MgBr_2$

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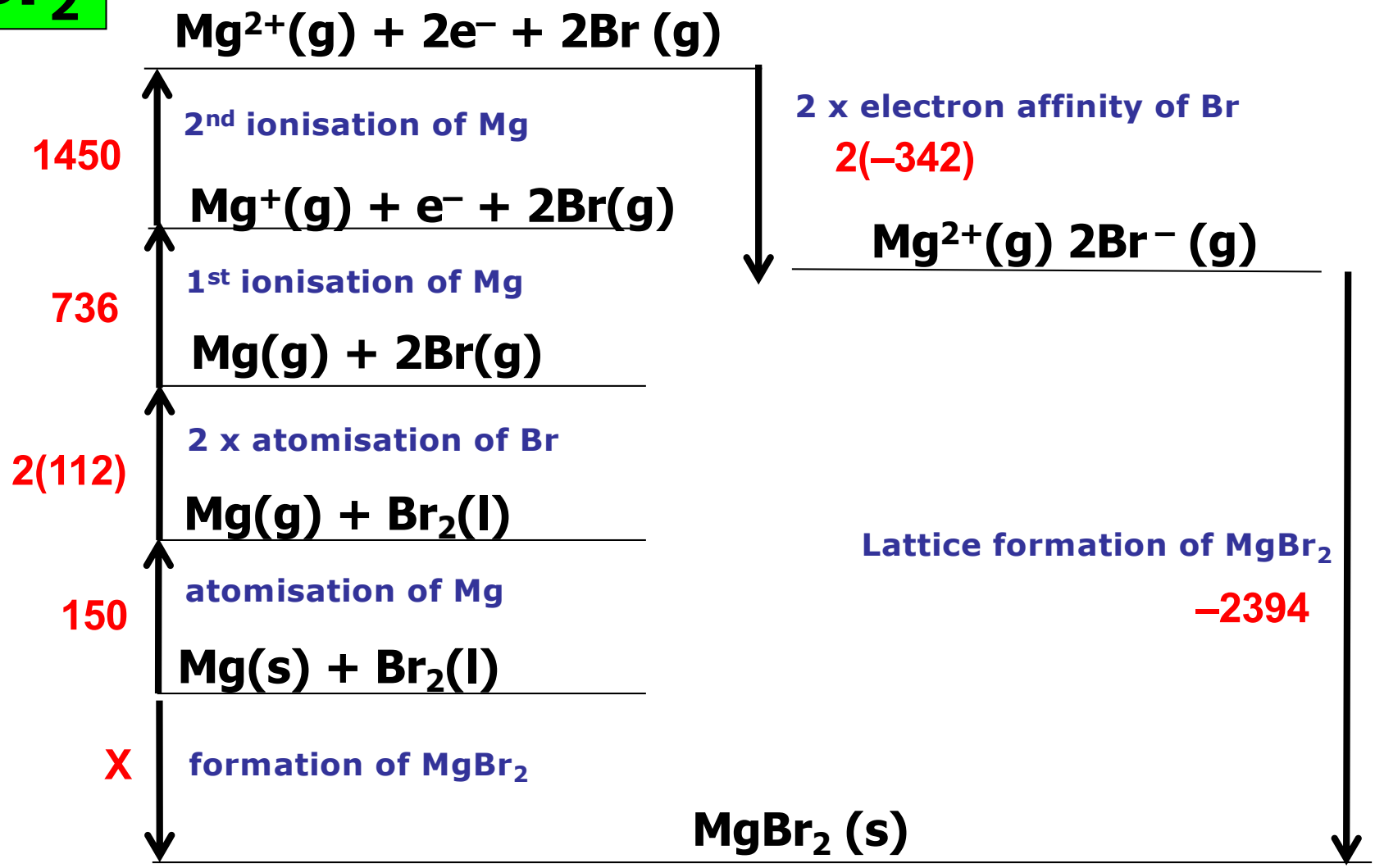
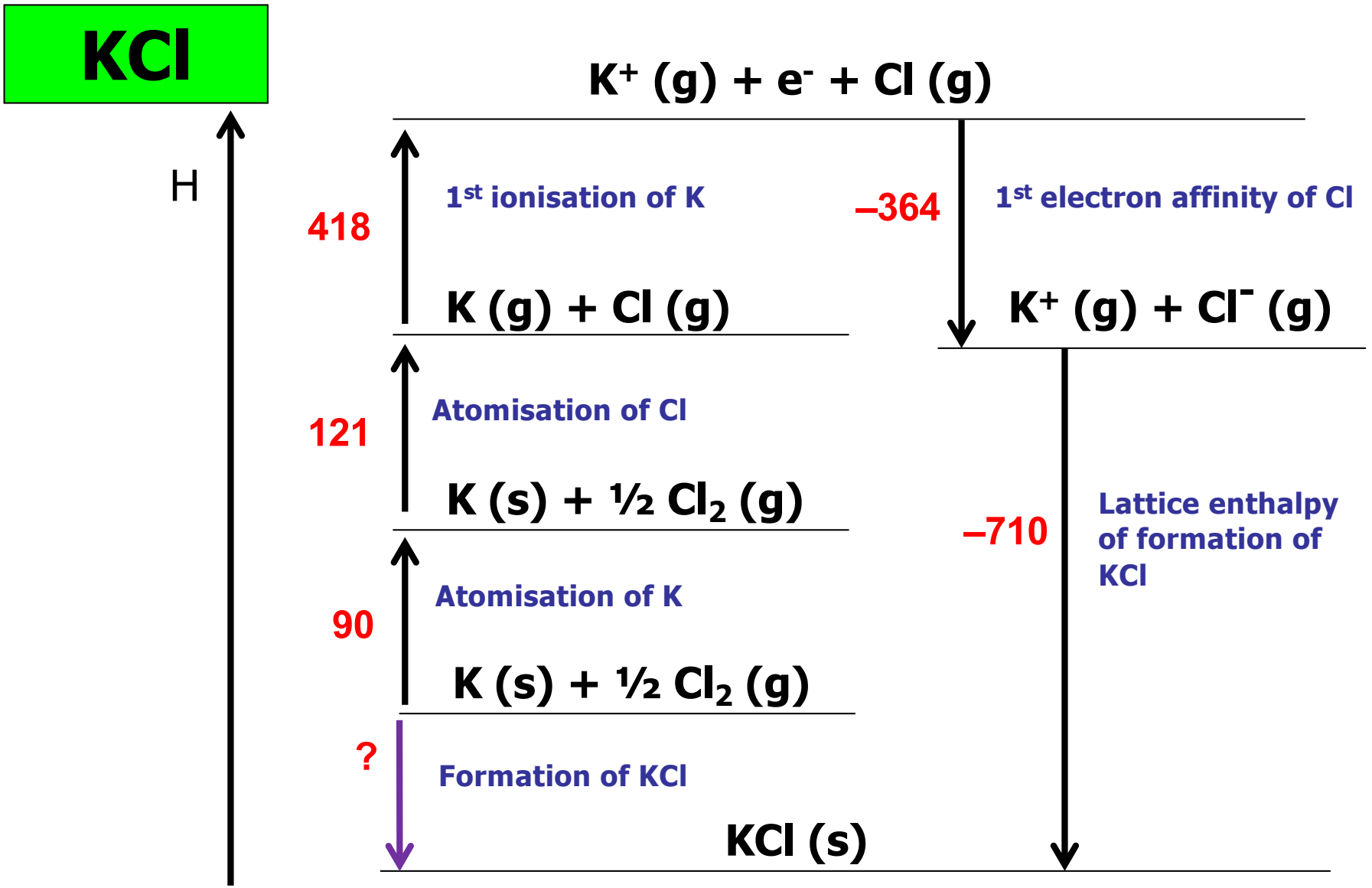
# $MgBr_2$




