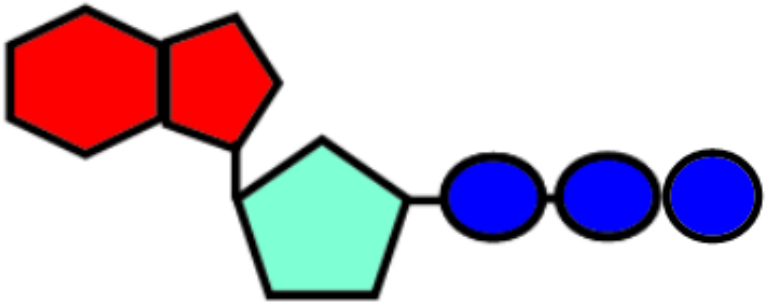
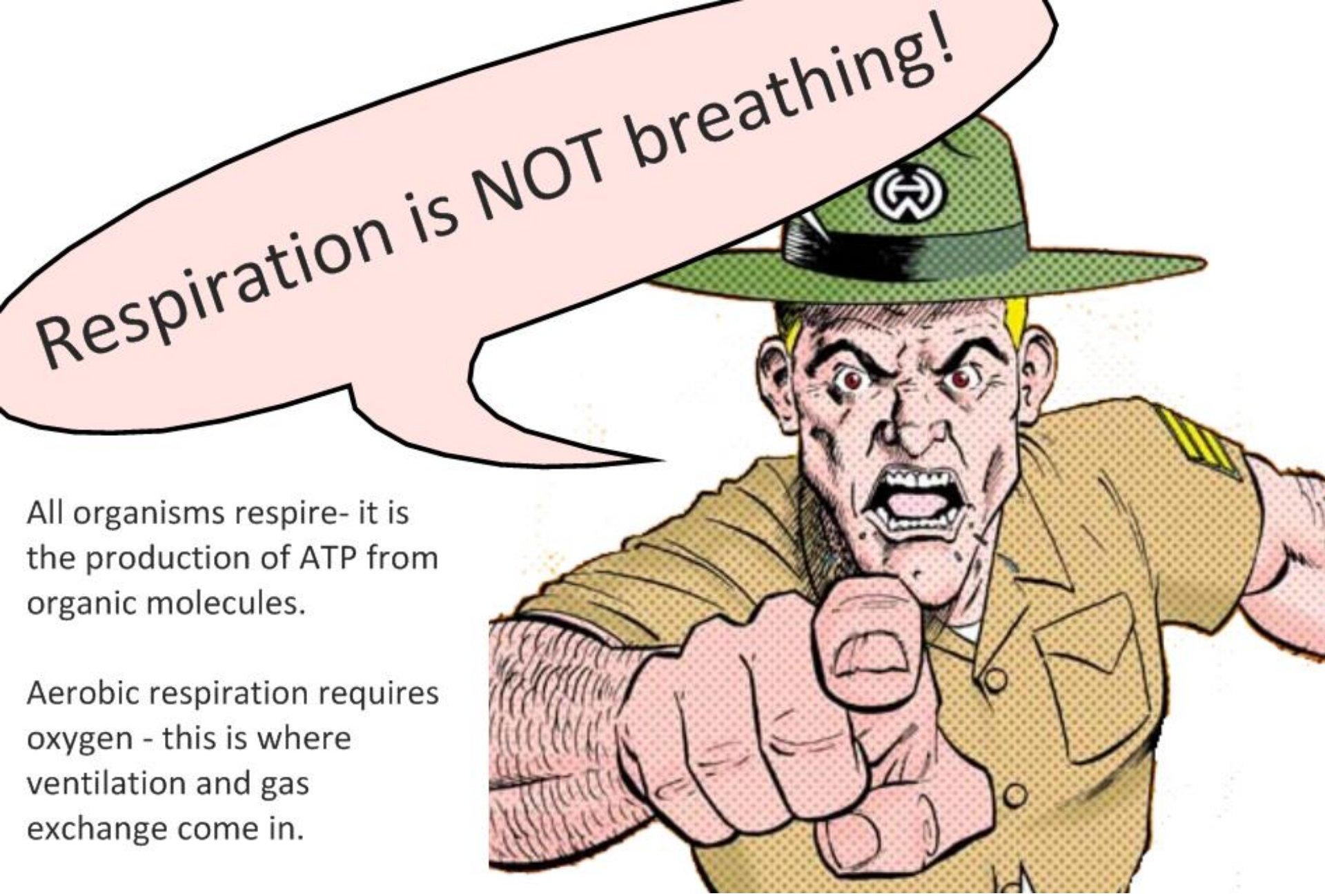


Cellular Respiration (Core)

Stephen Taylor
Bandung International School



All organisms respire- it is the production of ATP from organic molecules.

Aerobic respiration requires oxygen - this is where ventilation and gas exchange come in.

Cell Respiration

"The controlled release of energy

by enzymes:
metabolic pathways and cycles!

Cell Respiration

"The controlled release of energy

by enzymes:
metabolic pathways and cycles!

How can cells control the rate of enzyme catalysed pathways and cycles?

Cell Respiration

"The controlled release of energy

by enzymes:

metabolic pathways and cycles!

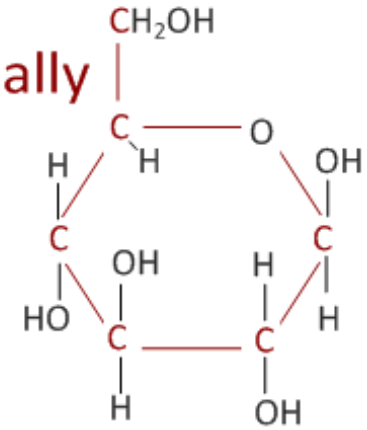
How can cells control the rate of enzyme catalysed pathways and cycles?

end product inhibition!

Cell Respiration

"The controlled release of energy from organic compounds in cells

usually

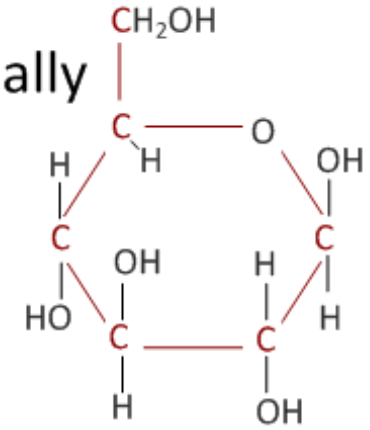


glucose/ carbohydrates

Cell Respiration

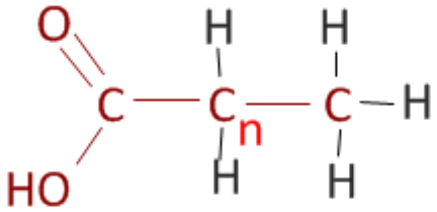
"The controlled release of energy from organic compounds in cells

