Chemistry 201

Energy conversion
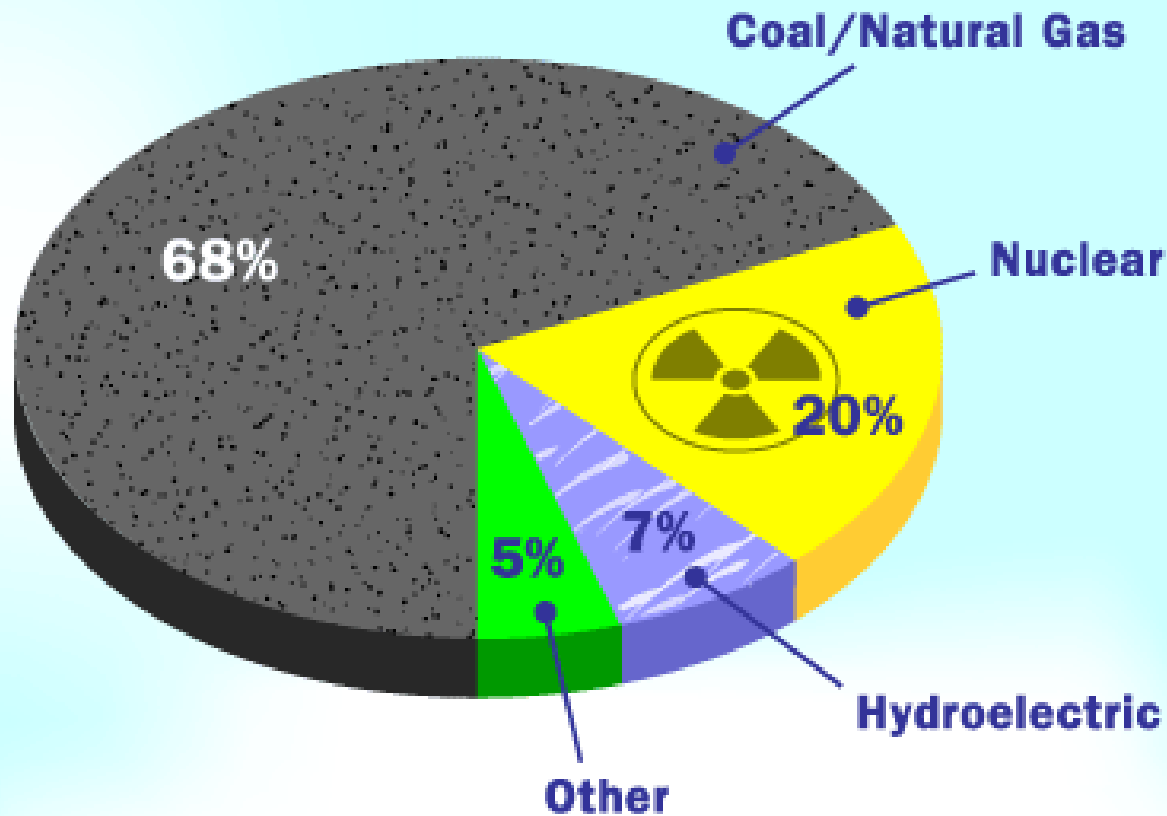Comparison of fuels
Balancing the general hydrocarbon eqn
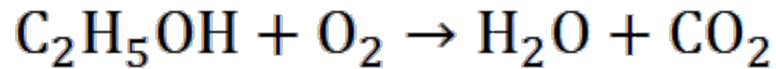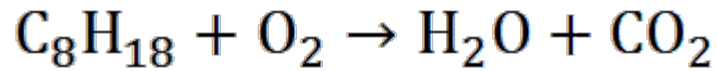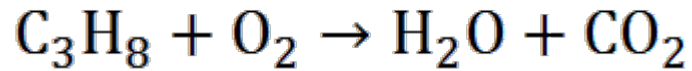
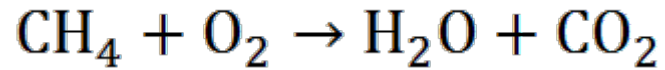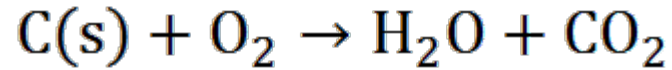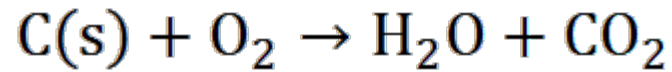**NC State** University

