

# A2 2.1 Energy and ATP

We are covering:

- How does ATP store energy?
- How is ATP synthesised?
- What is the role of ATP?

Starter - write a  
definition for  
energy

# 'The ability to do work'

Why do we need it?

- Metabolism
- Movement
- Active transport
- Maintenance, repair and division of cells
- Production of substances
- Maintenance of body temperature

# Energy and metabolism

Light energy is converted by plants into chemical energy during photosynthesis



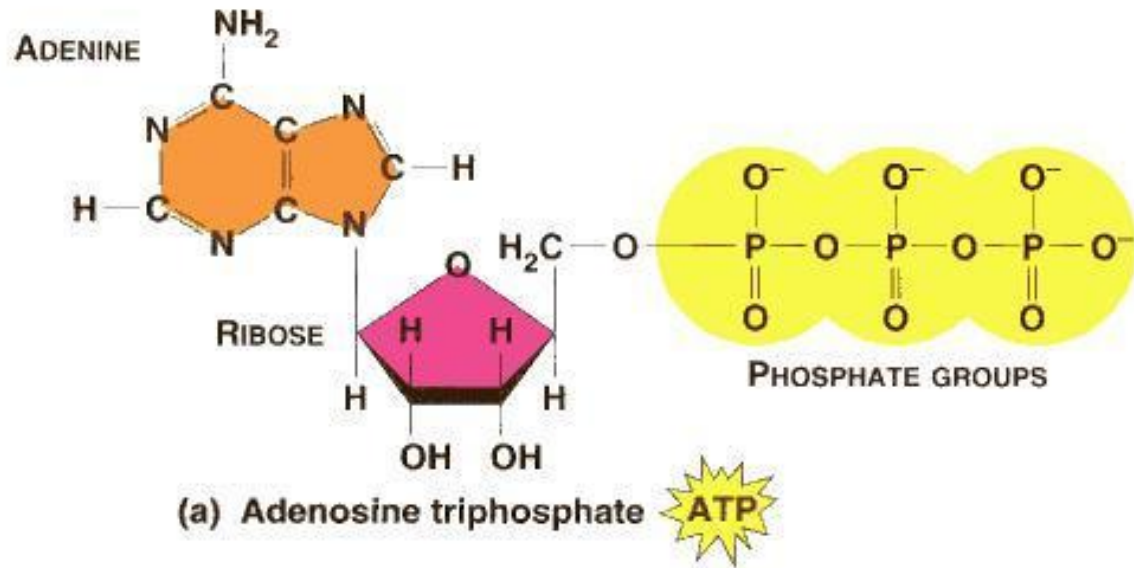
The chemical energy from photosynthesis, in the form of organic molecules, is converted into ATP during respiration



ATP is used by cells to perform useful work

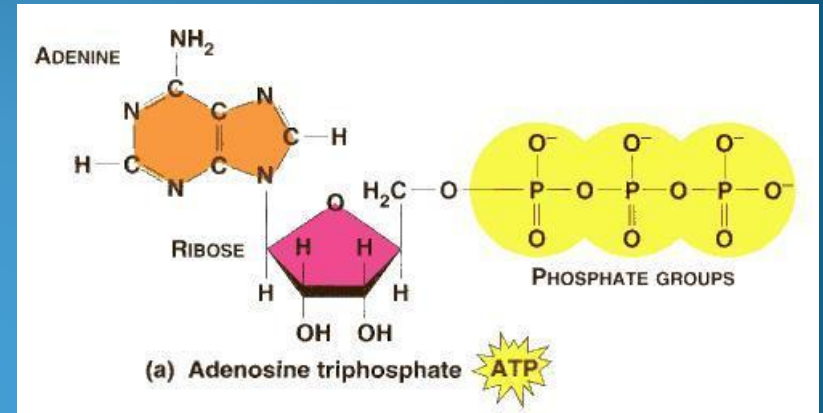
# ATP - adenine triphosphate

**ATP made up of:**  
Adenine (a base)  
Ribose (a pentose sugar)  
3 phosphate groups



# How ATP releases energy

- The 3 phosphate groups are joined together by 2 high energy bonds
- ATP can be hydrolysed to break a bond which releases a large amount of energy
- Hydrolysis of ATP to ADP (adenosine diphosphate) is catalysed by the enzyme ATPase



# It's reversible!

- ATP can be reformed from ADP + Pi in a hydrolysis reaction, this occurs in 3 ways;
  1. **Photophosphorylation** – occurs in the chlorophyll during photosynthesis
  2. **Oxidative phosphorylation** – occurs in the mitochondria during the electron transport chain (part of respiration)
  3. **Substrate-level phosphorylation** – when phosphate groups are transferred from donor molecules to ADP

# Better than glucose?

- The energy released from the splitting of ATP into ADP releases energy in small, manageable bursts
- Hydrolysis of ATP to ADP is a single reaction, glucose breakdown requires a long series of reactions

**Why can we describe ATP as an immediate energy source?**

# Advantages of ATP

- Instant source of energy in the cell
- Releases energy in small amounts as needed
- It is mobile and transports chemical energy to where it is needed IN the cell
- Universal energy carrier and can be used in many different chemical reactions

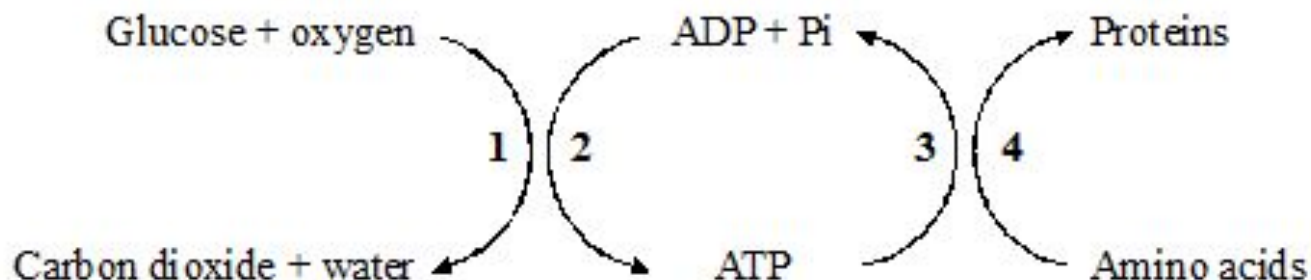


# Which reactions use ATP?

- Metabolic processes
- Movement
- Active transport
- Secretion
- Activation of molecules
- Bioluminescence



ATP links energy-releasing (exergonic) reactions with energy-requiring (endergonic) reactions. The diagram shows some of these reactions.



(a) Give the numbers in the diagram that correspond to *exergonic* reactions.

.....

(1)

(b) Explain why the total energy released from an exergonic reaction is not all available for the linked endergonic reaction.

.....

.....

(1)

(c) The diagram shows some of the reactions of respiration.

(a) 1 and 3;

(b) Some energy lost as heat; 1