Math Gymnastics: What's it Good For?

ΔH°_f

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Standard enthalpies of formation

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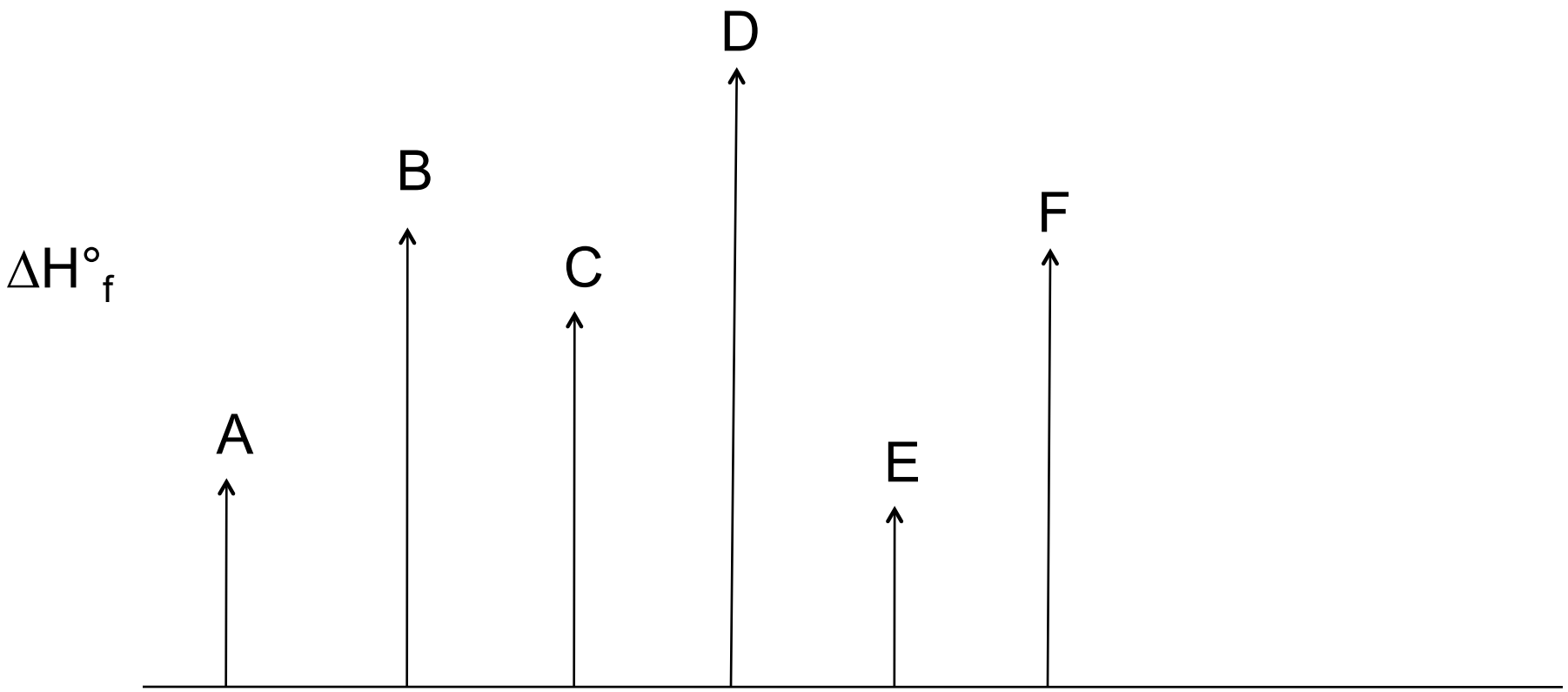