usually

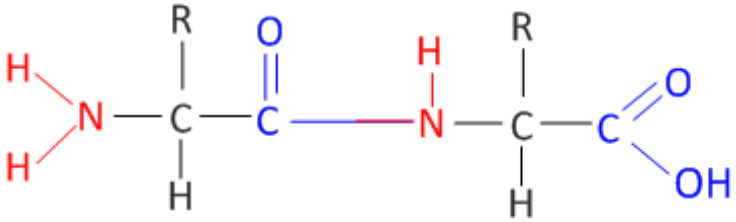


glucose/ carbohydrates

sometimes



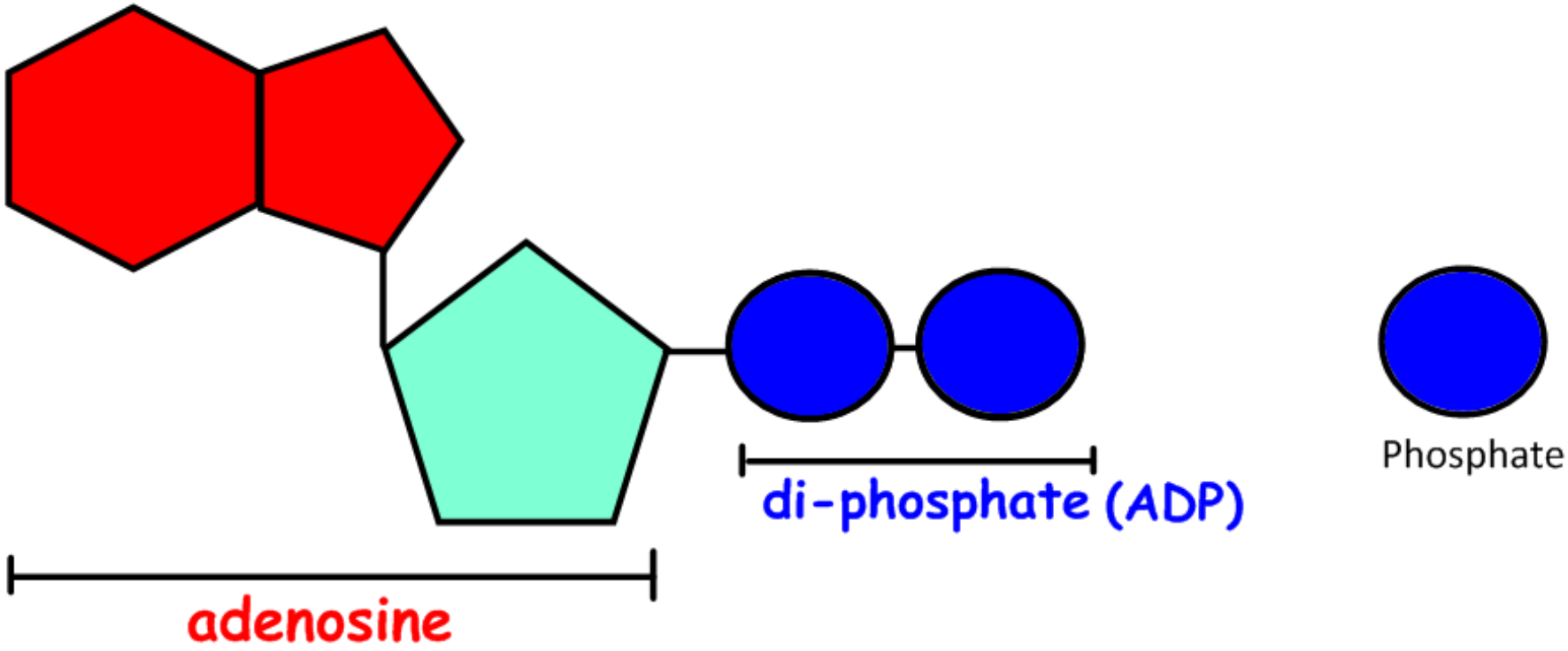
lipids/ fatty acids



proteins

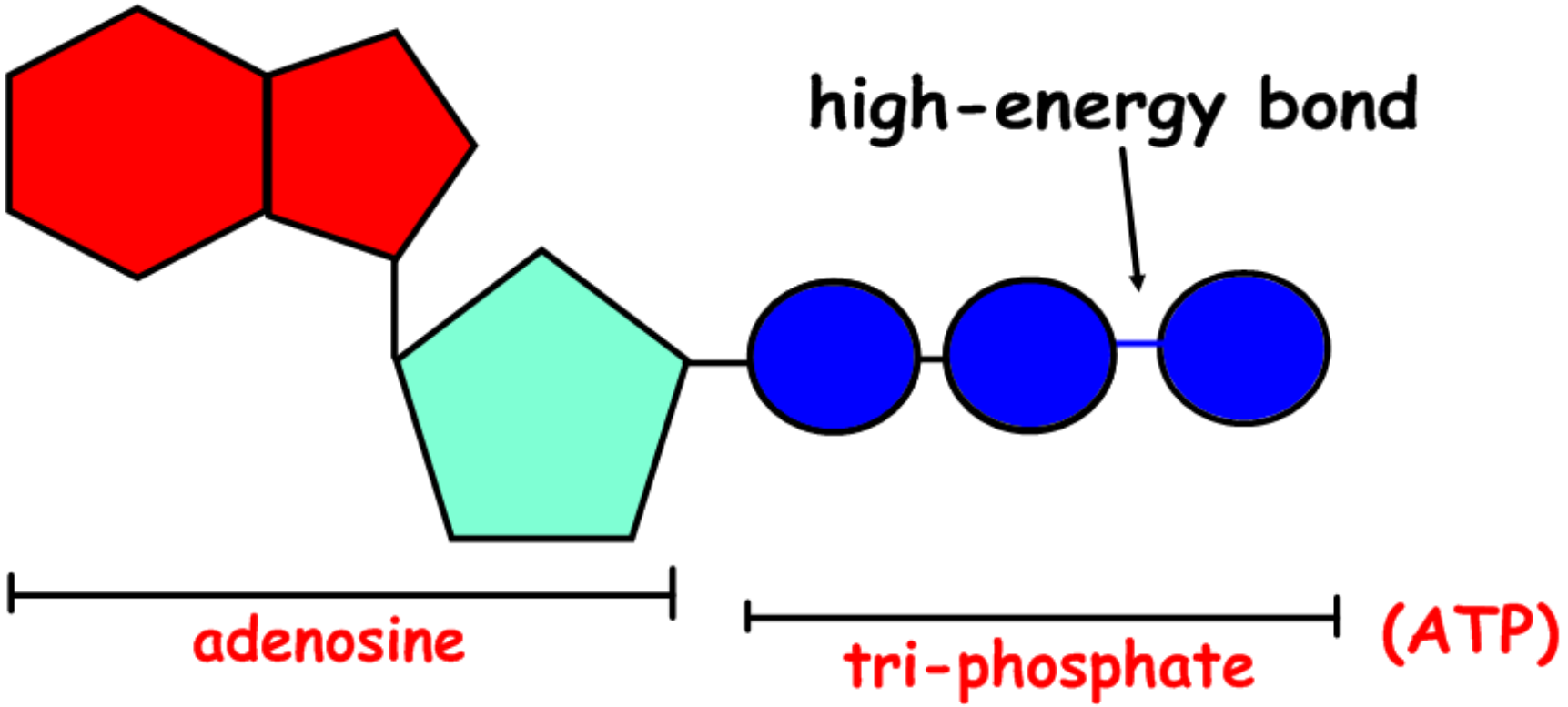
Cell Respiration

"The controlled release of energy from organic compounds in cells to form ATP"



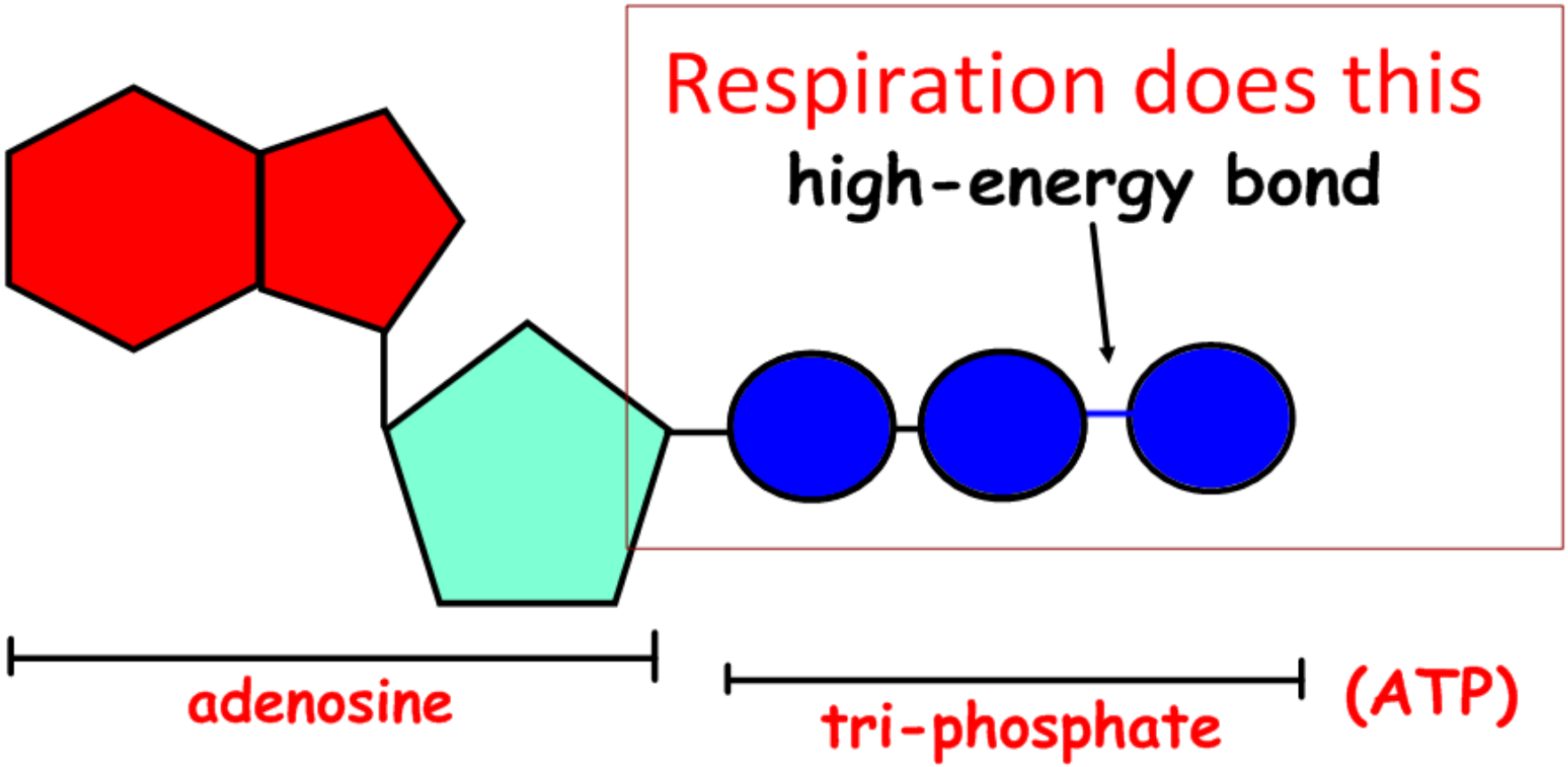
Cell Respiration

"The controlled release of energy from organic compounds in cells to form ATP"



Cell Respiration

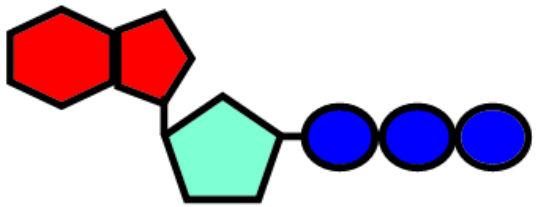
"The controlled release of energy from organic compounds in cells to form ATP"



Cell Respiration

Universality vs diversity!

"The controlled release of energy from organic compounds in cells to form ATP"



used for
energetic processes

muscle contraction

active transport

protein synthesis

vesicle transport

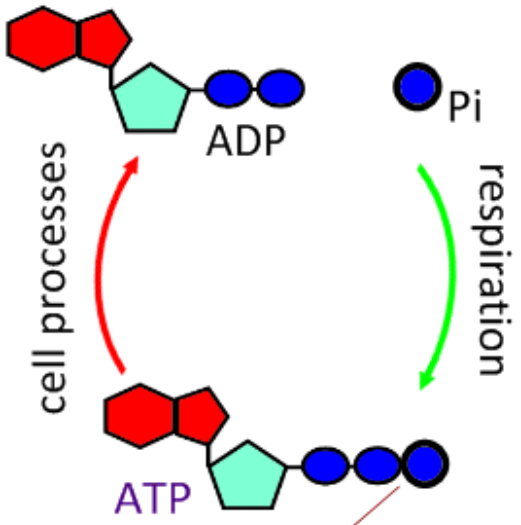
DNA/ RNA replication

cell signalling

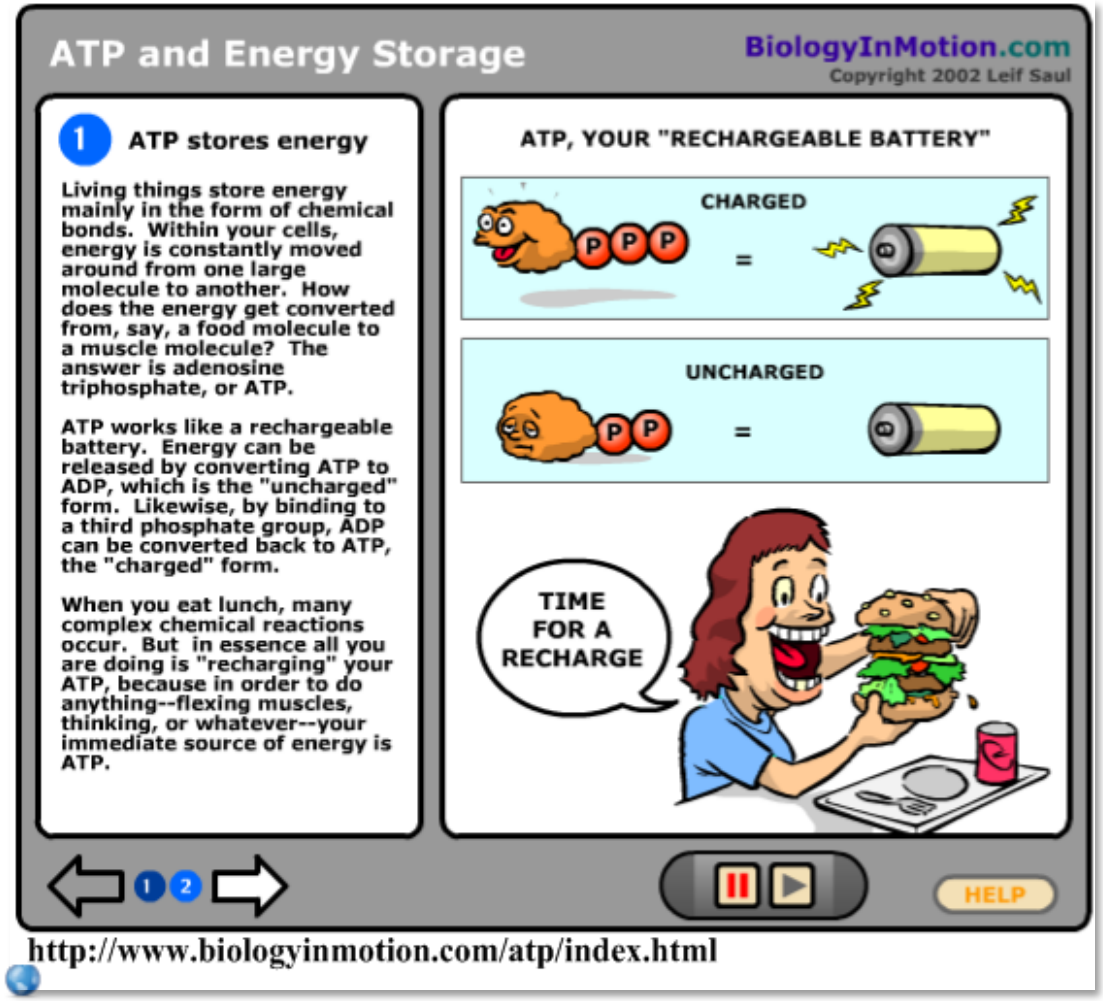
ATP

adenosine tri-phosphate

Respiration generates ATP from ADP and phosphate ions in the cell.