$\Delta H_{formation}$ = 150 + 2(112) + 736 + 1450 + 2(–342) –2394

$\Delta H_{formation}$ = **– 518 kJ mol$^{-1}$**




$\Delta H_{formation} = 90 + 121 + 418 - 364 - 710 = \underline{-445 \text{ kJ mol}^{-1}}$

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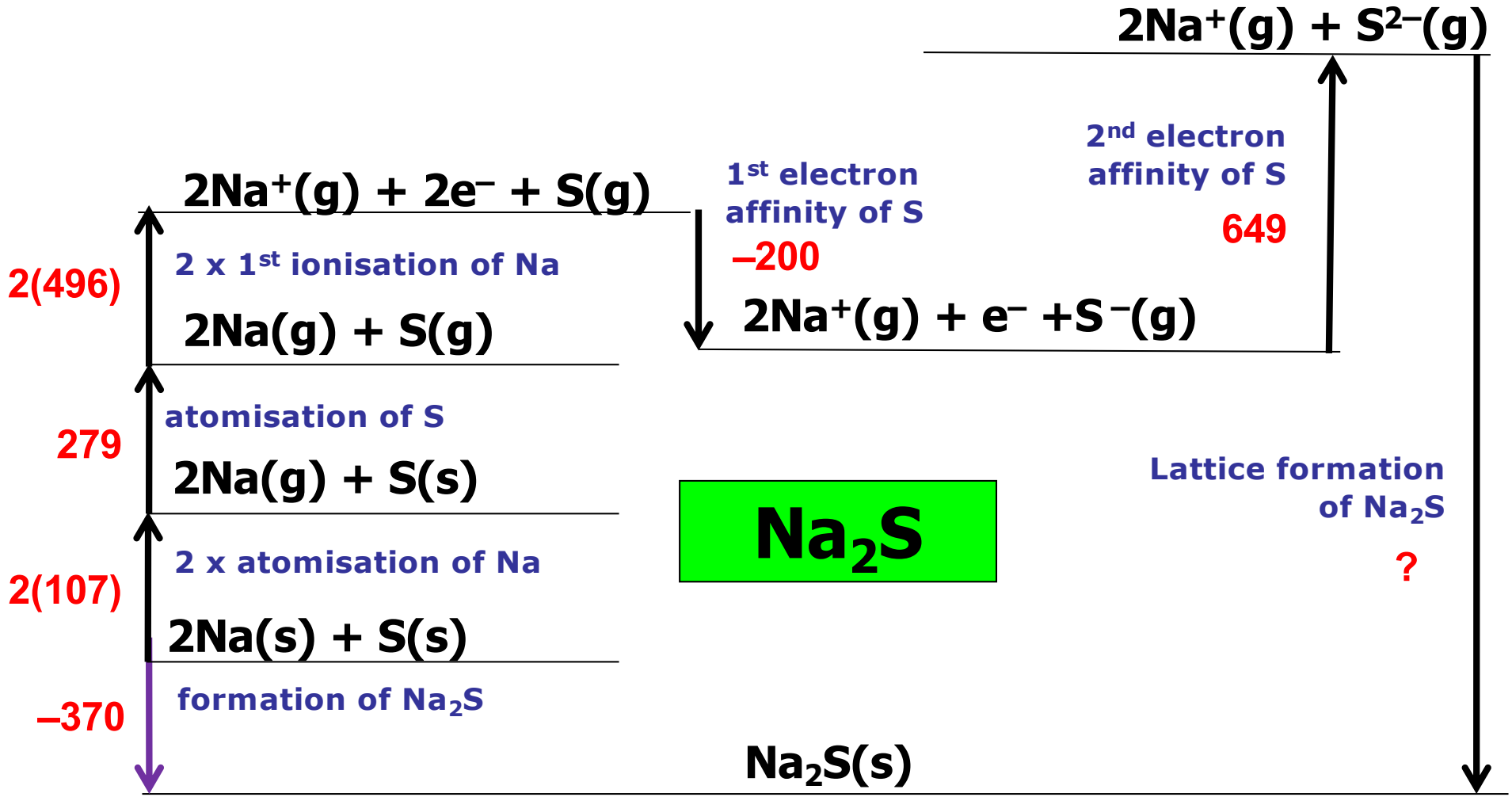