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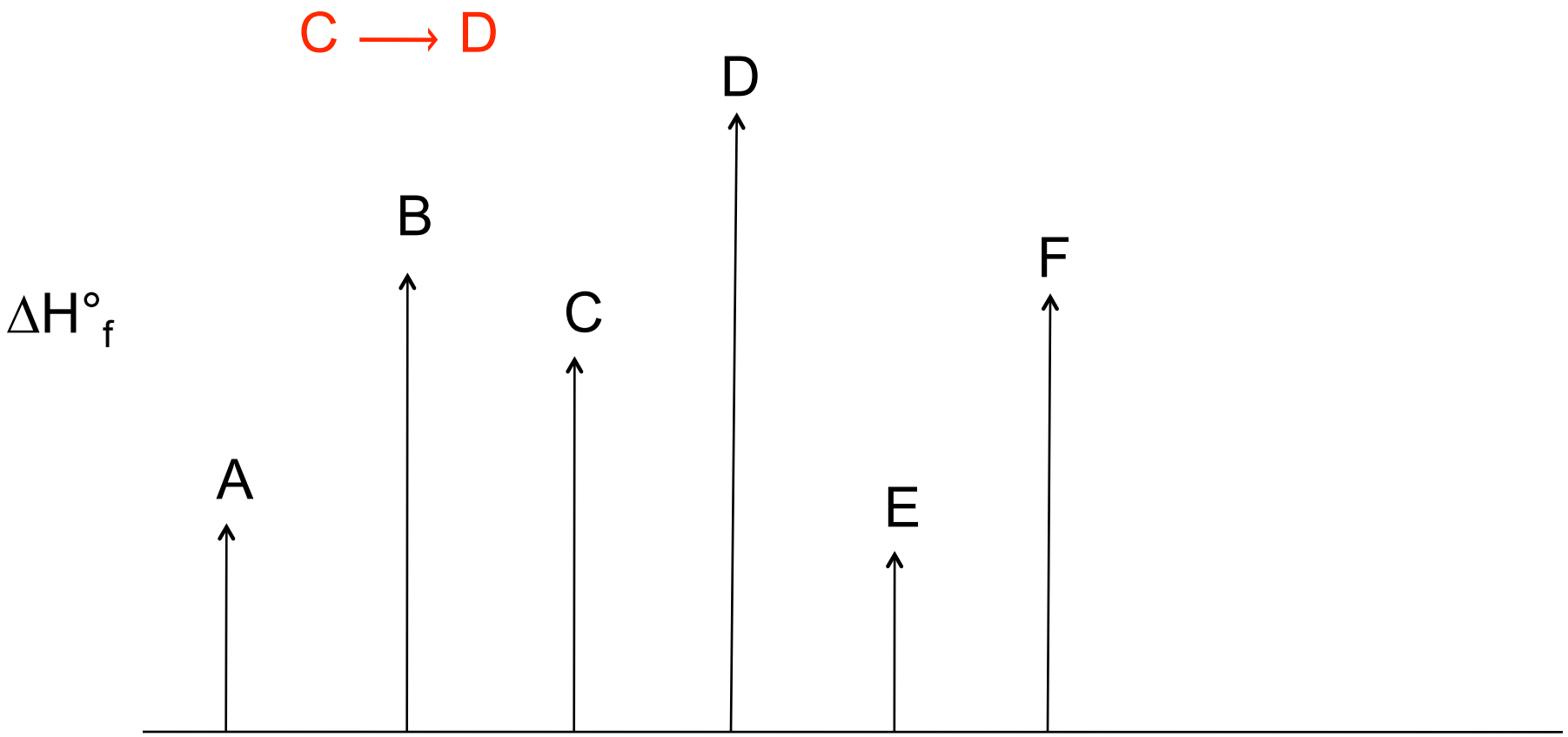

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Standard enthalpies of formation

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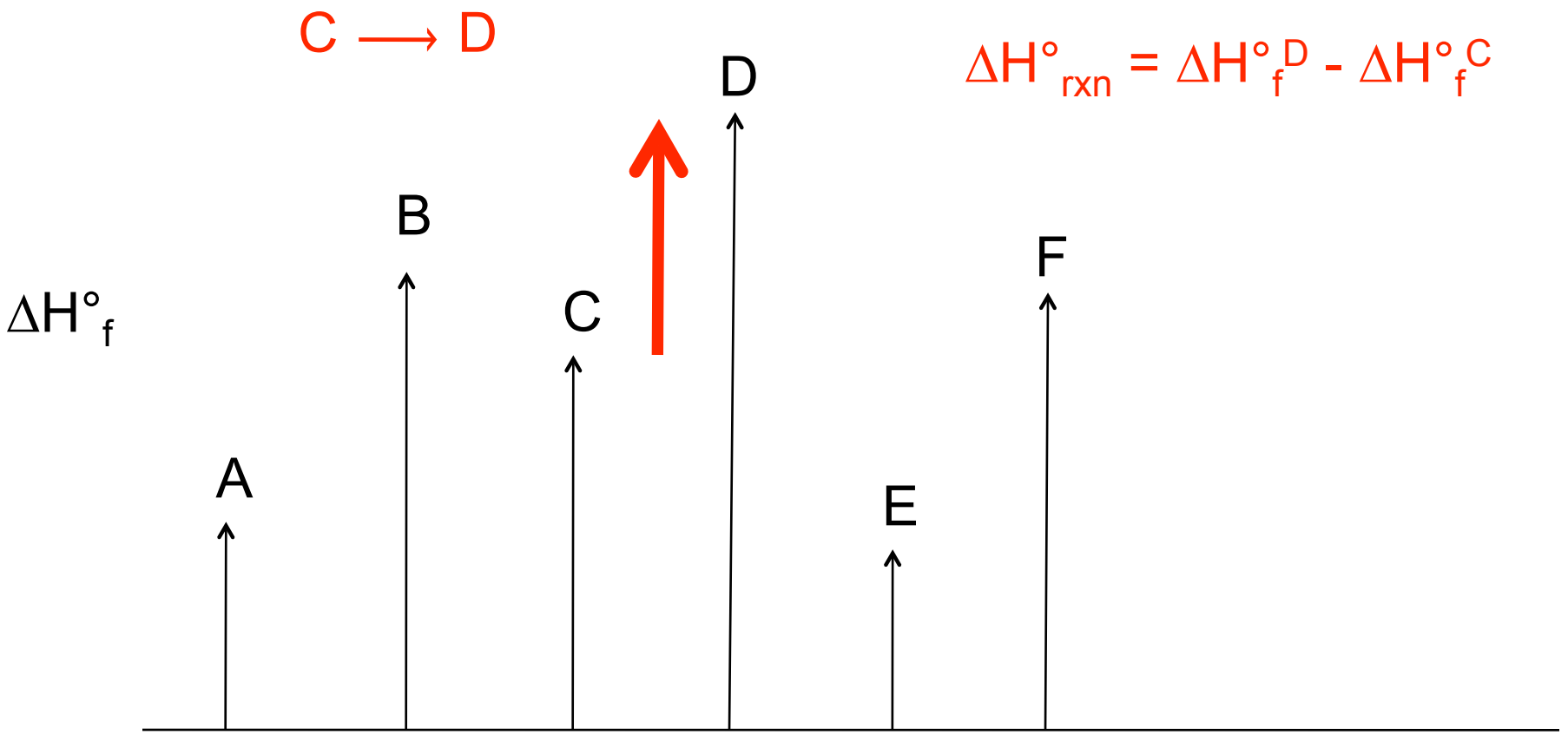
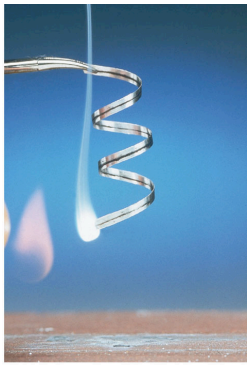