This high energy bond is a temporary store of energy, which is broken to release energy in cell processes.

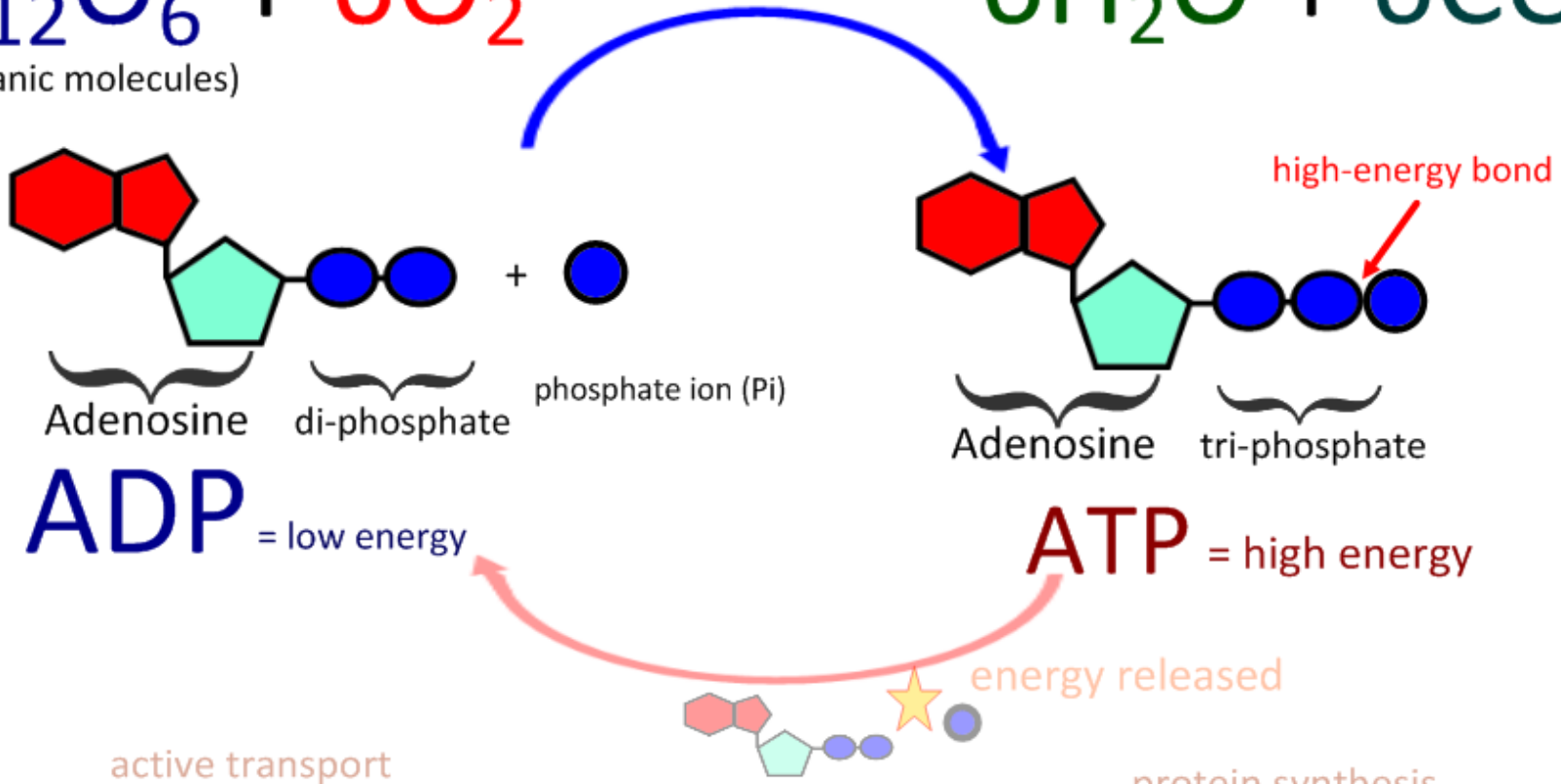


ATP is not a stable long-term energy store. Cells in tissues which have a high energy demand are rich in mitochondria, in order to keep generating sufficient ATP. Long-term stores include lipids and glycogen, which can be metabolised through respiration as needed.

Cell Respiration

$C_6H_{12}O_6 + 6O_2 \longrightarrow 6H_2O + 6CO_2$

(or other organic molecules)



Cellular Processes

active transport

vesicle transport

muscle contraction

protein synthesis

DNA/ RNA replication

Cell signalling

Glucose is a 6-carbon organic compound

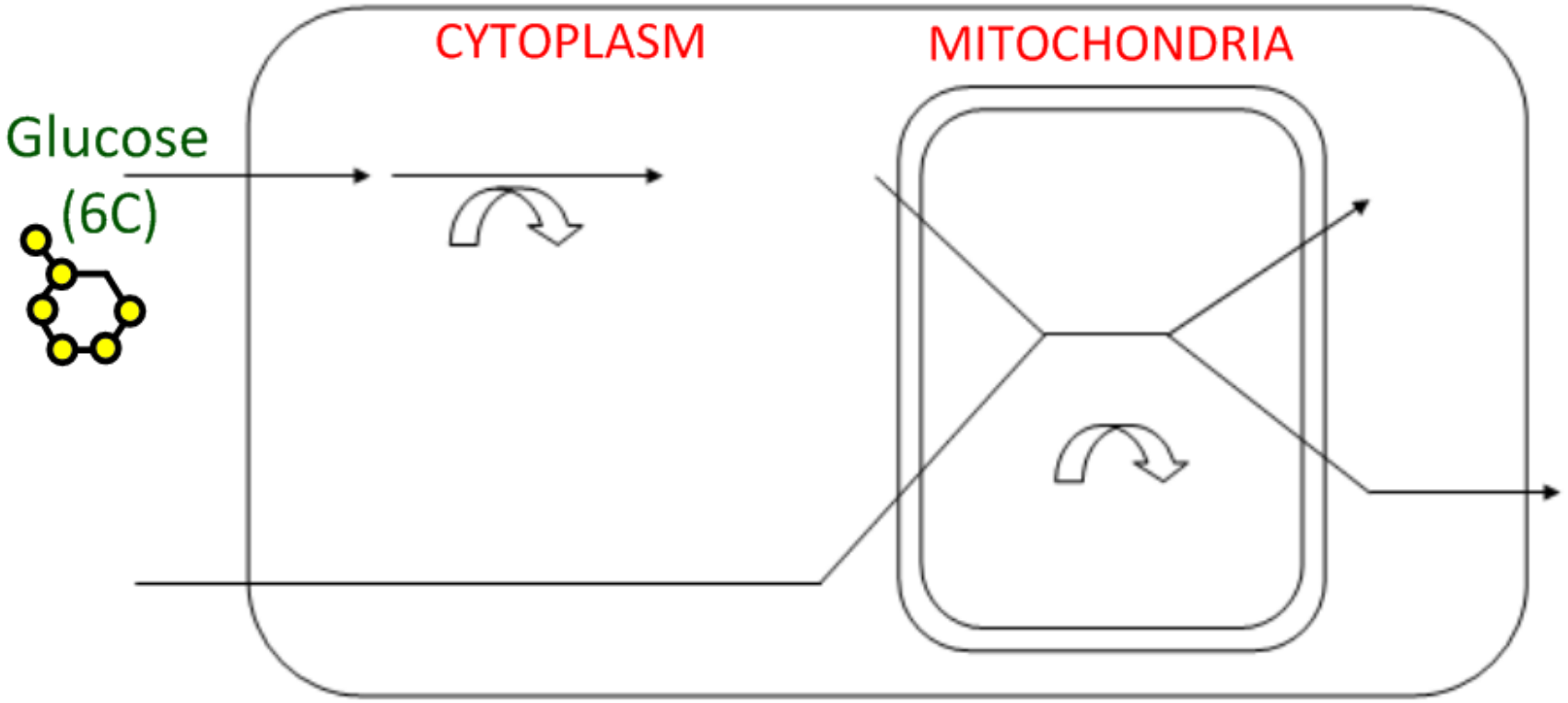


Image adapted from IB Biology Course Companion (Mindorff and Allott)

Glucose is a 6-carbon organic compound which is split into two pyruvate molecules in cytoplasm

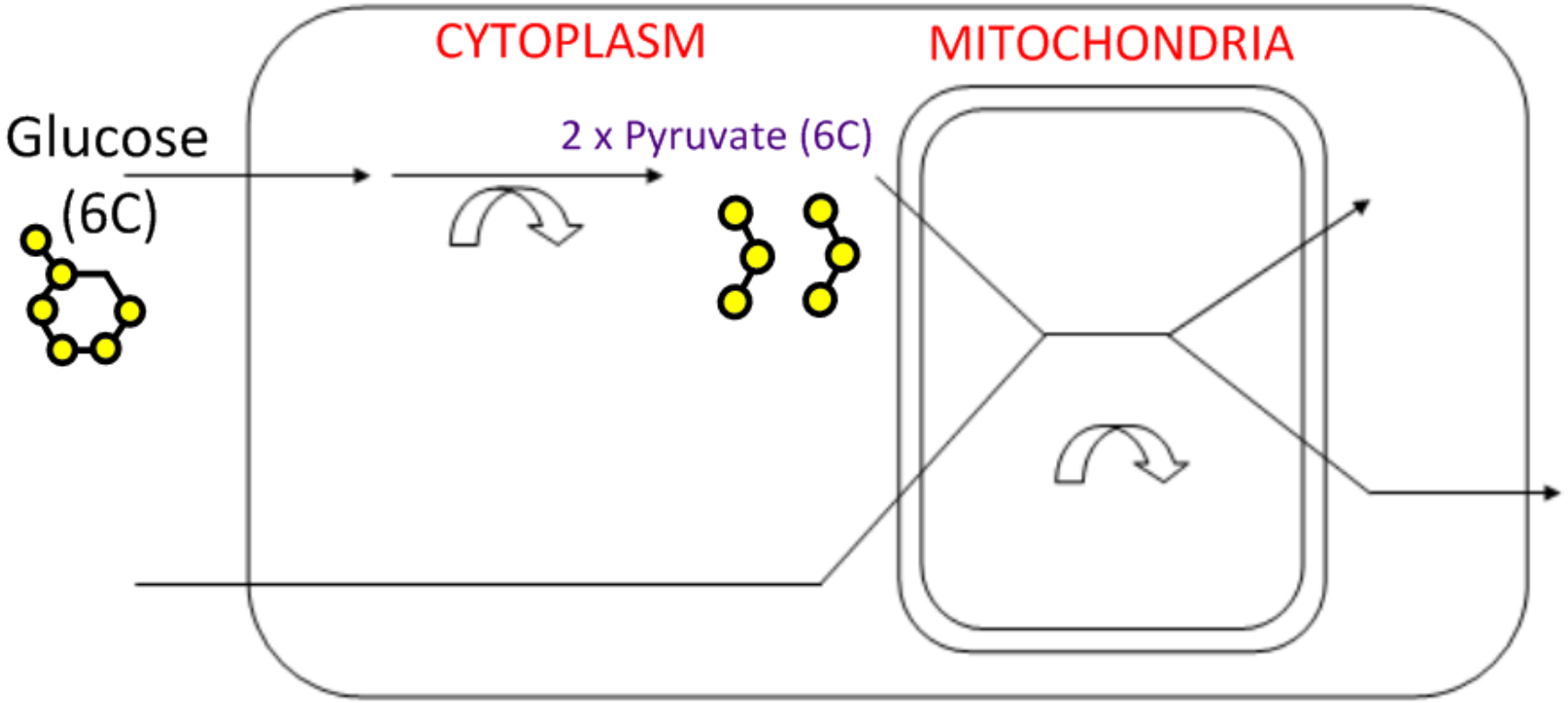


Image adapted from IB Biology Course Companion (Mindorff and Allott)

Glucose is a 6-carbon organic compound which is split into two pyruvate molecules in cytoplasm, with a small yield of ATP.