$$-370 = 2(107) + 279 + 2(496) - 200 + 649 + \Delta H_{lattice}$$

$$\Delta H_{lattice} = -370 - 2(107) - 279 - 2(496) + 200 - 649$$

$$= \underline{-2304 \text{ kJ mol}^{-1}}$$

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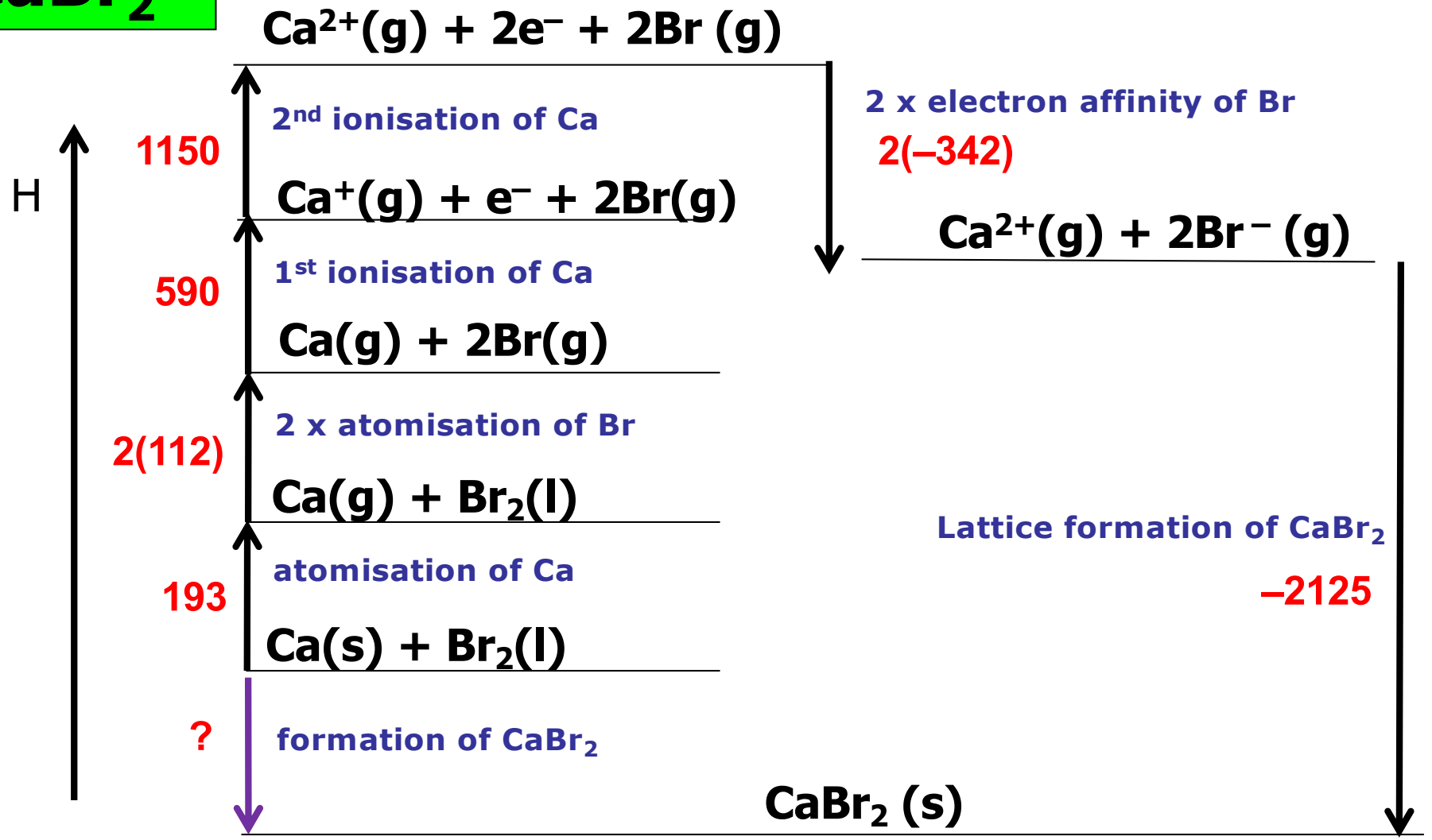
# $CaBr_2$