Mg combines with oxygen and is oxidized.

(has its electrons stolen)



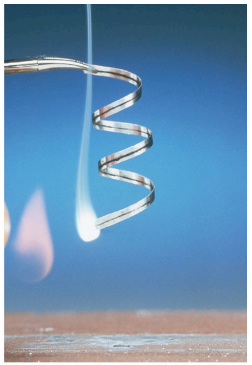
(b)

$$2\ Mg(s) + O_2(g) \longrightarrow 2\ MgO(s)$$

O_2 is the oxidizing agent

Mg combines with oxygen and is oxidized.

(has its electrons stolen)



(b)

$$2\,Mg(s) + O_2(g) \longrightarrow 2\,MgO(s)$$

0

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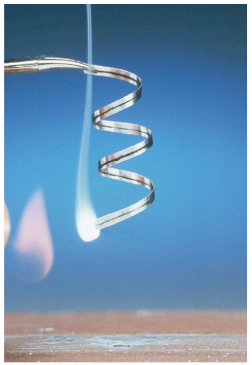

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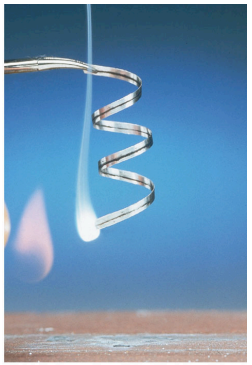

(b)

$$2\,Mg(s) + O_2(g) \longrightarrow 2\,MgO(s)$$

0 0 +2

O_2 is the oxidizing agent

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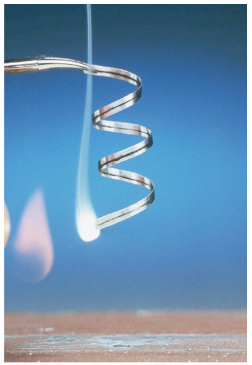

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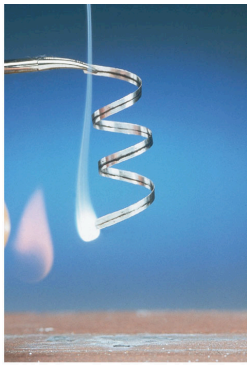

(b)

$$2\,Mg(s) + O_2(g) \longrightarrow 2\,MgO(s)$$

0 0 +2 -2

O_2 is the oxidizing agent

$$\Delta H_f^{MgO} = -601\ kJ$$

Sodium in water

$$2\ Na\ (s) + 2\ H_2O\ (aq) \longrightarrow\ 2NaOH\ (aq) + H_2\ (g)$$

Sodium in water

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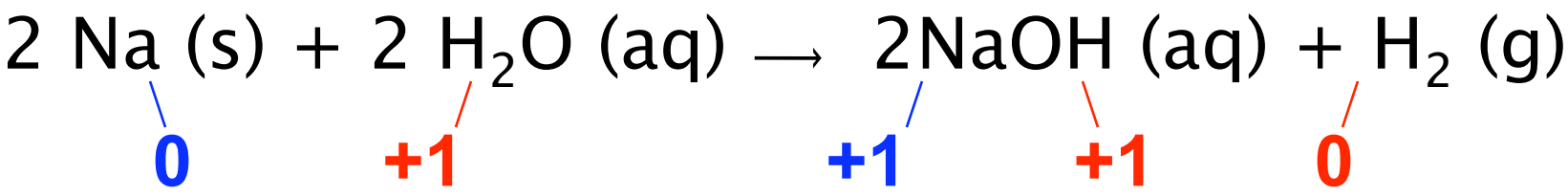
0 **+1**