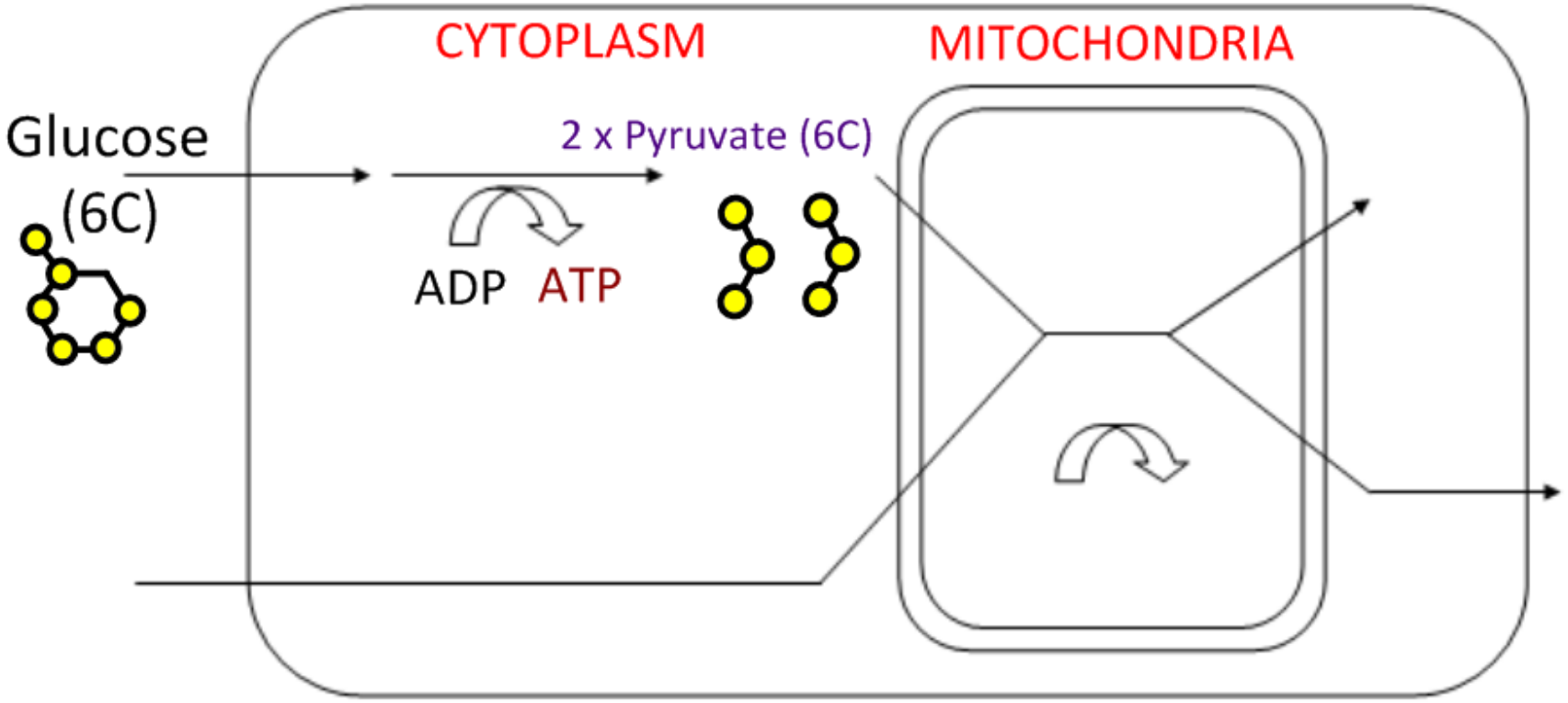
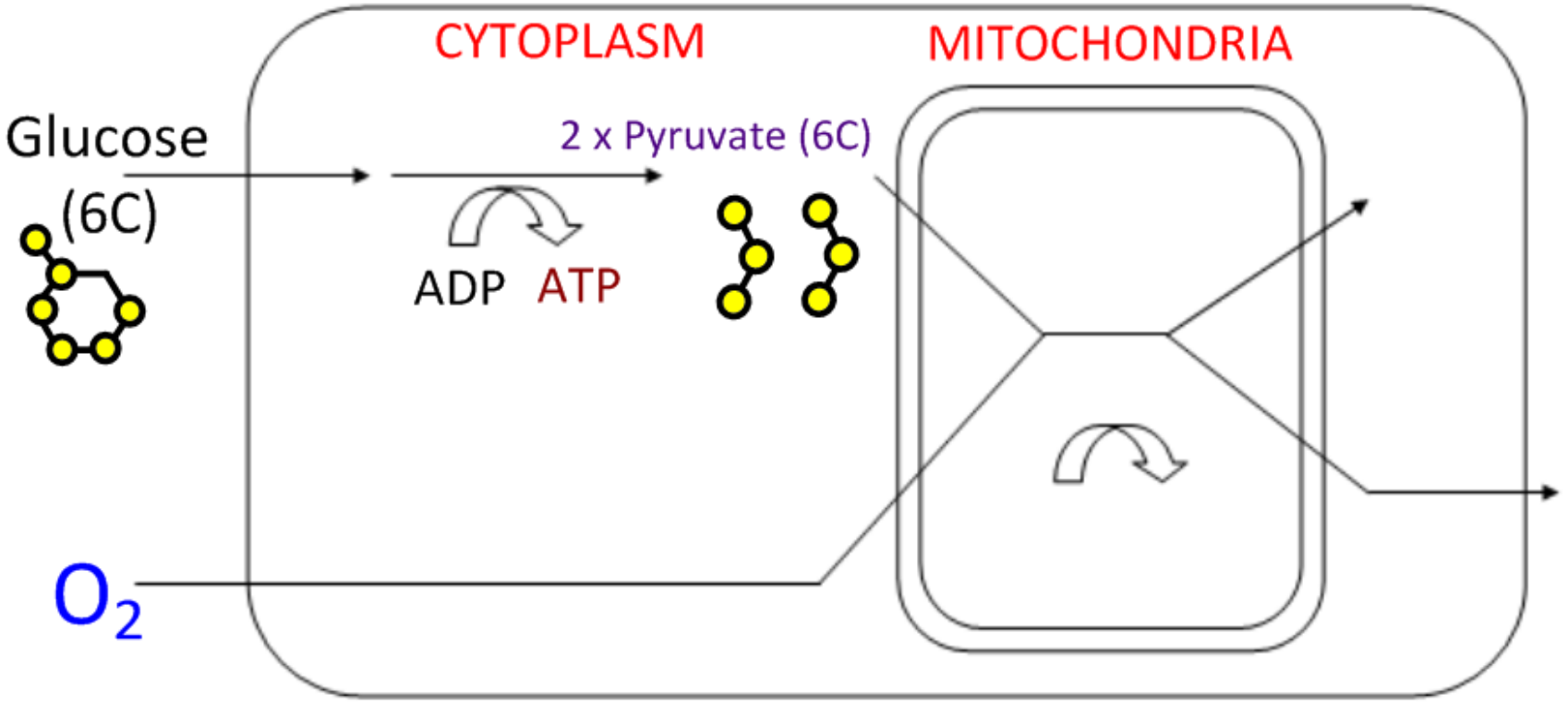


Image adapted from IB Biology Course Companion (Mindorff and Allott)

Aerobic respiration occurs in the presence of oxygen.

Reactions continue in the mitochondria.



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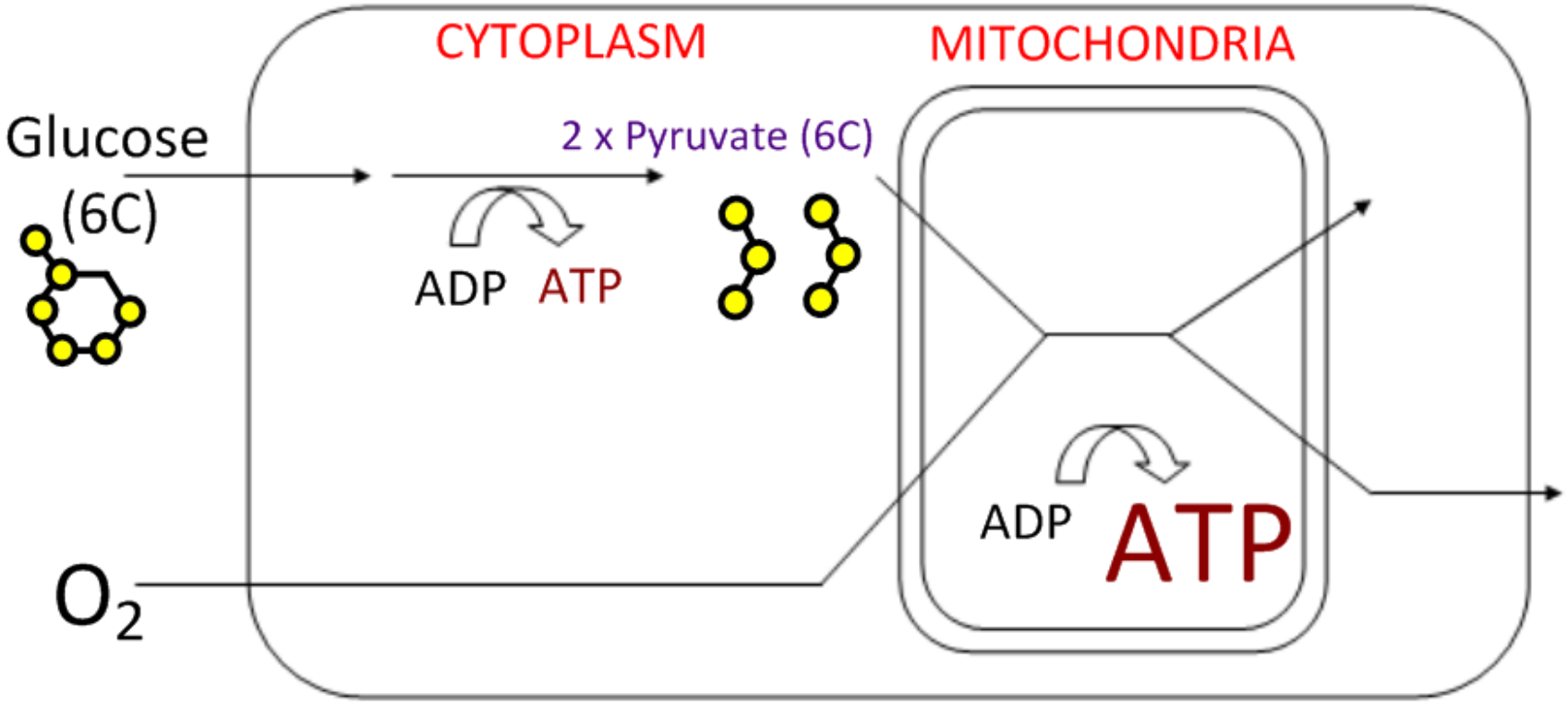

A large yield of ATP is given.