$\Delta H_{formation} = 193 + 2(112) + 590 + 1150 - 2(342) - 2125$

$= \underline{-652 \text{ kJ mol}^{-1}}$

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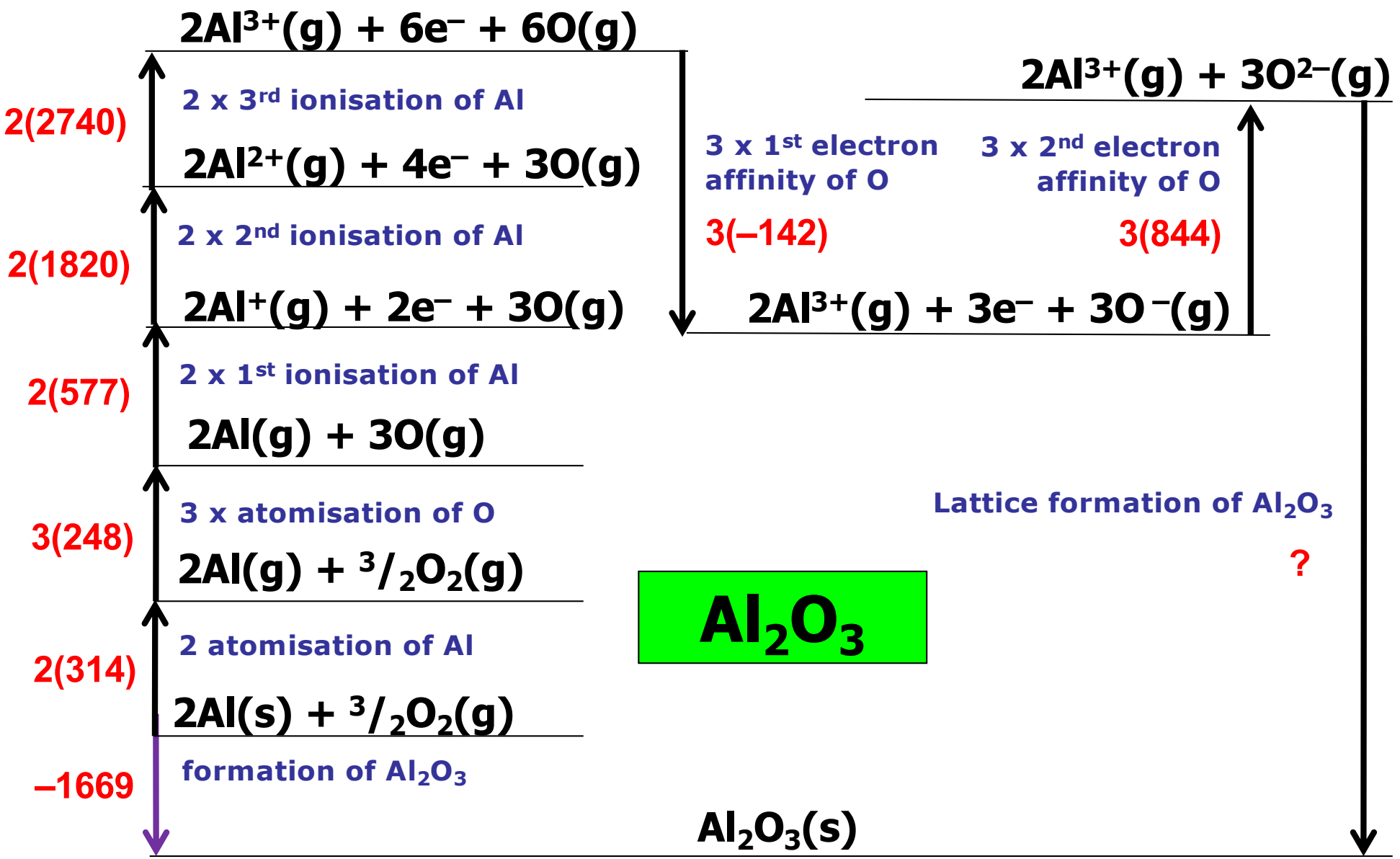


$-1669 = 2(314) + 3(248) + 2(577) + 2(1820) + 2(2740) + 3(-142) + 3(844) + \Delta H$

$\Delta H = -1669 - 2(314) - 3(248) - 2(577) - 2(1820) - 2(2740) + 3(142) - 3(844)$

$= \underline{-15421 \text{ kJ mol}^{-1}}$

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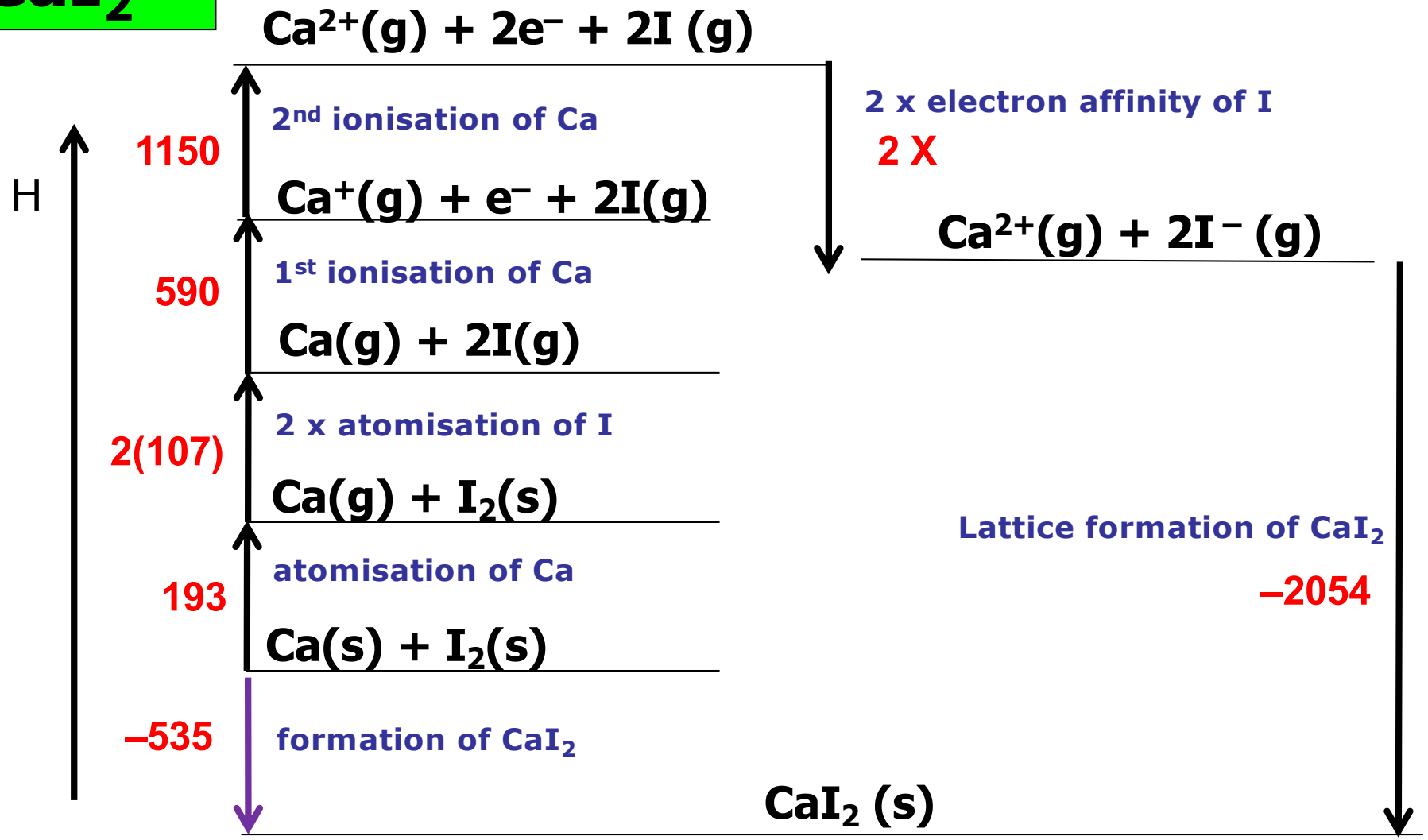
# $CaI_2$