Sodium in water



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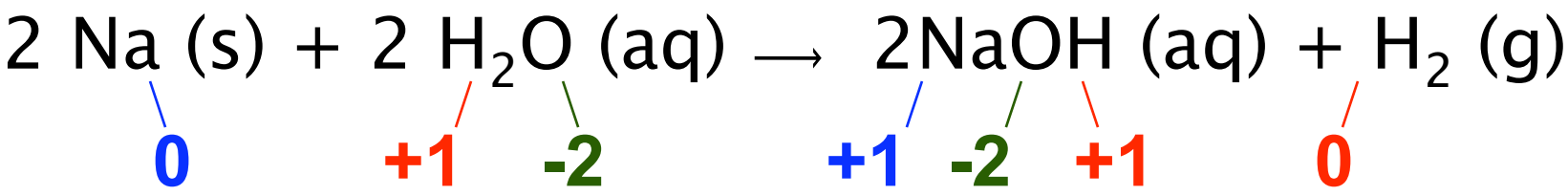

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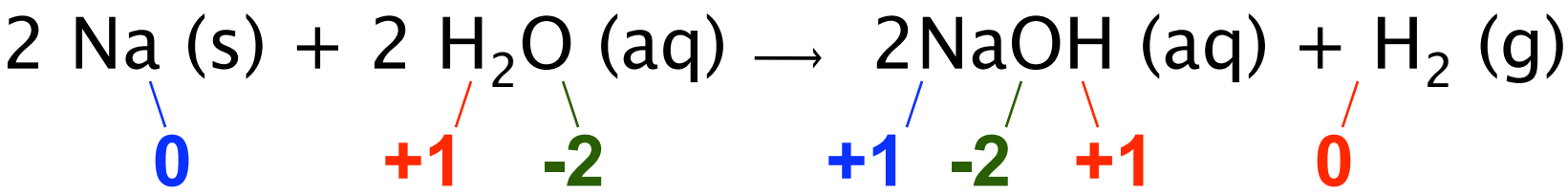
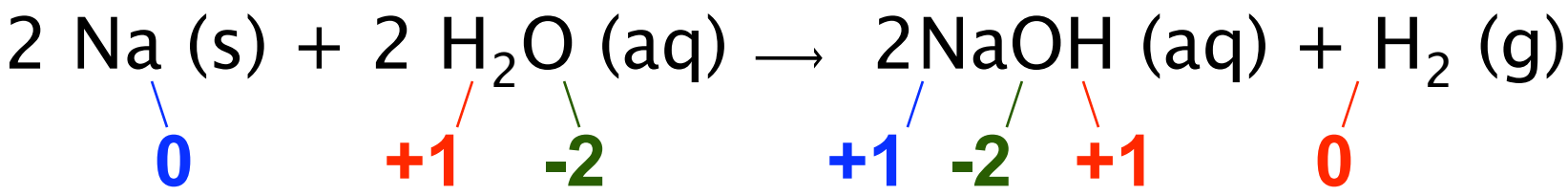


Electronegativity
Na = 0.9
H = 2.2

Sodium in water



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Predict energetics (ΔH):

Sodium in water

$$2\ Na\ (s) + 2\ H_2O\ (aq) \longrightarrow 2NaOH\ (aq) + H_2\ (g)$$

0 +1 -2 +1 -2 +1 0

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$$\Delta H_{rxn} = \sum \Delta H_f^{\text{products}} - \sum \Delta H_f^{\text{reactants}}$$

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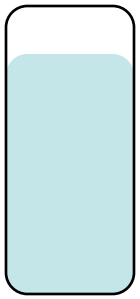
$$\Delta H_{rxn} = 2(-469\ kJ) + 0 - 2(0) - 2(-286\ kJ) = -366\ kJ$$

Sodium carbonate in soda

$$Na_2CO_3\ (aq) + 2H_2O\ (aq) \longrightarrow\ 2NaOH\ (aq) + CO_2\ (g) + H_2O\ (l)$$