Image adapted from IB Biology Course Companion (Mindorff and Allott)

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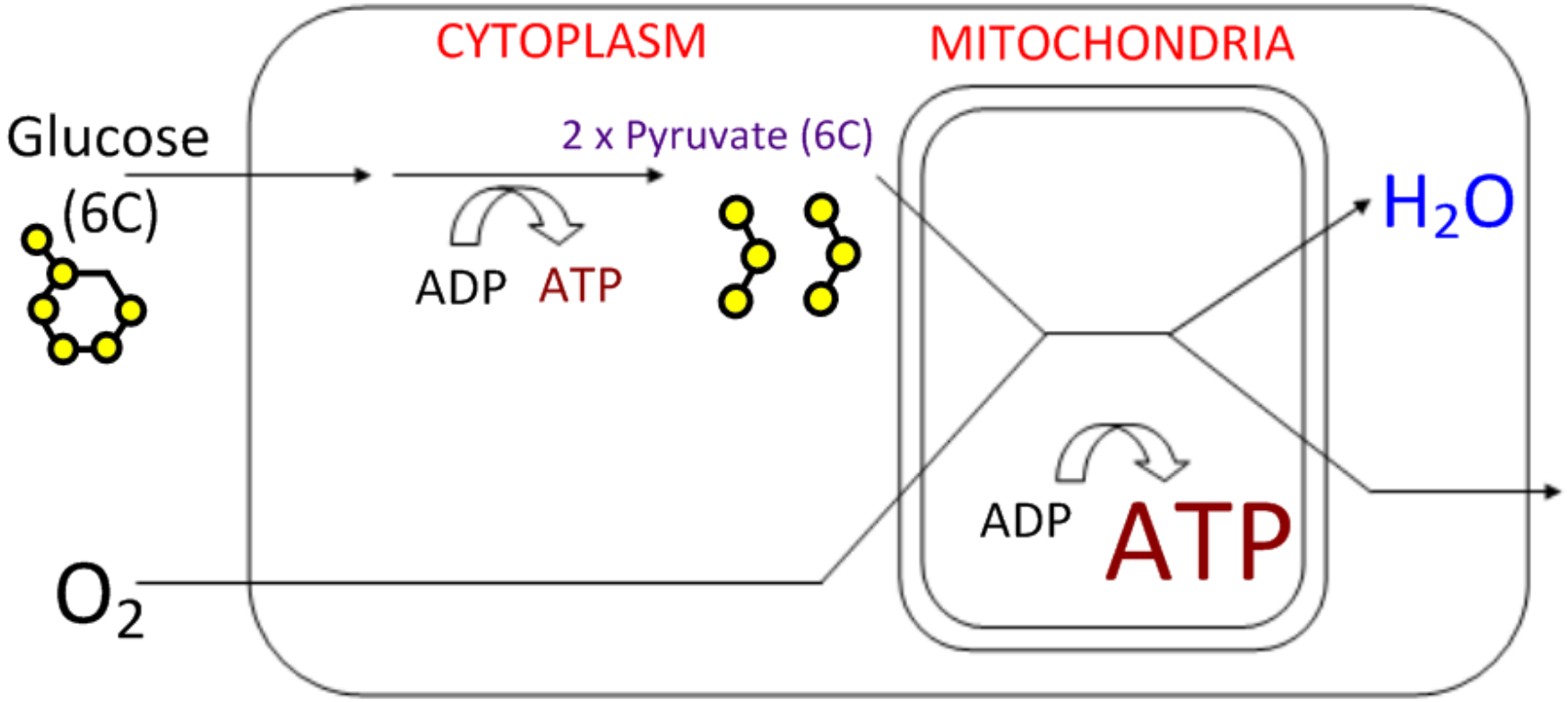

A large yield of ATP is given.

Water is a waste product recycled in the cell.

Image adapted from IB Biology Course Companion (Mindorff and Allott)

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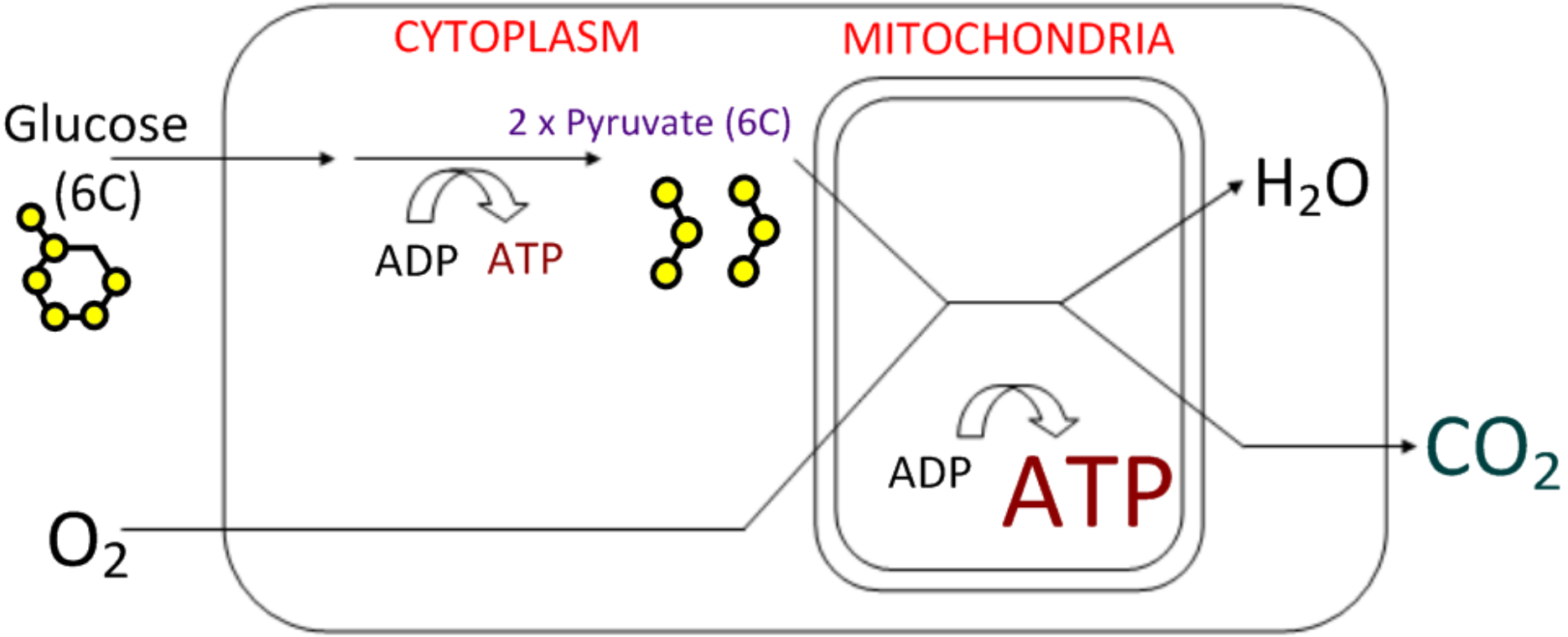


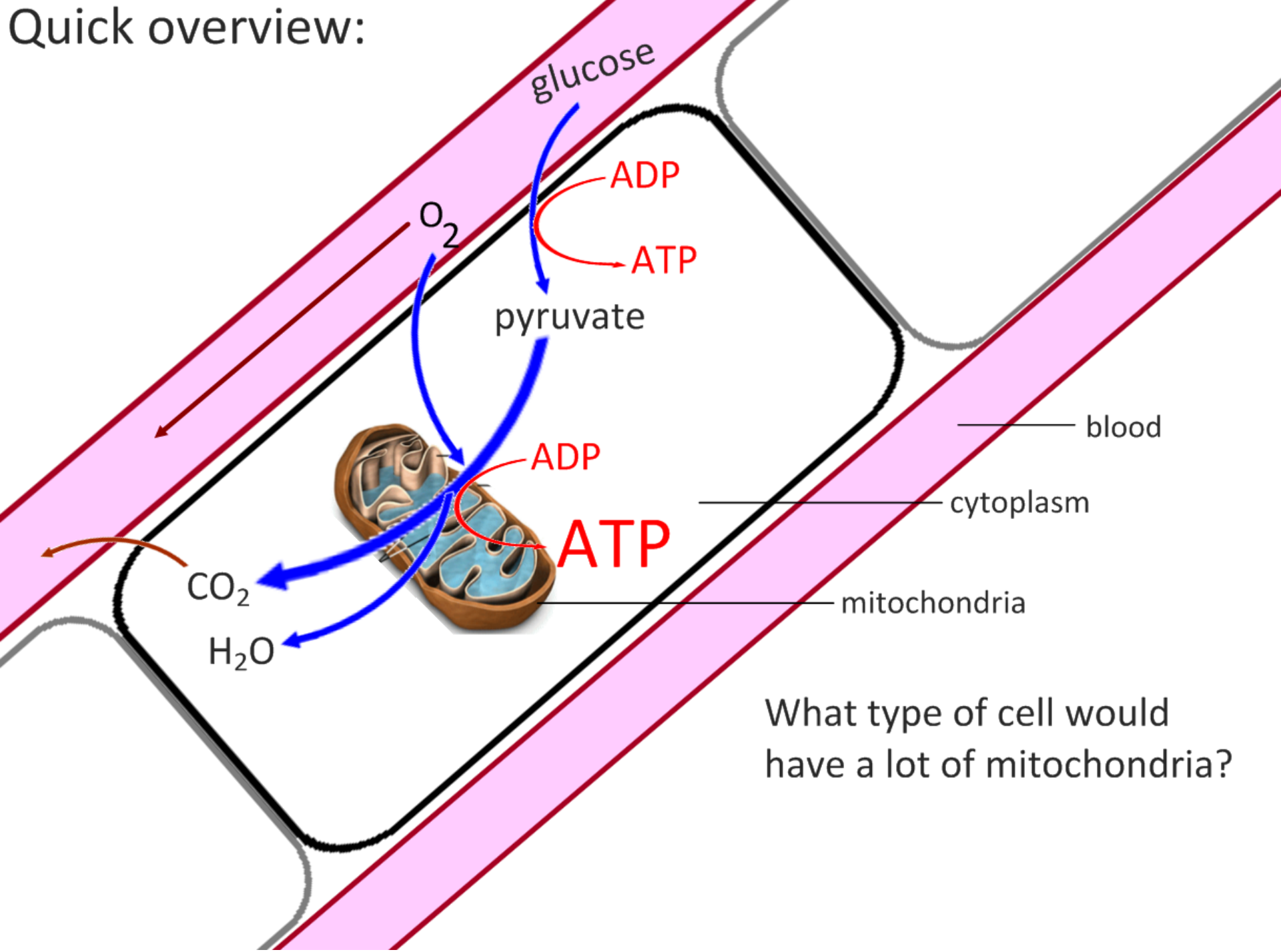
A large yield of ATP is given.

Water is a waste product recycled in the cell.

CO_2 is excreted through gas exchange.

Image adapted from IB Biology Course Companion (Mindorff and Allott)

Quick overview:



What type of cell would have a lot of mitochondria?