Focus on energy

Power Production in the USA

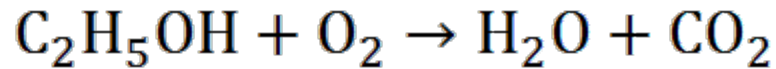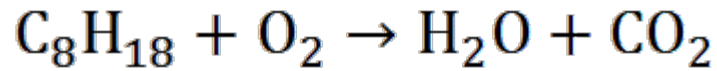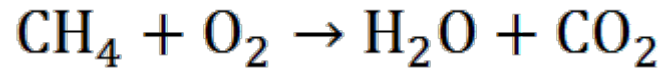- Coal/Natural Gas — 68%
- Nuclear — 20%
- Hydroelectric — 7%
- Other — 5%

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Fuels

$$C(s) + O_2 \rightarrow H_2O + CO_2$$

$$CH_4 + O_2 \rightarrow H_2O + CO_2$$

$$C_3H_8 + O_2 \rightarrow H_2O + CO_2$$

$$C_8H_{18} + O_2 \rightarrow H_2O + CO_2$$

$$C_2H_5OH + O_2 \rightarrow H_2O + CO_2$$

Fuels

$$C(s) + O_2 \rightarrow H_2O + CO_2$$ **Coal**

$$CH_4 + O_2 \rightarrow H_2O + CO_2$$

$$C_3H_8 + O_2 \rightarrow H_2O + CO_2$$

$$C_8H_{18} + O_2 \rightarrow H_2O + CO_2$$

$$C_2H_5OH + O_2 \rightarrow H_2O + CO_2$$

Fuels

$$C(s) + O_2 \rightarrow H_2O + CO_2$$

$$CH_4 + O_2 \rightarrow H_2O + CO_2$$

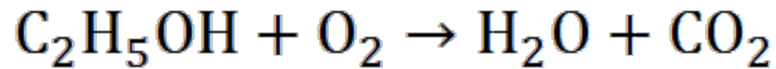$$C_3H_8 + O_2 \rightarrow H_2O + CO_2$$
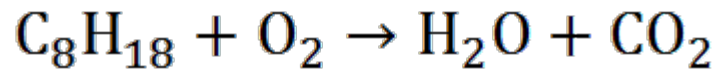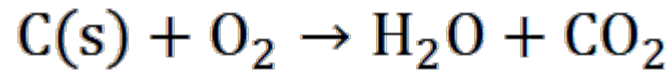
$$C_8H_{18} + O_2 \rightarrow H_2O + CO_2$$

$$C_2H_5OH + O_2 \rightarrow H_2O + CO_2$$

Coal

Methane

Fuels

$$C(s) + O_2 \rightarrow H_2O + CO_2$$

$$CH_4 + O_2 \rightarrow H_2O + CO_2$$

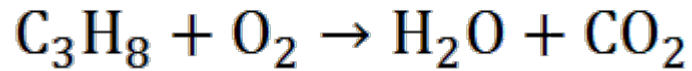$$C_3H_8 + O_2 \rightarrow H_2O + CO_2$$
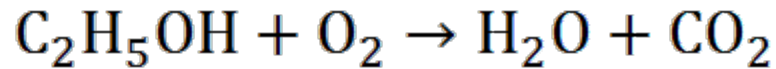
$$C_8H_{18} + O_2 \rightarrow H_2O + CO_2$$

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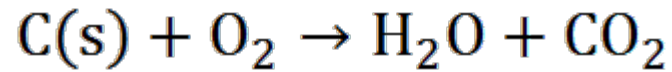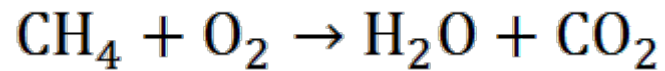
Coal

Methane

Propane

Fuels

$$C(s) + O_2 \rightarrow H_2O + CO_2$$

$$CH_4 + O_2 \rightarrow H_2O + CO_2$$

$$C_3H_8 + O_2 \rightarrow H_2O + CO_2$$

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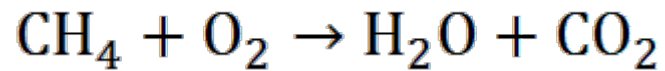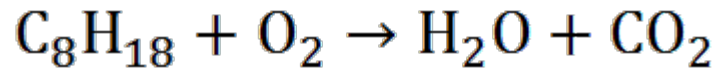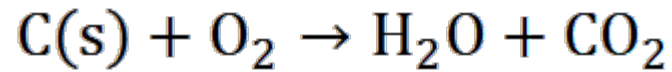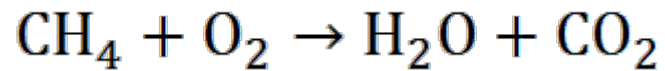
Coal