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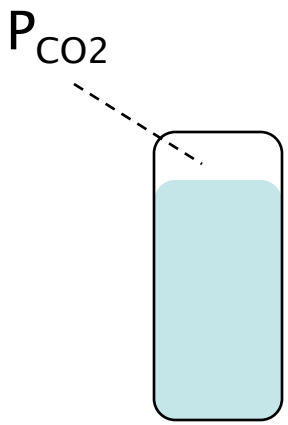

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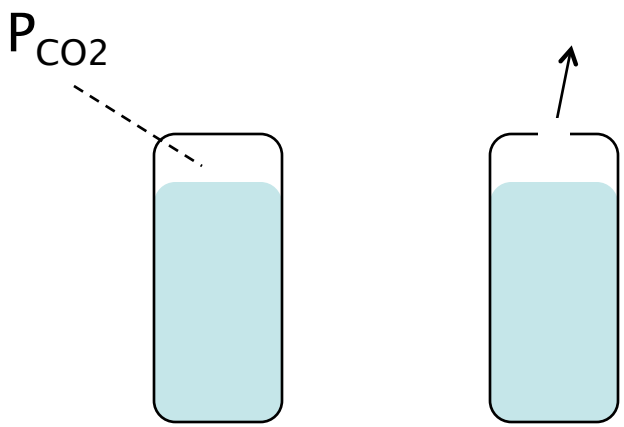

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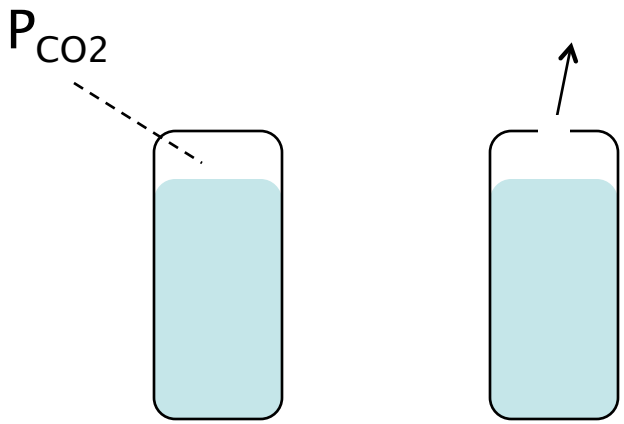

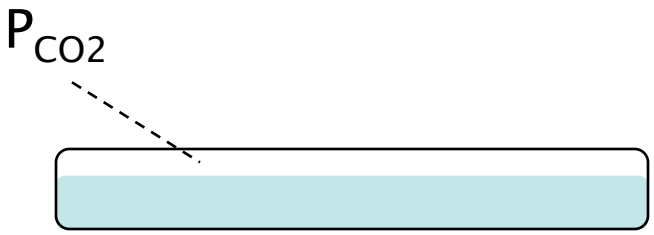

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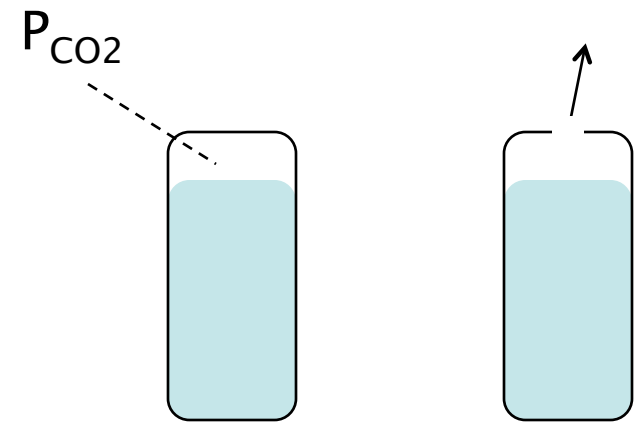