Glucose is a 6-carbon organic compound

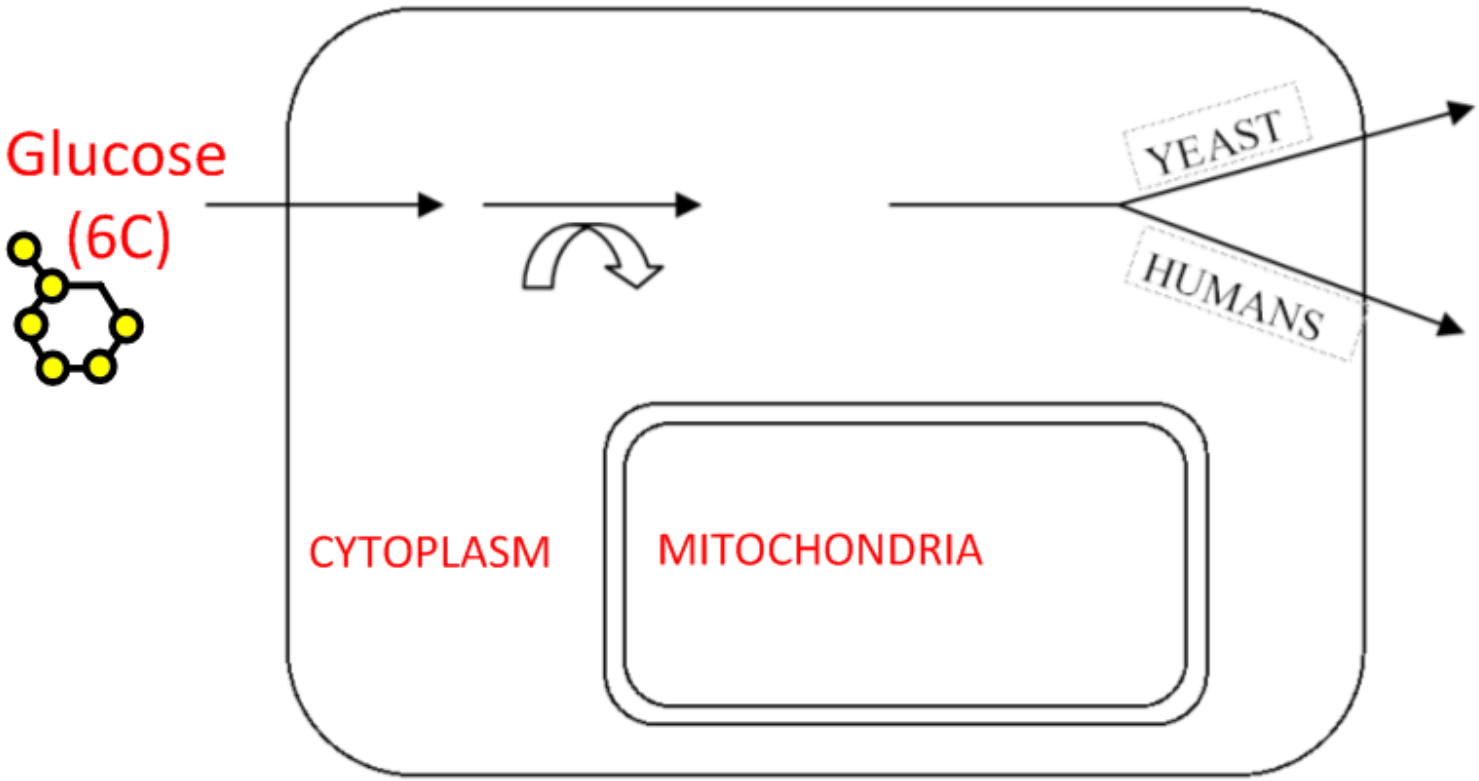


Image adapted from IB Biology Course Companion (Mindorff and Allott)

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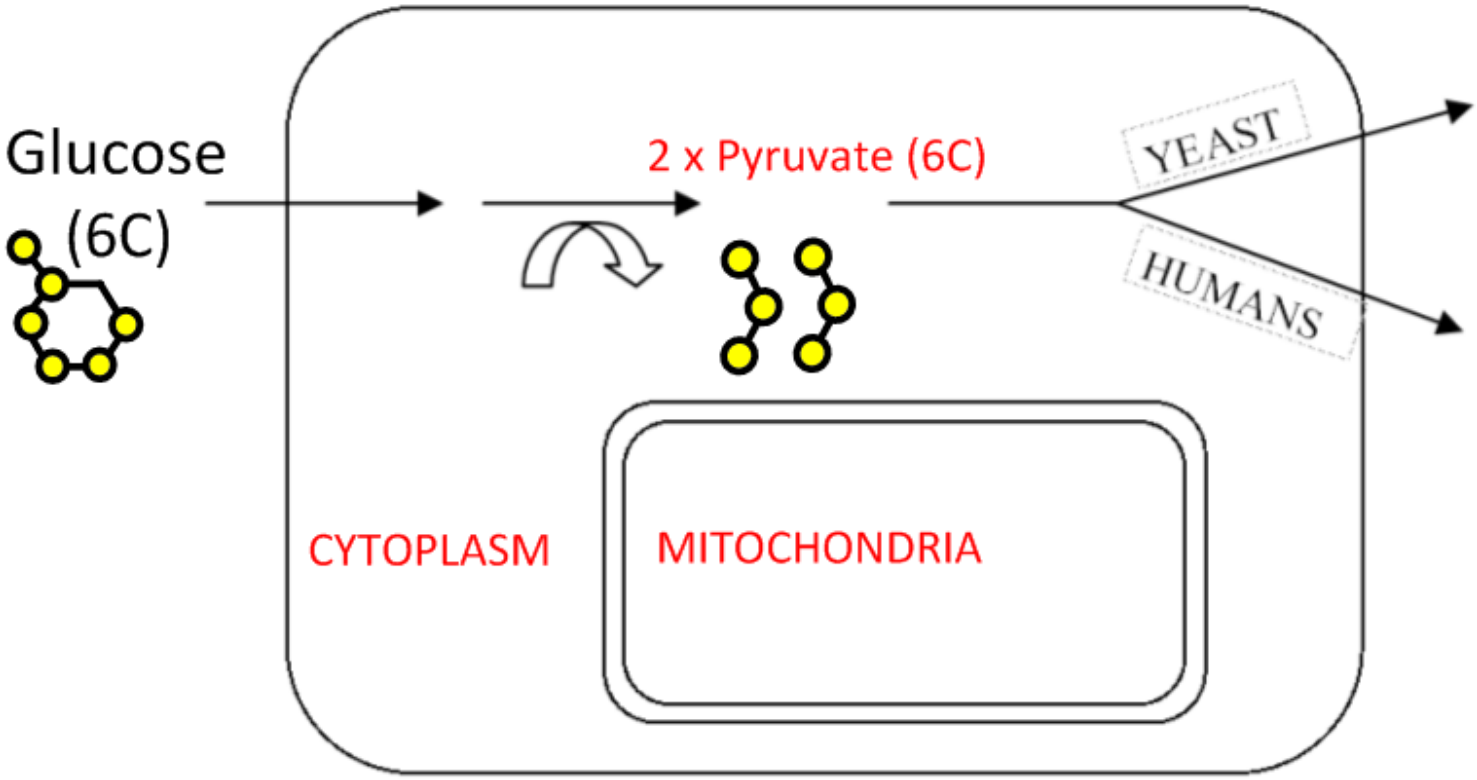

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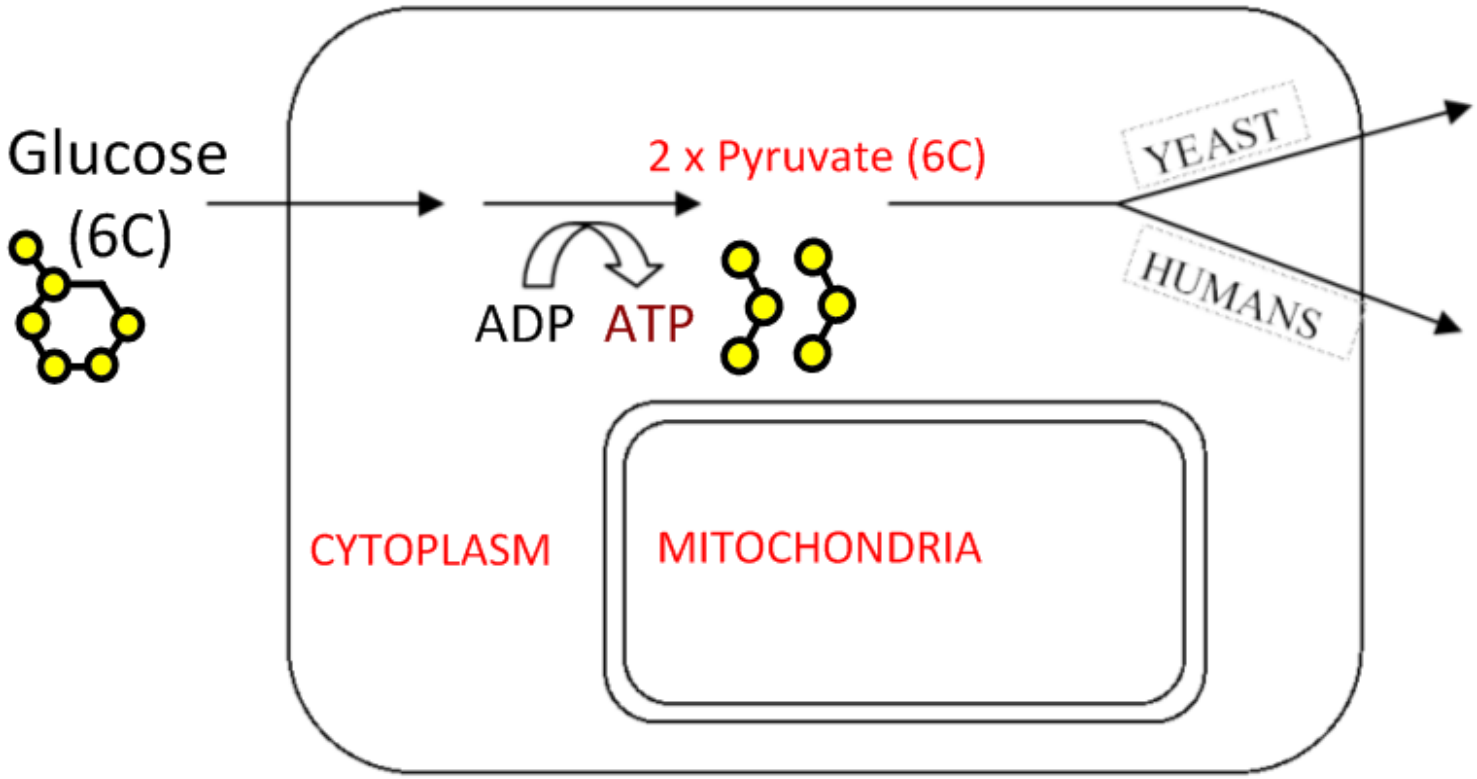
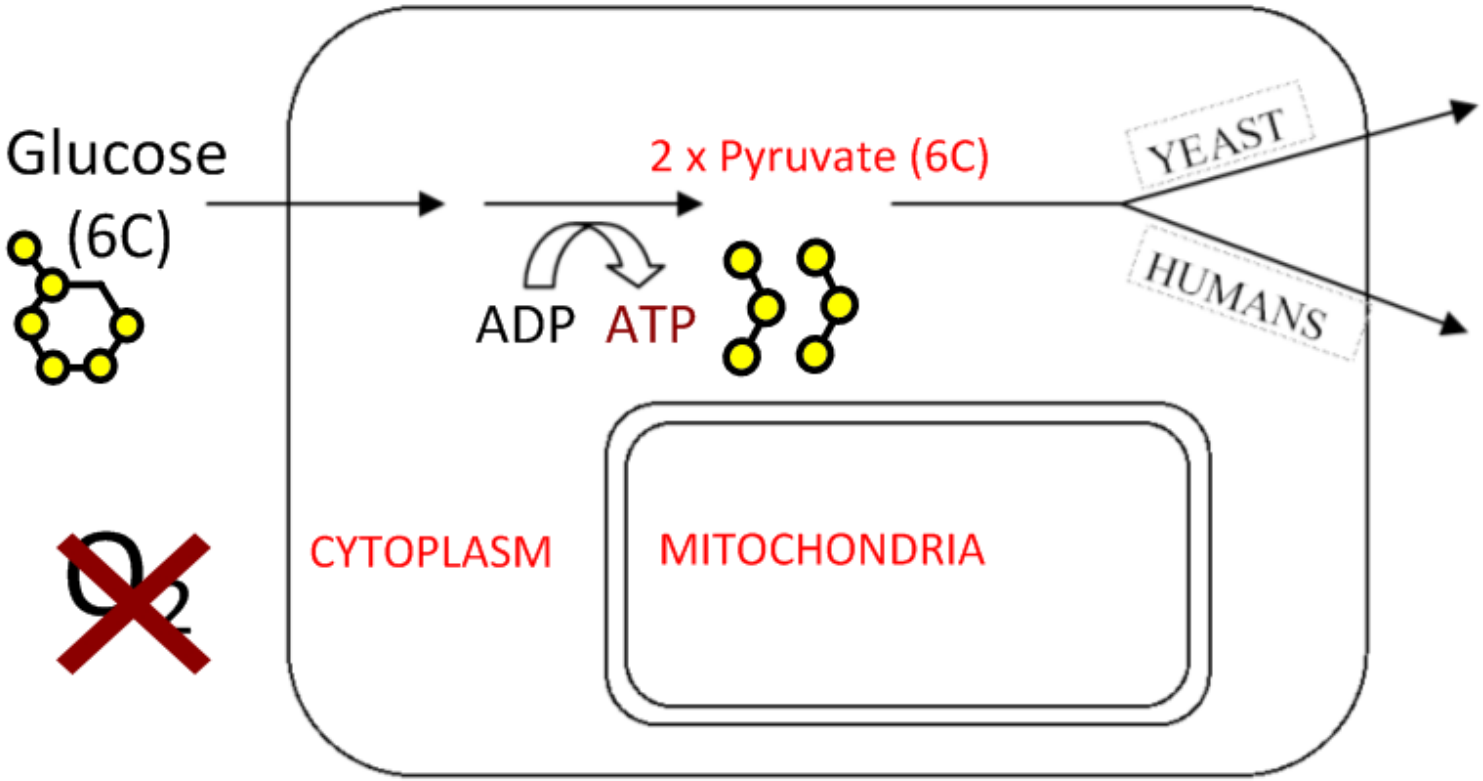