$-535 = 193 + 2(107) + 590 + 1150 + 2X - 2054$

$2X = -535 - 193 - 2(107) - 590 - 1150 + 2054$

$2X = -628 \qquad X = \underline{-314 \text{ kJ mol}^{-1}}$

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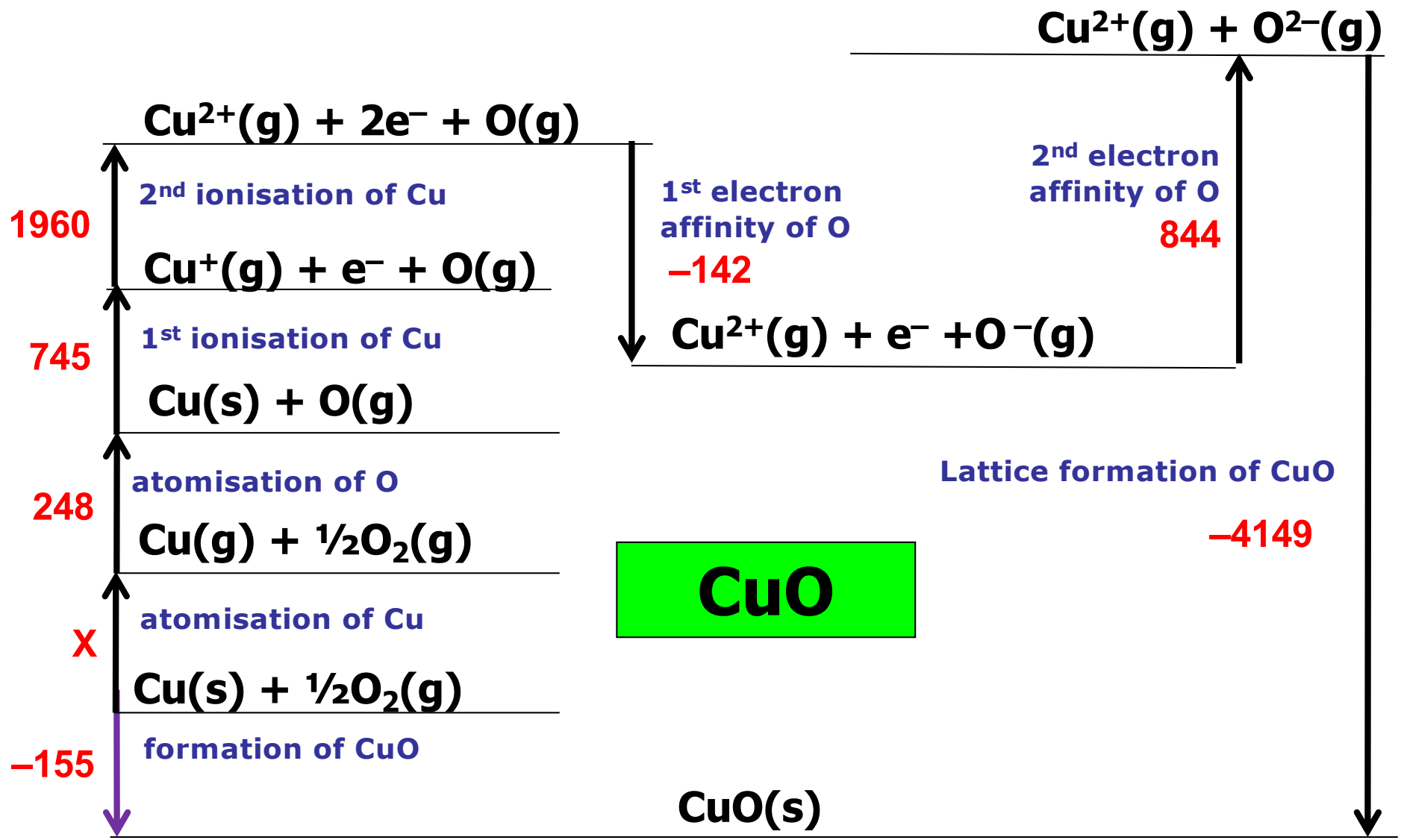