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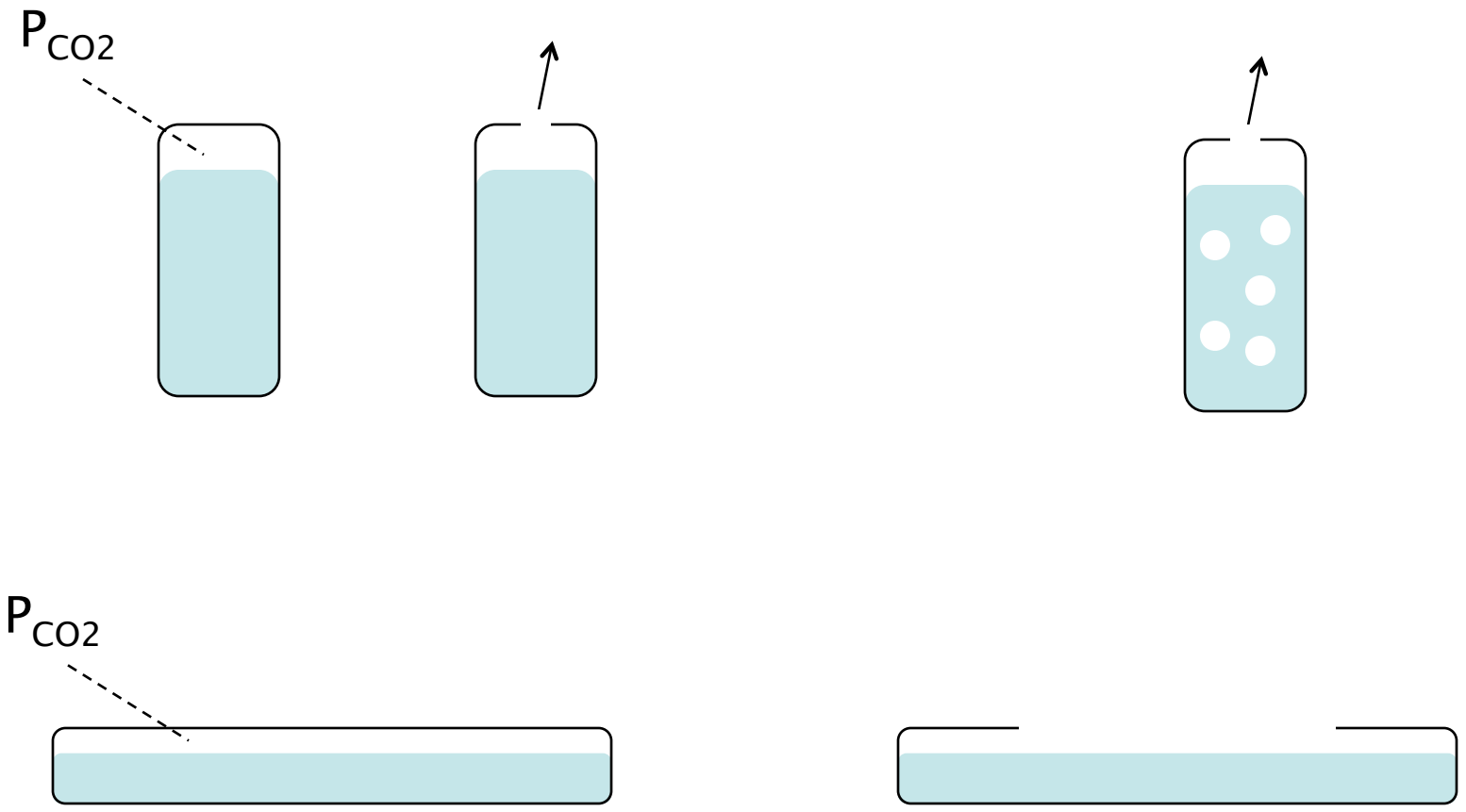

Combustion of H_2

$$O_2\,(g) + 2\,H_2\,(g) \longrightarrow 2\,H_2O\,(aq)$$

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$$\Delta H_{rxn} = 2\Delta H_f^{H_2O(aq)} - \Delta H_f^{O_2(g)} - 2\Delta H_f^{H_2(g)}$$

Combustion of H_2

O_2 (g) + 2 H_2 (g) $\longrightarrow$ 2 H_2O (aq)

$$\Delta H_{rxn} = 2\Delta H_f^{H_2O(aq)} - \Delta H_f^{O_2(g)} - 2\Delta H_f^{H_2(g)}$$

$$\Delta H_{rxn} = 2(-286\ kJ) - 0 - 2(0) = -572\ kJ$$

Combustion of H_2

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$$\Delta H_{rxn} = 2\Delta H_f^{H_2O(aq)} - \Delta H_f^{O_2(g)} - 2\Delta H_f^{H_2(g)}$$

$$\Delta H_{rxn} = 2(-286\ kJ) - 0 - 2(0) = -572\ kJ$$

Hydrolysis of water

$$2\ H_2O\ (aq) \longrightarrow\ O_2\ (g) + 2\ H_2\ (g)$$

Combustion of H_2

O_2 (g) + 2 H_2 (g) $\longrightarrow$ 2 H_2O (aq)