Image adapted from IB Biology Course Companion (Mindorff and Allott)

Anaerobic respiration occurs in the absence of oxygen.

Reactions do not continue in the mitochondria.



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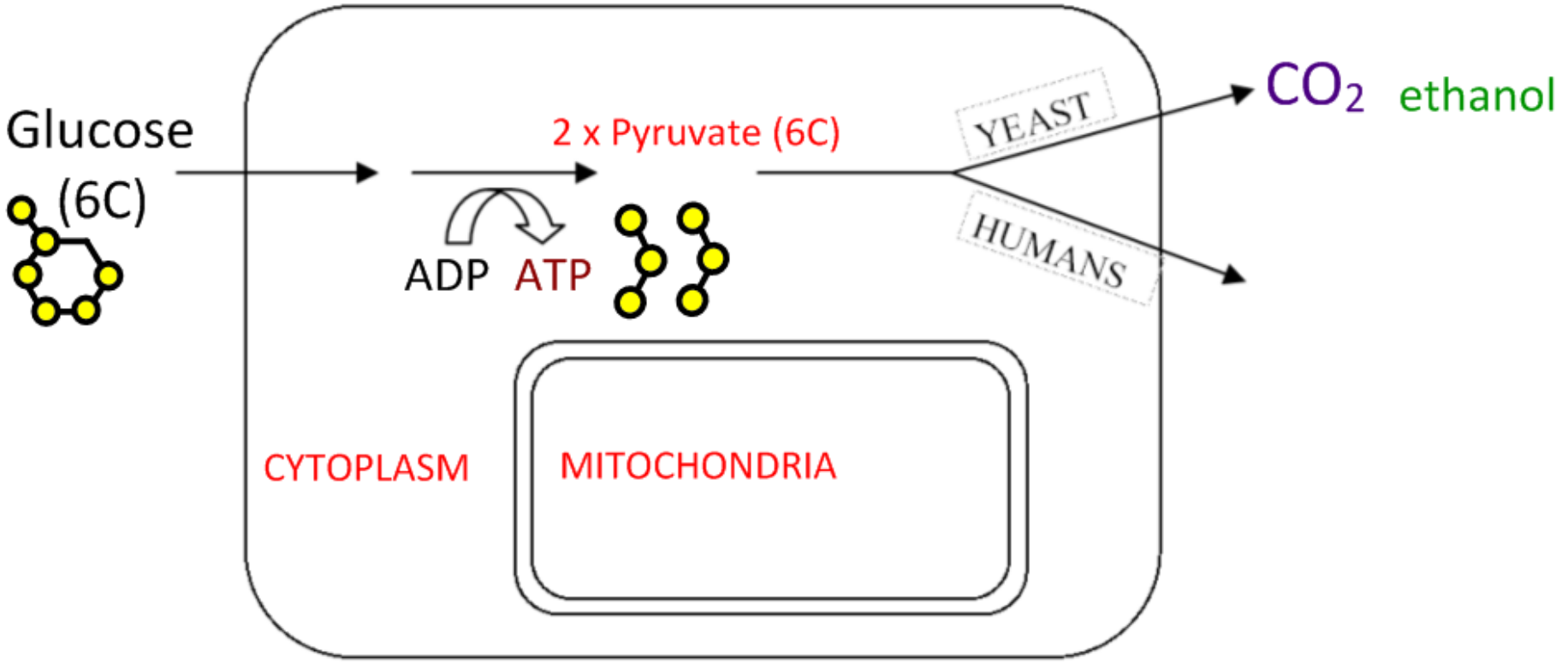
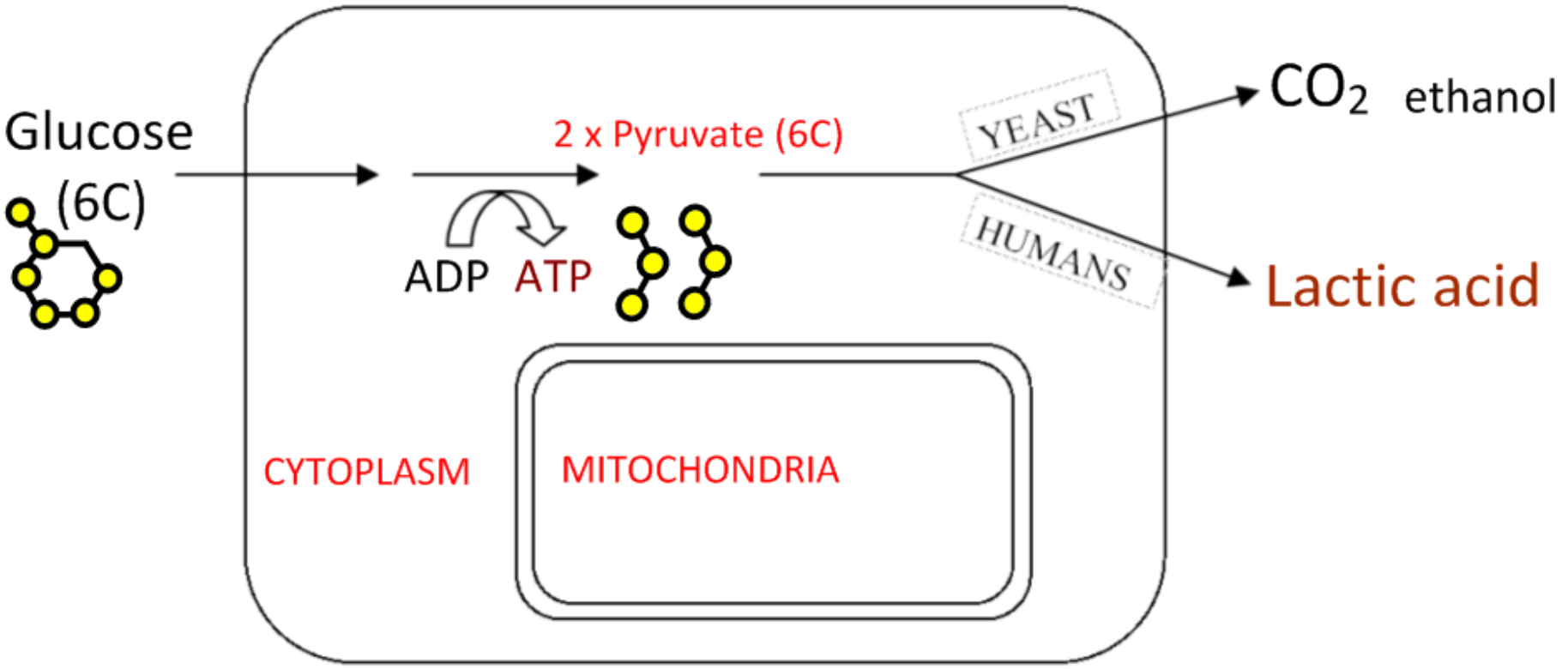


Carbon dioxide and ethanol are produced in yeast (fermentation).

Image adapted from IB Biology Course Companion (Mindorff and Allott)

Anaerobic respiration occurs in the absence of oxygen.

Reactions do not continue in the mitochondria.



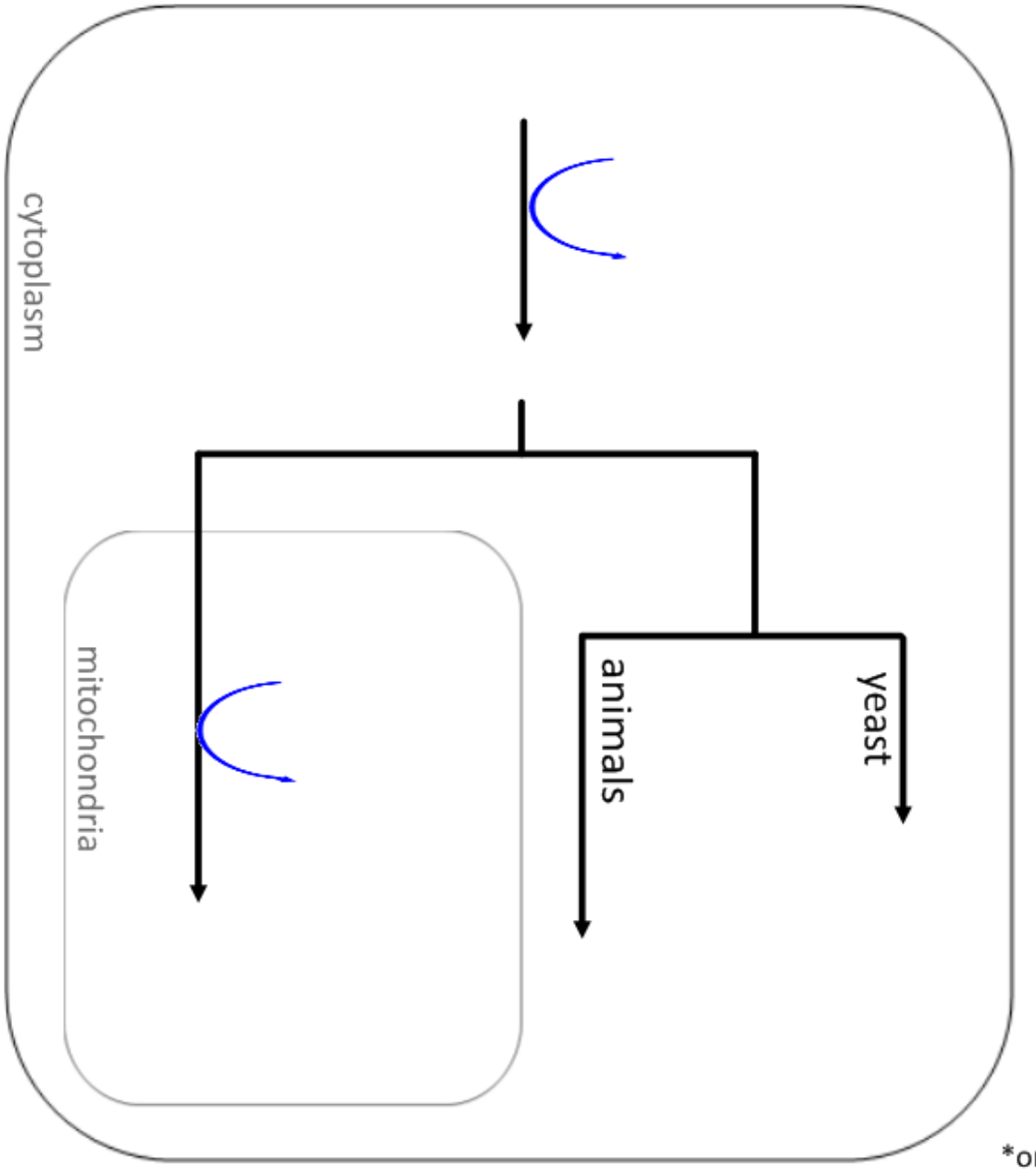
Carbon dioxide and ethanol are produced in yeast (fermentation).