$-155 = X + 248 + 745 + 1960 - 142 + 844 - 4149$

$X = -155 - 248 - 745 - 1960 + 142 - 844 + 4149$

$= \underline{+ 339 \text{ kJ mol}^{-1}}$

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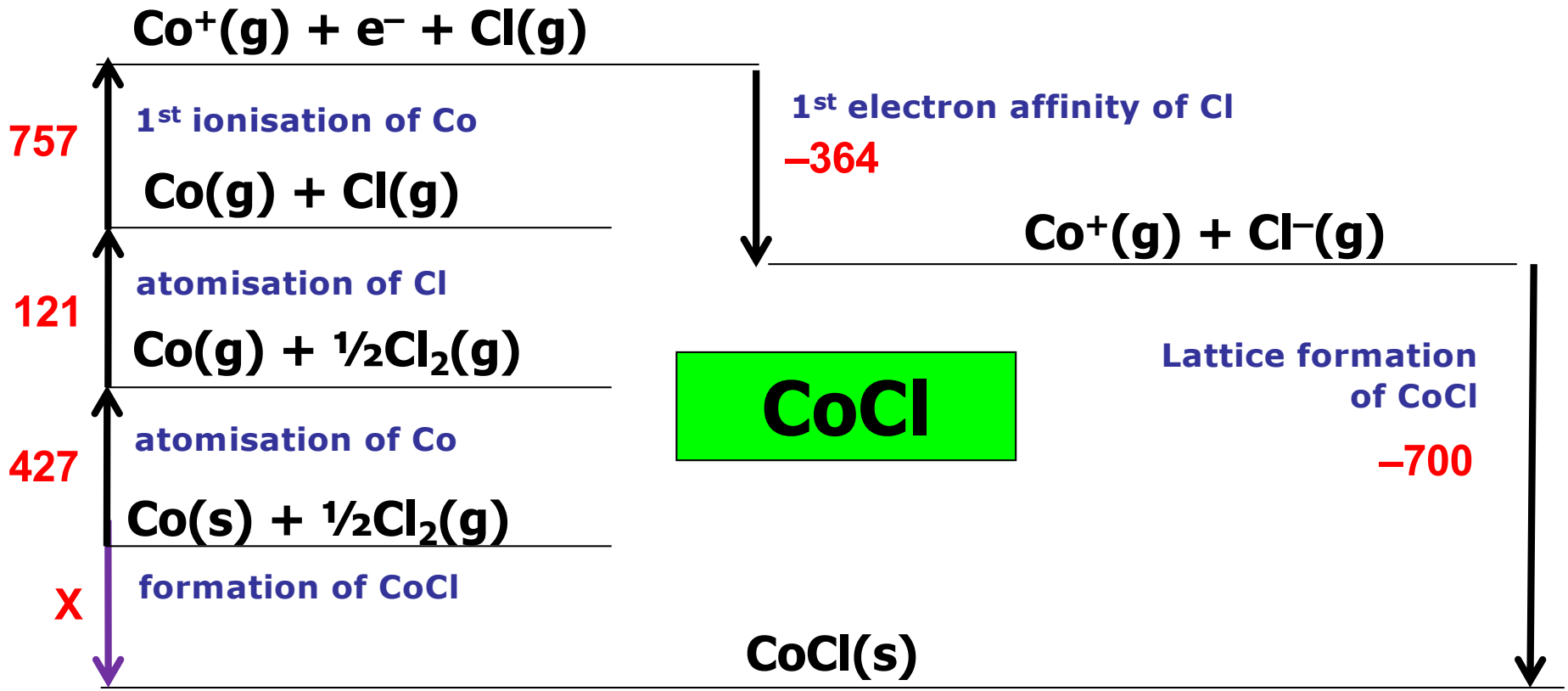


$\Delta H_{formation}$ = 427 + 121 + 757 – 364 – 700

= **+ 241 kJ mol$^{-1}$**

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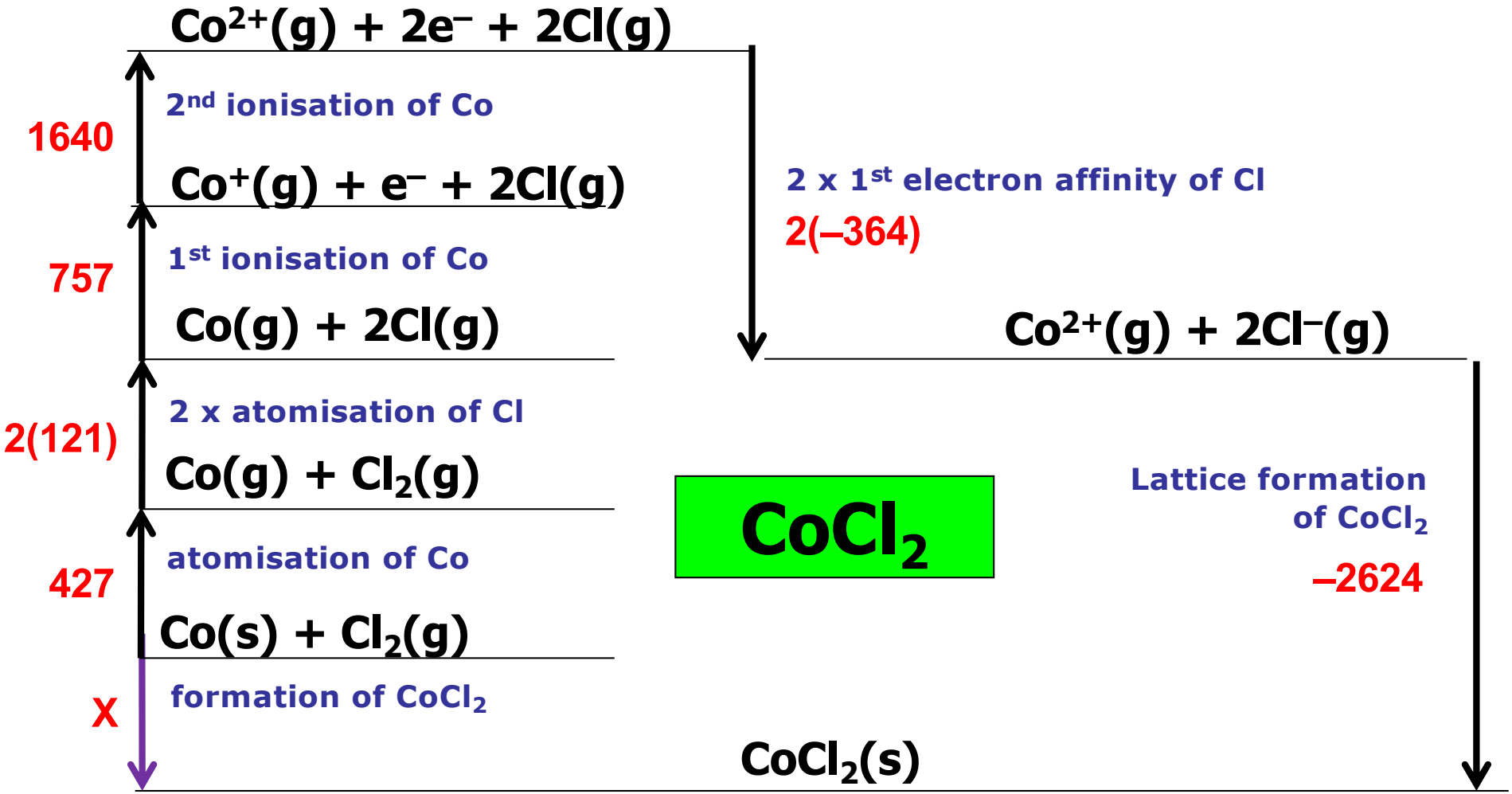