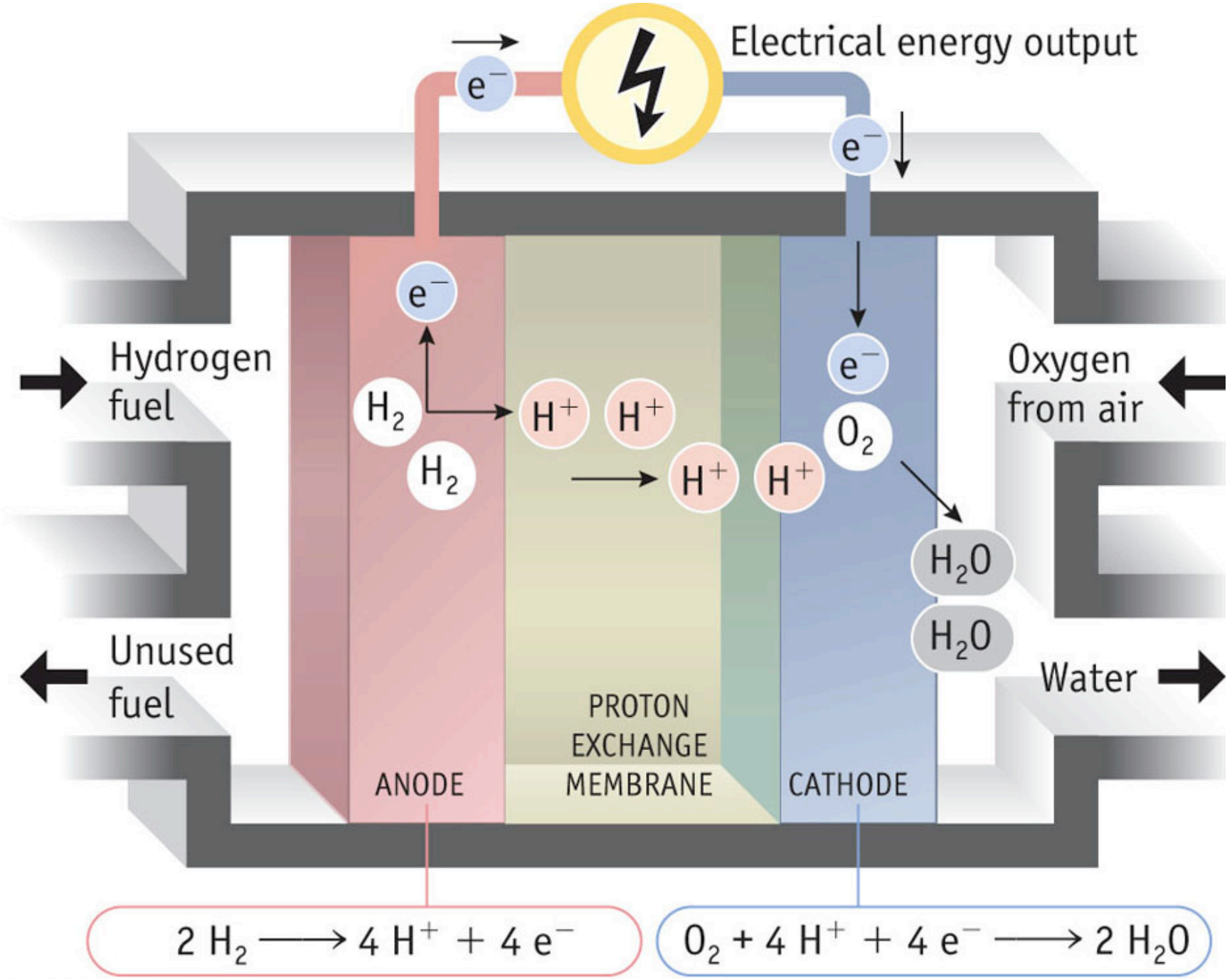
$$\Delta H_{rxn} = 2\Delta H_f^{H_2O(aq)} - \Delta H_f^{O_2(g)} - 2\Delta H_f^{H_2(g)}$$

