Carbon Cycle - Combustion, Metabolism

CH$_4$ + O$_2$ $\rightarrow$ CO$_2$ + H$_2$O + energy

or oxygen carbon water (heat)

C$_6$H$_{12}$O$_6$ dioxide

represents any fossil fuel, food, organic matter

Pathways for ATP Production

Fig. 20.2: http://www.zuniv.net/physiology/book/chapter20.html
Solubility of $O_2$ in Water vs. temperature.

$O_2$ content vs. water temp.

$O_2$ consumption.
Rates of Diffusion

**Fick's Law**

$$Q = DA \frac{P_1 - P_2}{L}$$

- $Q$ = rate of diffusion of substance
- $D$ = diffusion coefficient through medium
- $A$ = cross-sectional area
- $P_1$ - $P_2$ = partial pressure difference
- $L$ = path length through which diffusion occurs
What can an animal optimize?

D: Air is $200,000 \times$ faster than in $H_2O$

L: thin

A: Maximize

$P_1 - P_2$:

- Reduce Boundary effects
- Ventilation
- Use a sink

Gill surface area

- Shark gill
- Dobson fly larva gill

Gills

Lung

Vagination

Invagination
The diagram illustrates the respiratory system, focusing on the exchange of gases. The text indicates:

- **A** = 70 m²
- **L** = 2 μm

Additionally, the text notes:

- 2000 mL
- Reserve volume = 1000 mL

The diagram also shows a countercurrent exchange system involving air and blood capillaries.
hemoglobin
heme compound
- Fe
Cooperativity
- binding of 1 O₂
facilitates binding of other

 oxy

% of Hb bound to O₂

20 40 60 80 100

Hb

P O₂

20 100

myoglobin
absorbed
adult Hb
released

reserve

lungs

P O₂ body