$\Delta H_{formation} = 427 + 2(121) + 757 + 1640 - 2(364) - 2624$

$= \underline{-286 \text{ kJ mol}^{-1}}$

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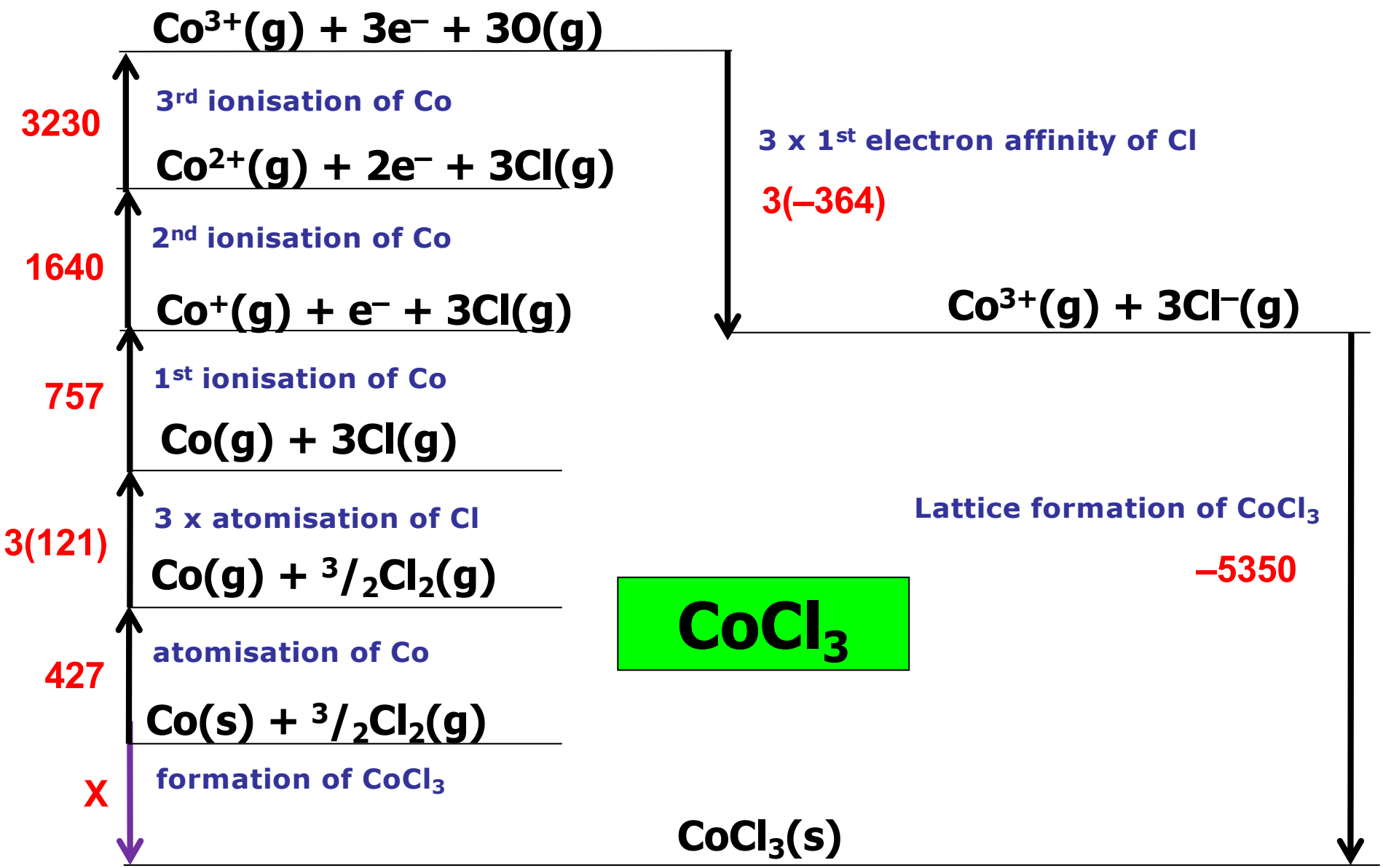