Methane

Propane

Octane

Fuels

$$C(s) + O_2 \rightarrow H_2O + CO_2$$

$$CH_4 + O_2 \rightarrow H_2O + CO_2$$

$$C_3H_8 + O_2 \rightarrow H_2O + CO_2$$

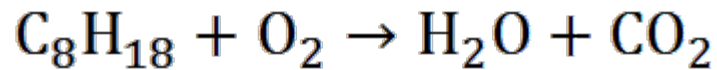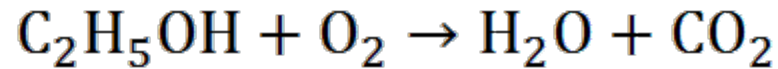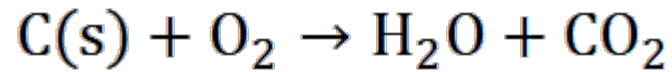$$C_8H_{18} + O_2 \rightarrow H_2O + CO_2$$
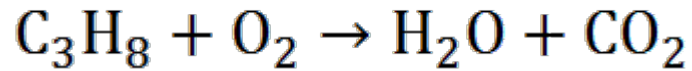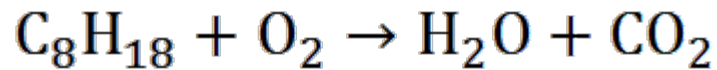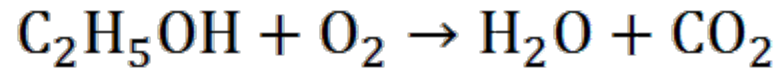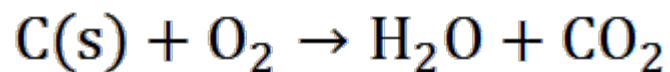
$$C_2H_5OH + O_2 \rightarrow H_2O + CO_2$$
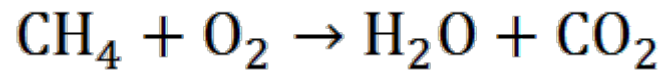
Coal

Methane

Propane

Octane

Ethanol
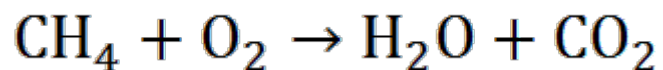
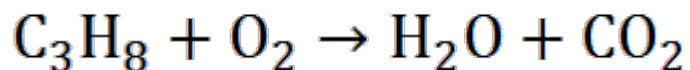# Fuels
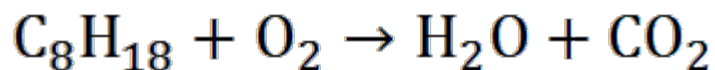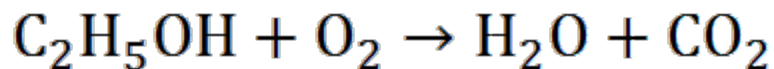
$$C(s) + O_2 \rightarrow H_2O + CO_2$$ **Coal**

$$CH_4 + O_2 \rightarrow H_2O + CO_2$$ **Methane**

$$C_3H_8 + O_2 \rightarrow H_2O + CO_2$$ **Propane**

$$C_8H_{18} + O_2 \rightarrow H_2O + CO_2$$ **Octane**

$$C_2H_5OH + O_2 \rightarrow H_2O + CO_2$$ **Ethanol**

General Hydrocarbon

$$C_nH_{2n+2} + O_2 \rightarrow H_2O + CO_2$$

Fuels

$$C(s) + \frac{3}{2}O_2 \rightarrow H_2O + CO_2$$ **Coal**

$$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$$ **Methane**

$$C_3H_8 + 5O_2 \rightarrow 4H_2O + 3CO_2$$ **Propane**

$$C_8H_{18} + \frac{25}{2}O_2 \rightarrow 9H_2O + 8\,CO_2$$ **Octane**
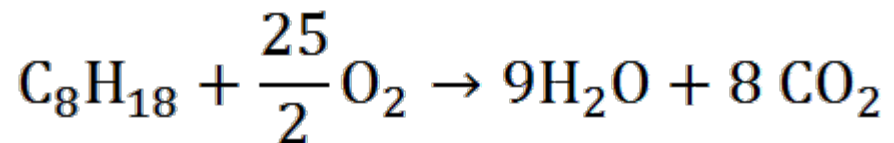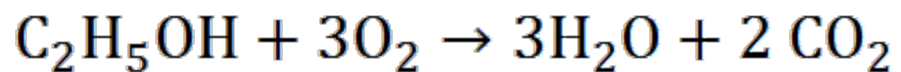
$$C_2H_5OH + 3O_2 \rightarrow 3H_2O + 2\,CO_2$$ **Ethanol**