$$\Delta H_{rxn} = 2(-286\ kJ) - 0 - 2(0) = -572\ kJ$$

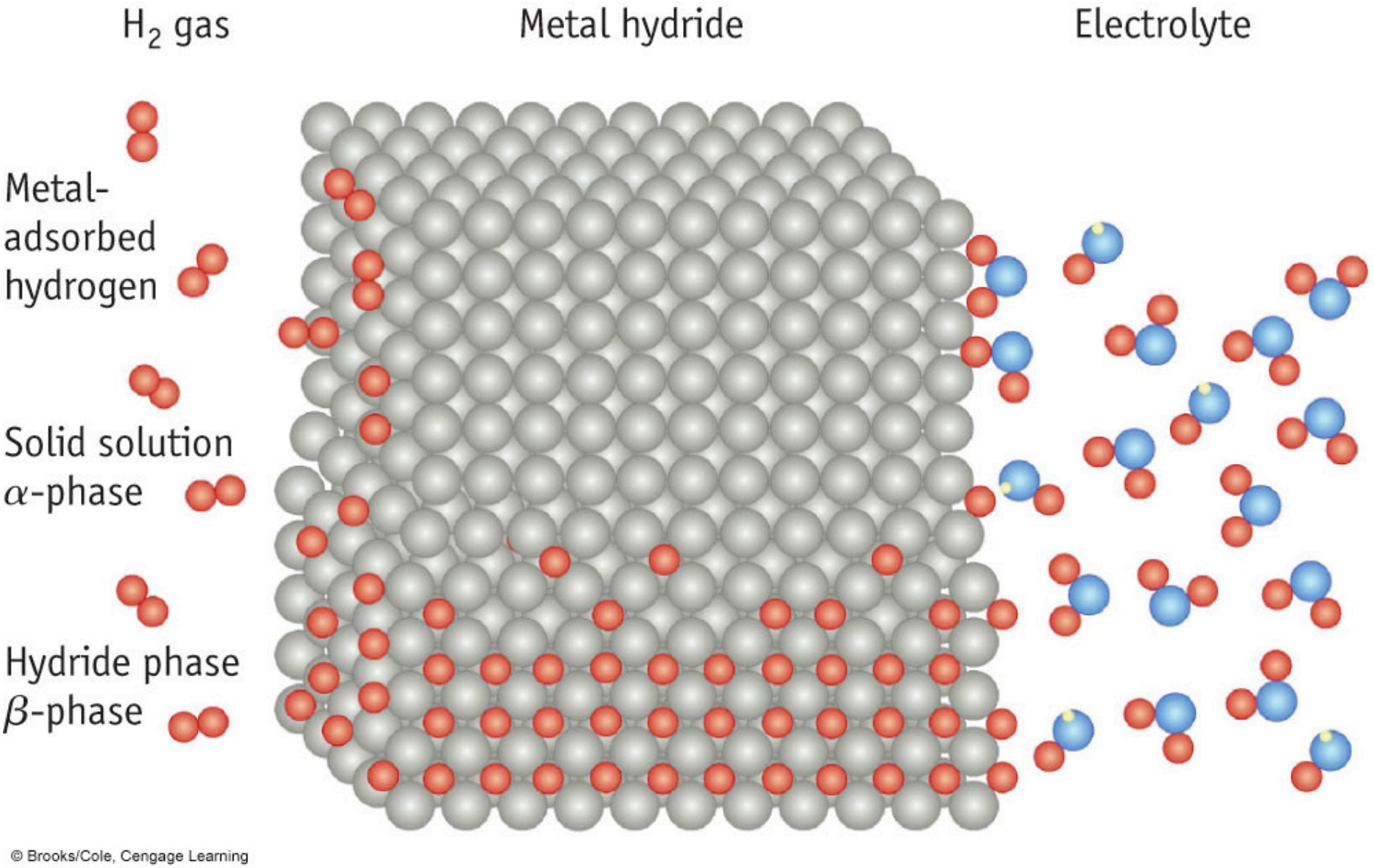
Hydrolysis of water

2 H_2O (aq) $\longrightarrow$ O_2 (g) + 2 H_2 (g)

$$\Delta H_{rxn} = +572\ kJ$$

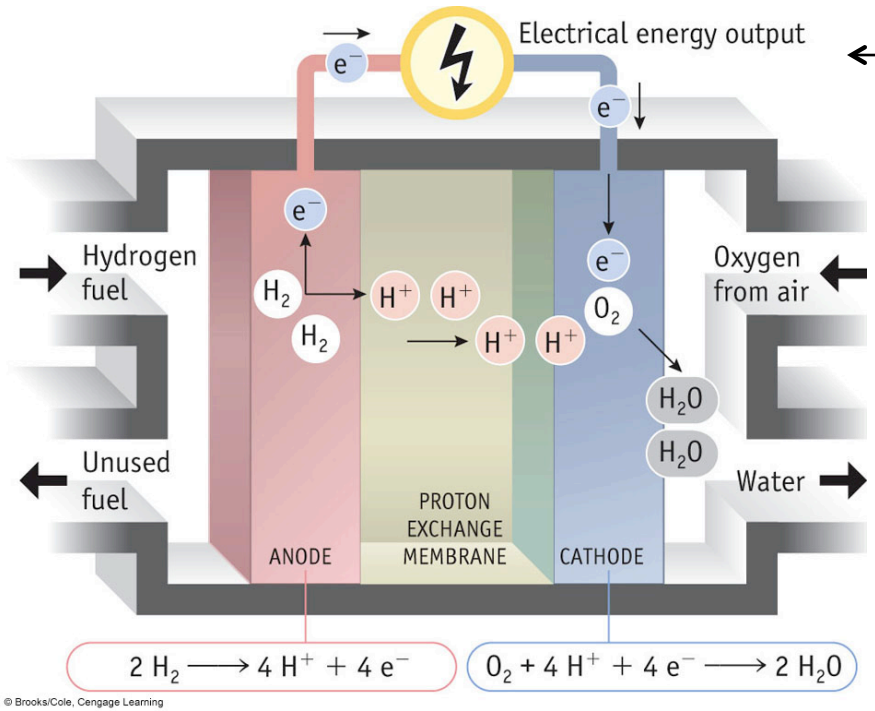


Interchapter, Fig. 9, p. 262



Interchapter, Fig. 13, p. 264

Hydrogen Fuel Cell



Work!!