$\Delta H_{formation}$ = 427 + 3(121) + 757 + 1640 + 3230 – 3(364) – 5350

= **– 25 kJ mol$^{-1}$**

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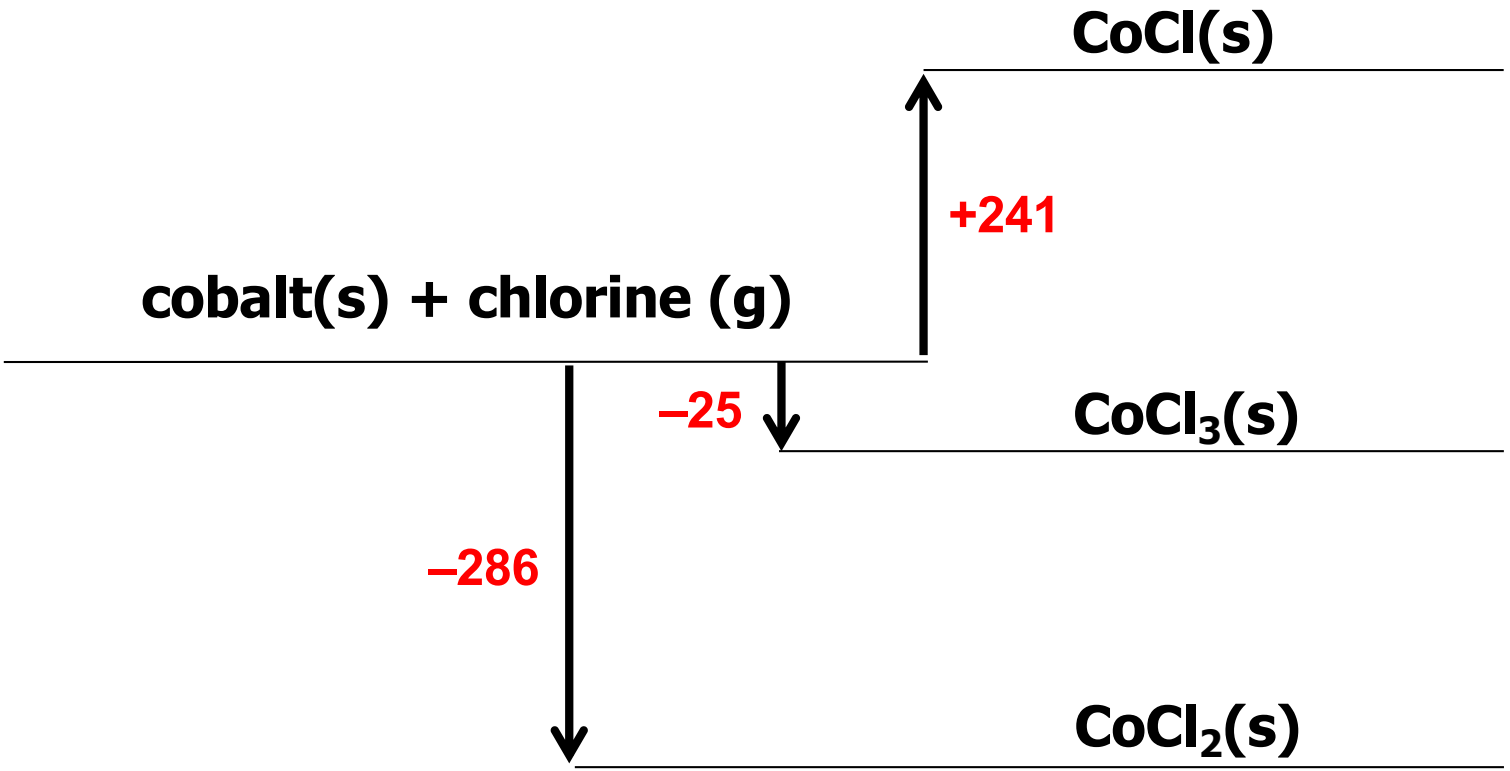
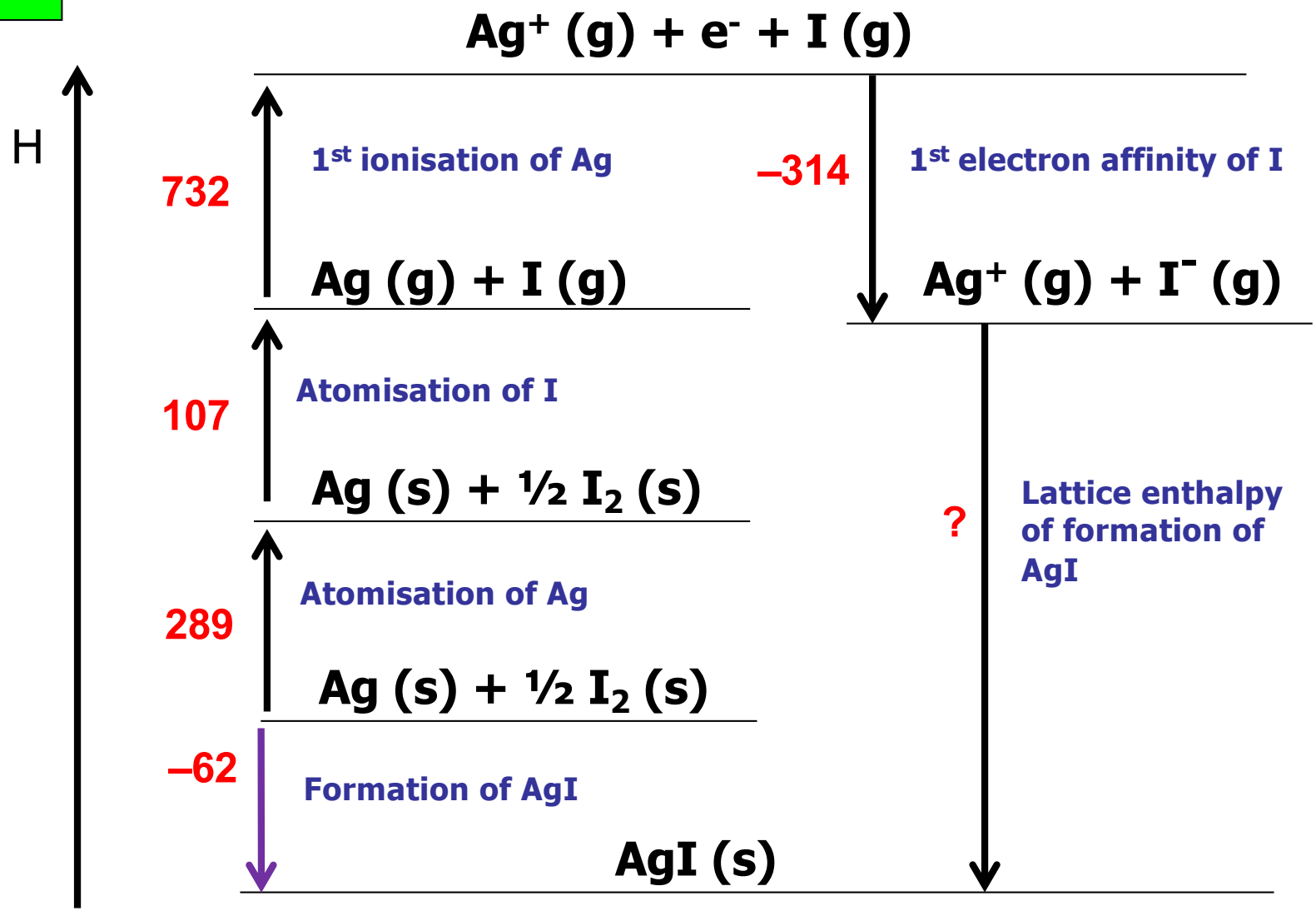



- **CoCl is unstable relative to the elements**
- **$CoCl_3(s)$ and $CoCl_2(s)$ are stable relative to elements**
- **$CoCl_2(s)$ is most stable form of cobalt chloride (and so most likely to form when the elements react**

# AgI




$-62 = 289 + 107 + 732 - 314 + \Delta H_{LE}$

$\Delta H_{LE} = -289 - 107 - 732 + 314 - 62$

$= -876 \text{ kJ mol}^{-1}$

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