Fuels (balanced equations)
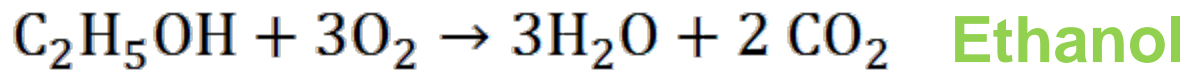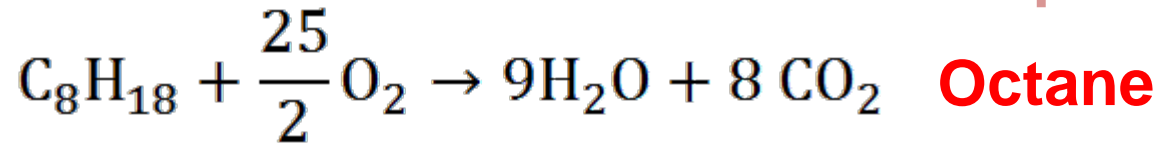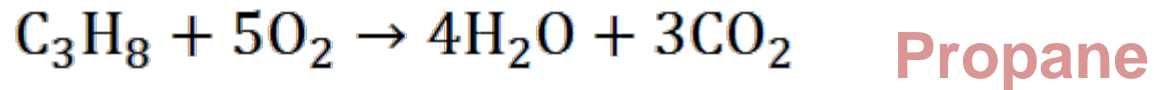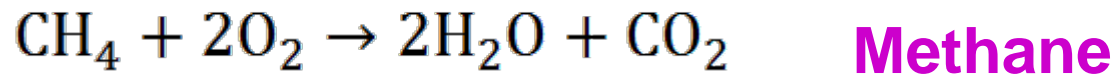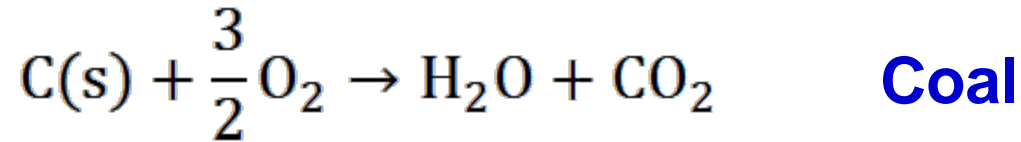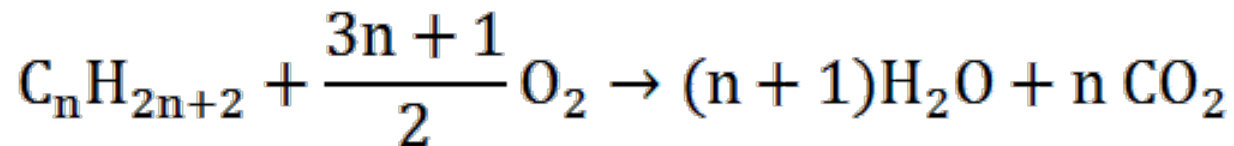
$$C(s) + \frac{3}{2}O_2 \rightarrow H_2O + CO_2$$ **Coal**

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$$C_2H_5OH + 3O_2 \rightarrow 3H_2O + 2\,CO_2$$ **Ethanol**

General Hydrocarbon

$$C_nH_{2n+2} + \frac{3n+1}{2}O_2 \rightarrow (n+1)H_2O + n\,CO_2$$

General hydrocarbon equation

$$a\ C_nH_{2n+2} + b\ O_2 \rightarrow x\ H_2O + y\ CO_2$$

General hydrocarbon equation

$$a\ C_nH_{2n+2} + b\ O_2 \rightarrow x\ H_2O + y\ CO_2$$
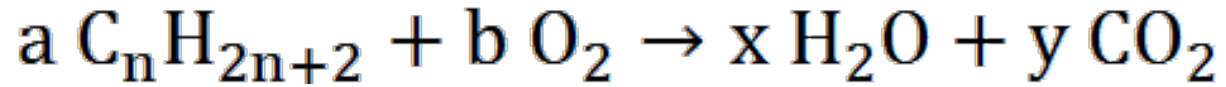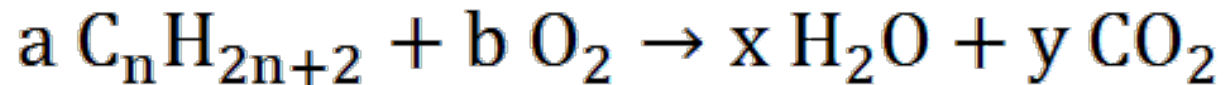
Write down the coefficient equations for each atom:

H: $(2n+2)a = 2x$

C: $(n)a = y$

O: $2b = x + 2y$

General hydrocarbon equation

$$a\ C_nH_{2n+2} + b\ O_2 \rightarrow x\ H_2O + y\ CO_2$$

Write down the coefficient equations for each atom:

H: $(n+1)a = x$

C: $(n)a = y$

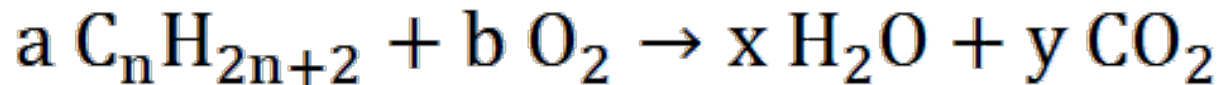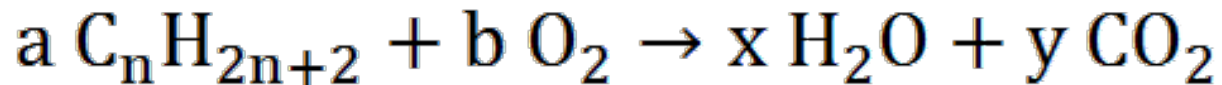O: $2b = x + 2y$

General hydrocarbon equation

$$a\ C_nH_{2n+2} + b\ O_2 \rightarrow x\ H_2O + y\ CO_2$$

Write down the coefficient equations for each atom:

H: (n+1)a = x
C: (n)a = y
O: 2b = x + 2y

Choose one coefficient to define the remaining ratios:

Let a = 1,
Then x = n + 1 and y = n, finally b = (3n + 1)/2

General hydrocarbon equation

$$C_nH_{2n+2} + \frac{3n+1}{2}O_2 \rightarrow (n+1)H_2O + n\,CO_2$$

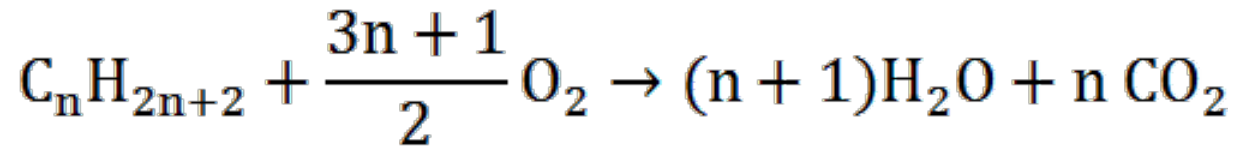Write down the coefficient equations for each atom:

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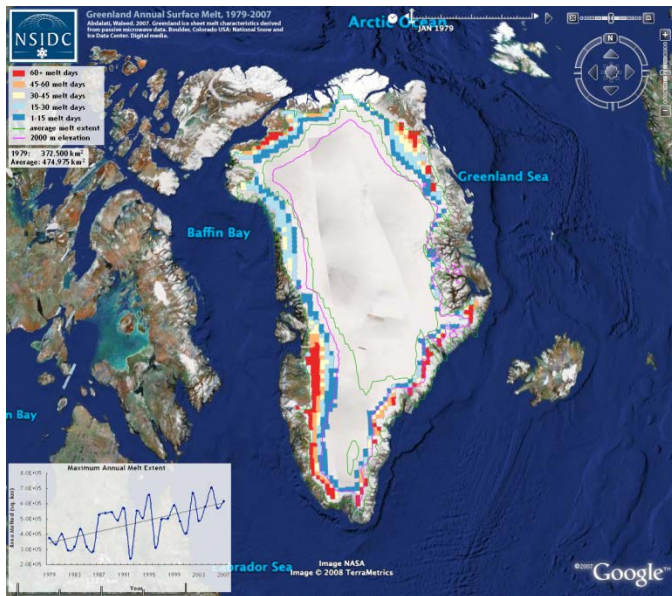Then $x = n + 1$ and $y = n$, finally $b = (3n + 1)/2$

Environmental pollution

Air pollution

Climate change

Non-renewable resource