Lactic acid (lactate) is produced in humans and other animals.

The overall yield of ATP is very low.

Image adapted from IB Biology Course Companion (Mindorff and Allott)

Drag 'n' Drop*



2 x Pyruvate

Glucose

no O_2

O_2

ethanol

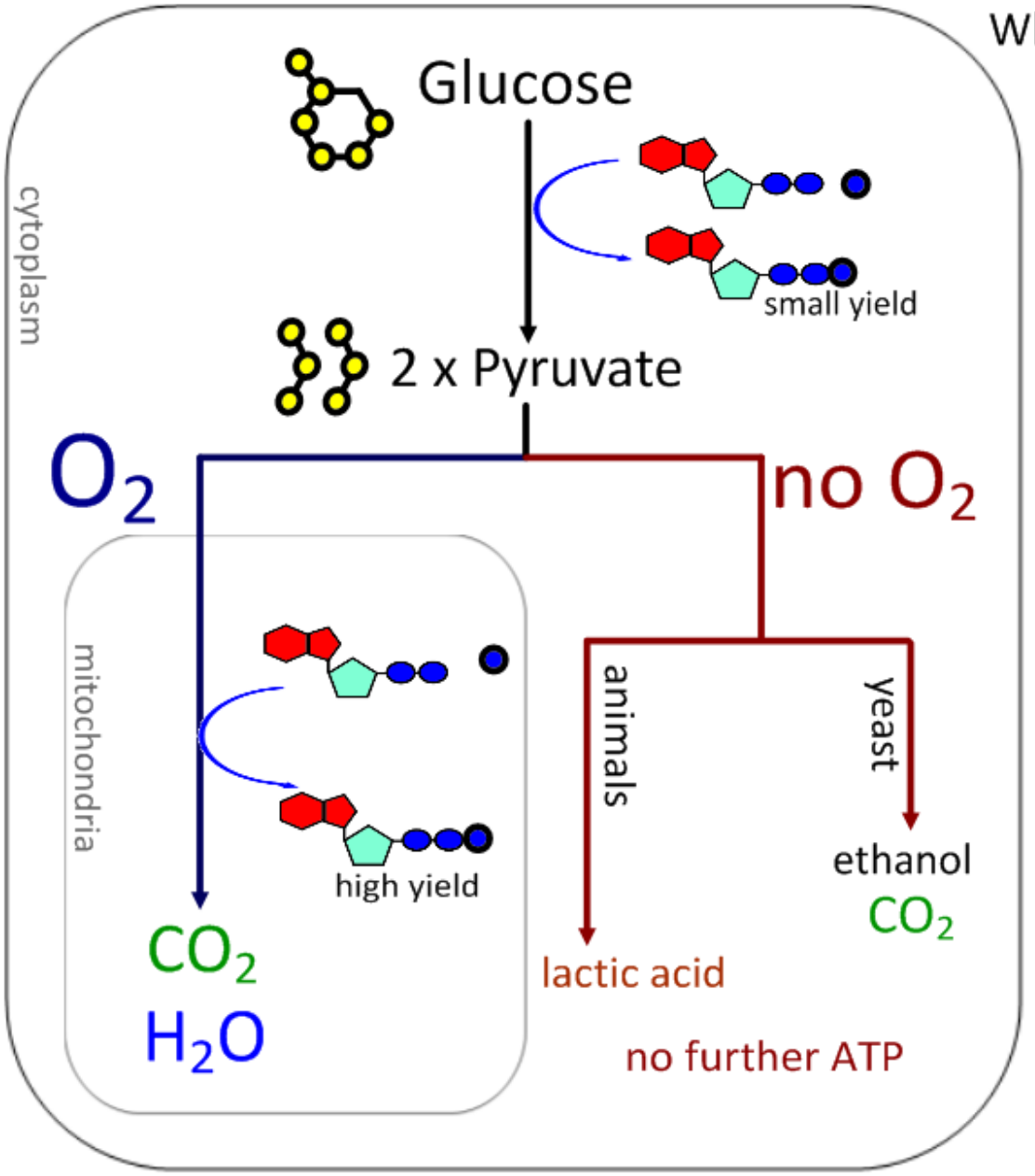
lactic acid

CO_2 CO_2

H_2O

no further ATP

*or print and write



Which molecules of respiration contain:

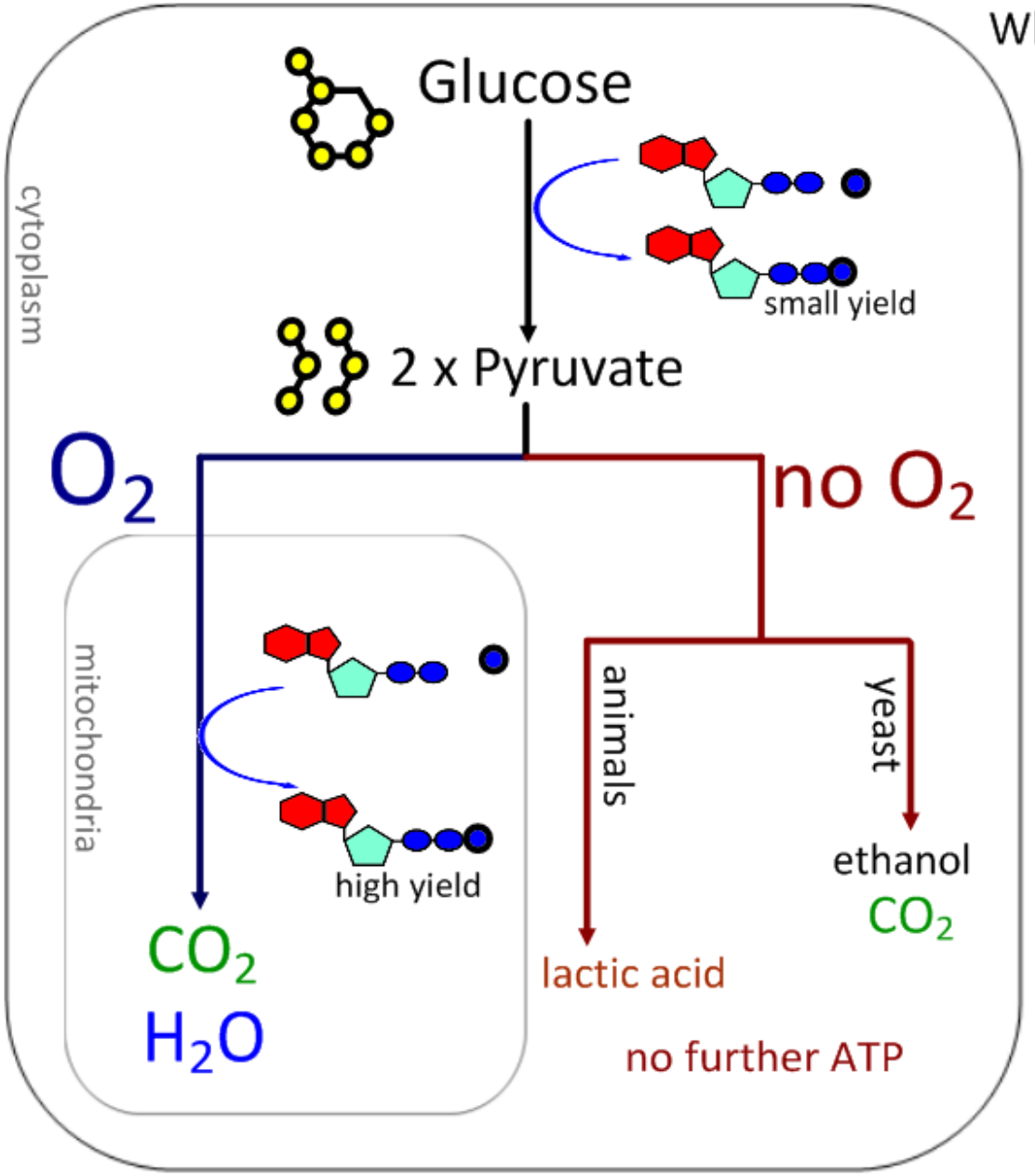
6 carbons?

3 carbons?

1 carbon?

0 carbons?

Phosphorous?



Which molecules of respiration contain:

6 carbons?

glucose

3 carbons?

pyruvate

1 carbon?

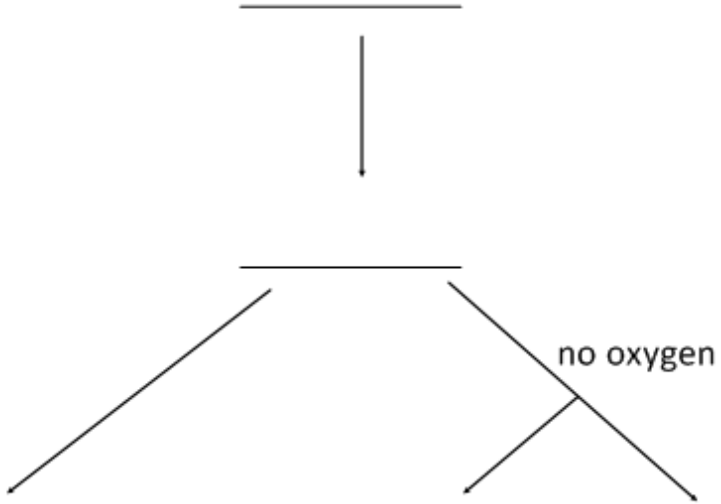
carbon dioxide

0 carbons?

water, oxygen

Phosphorous?

ATP



CO_2

lactate

oxygen

(6 carbon)

animals

H_2O

yeast

2 x

CO_2

pyruvate

34 x

glucose

(2 x 3 carbon)

ethanol

mitochondria

glucose (6 carbon)

2 x 

pyruvate (2 x 3 carbon)

oxygen

no oxygen

animals

yeast

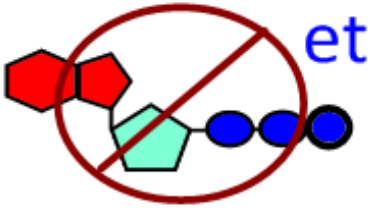
CO_2 H_2O

34 x 

lactate

CO_2

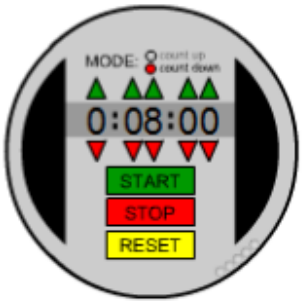
ethanol



Compare aerobic and anaerobic cell respiration.

(8 marks)

Similarities



Differences

Aerobic	Anaerobic

Compare aerobic and anaerobic cell respiration.

(8 marks)

Similarities

Both can start with glucose

Both produce pyruvate (by glycolysis)

Both produce ATP

Both produce CO_2

Differences

Aerobic	Anaerobic

Compare aerobic and anaerobic cell respiration.

(8 marks)

Similarities

Both can start with glucose

Both produce pyruvate (by glycolysis)

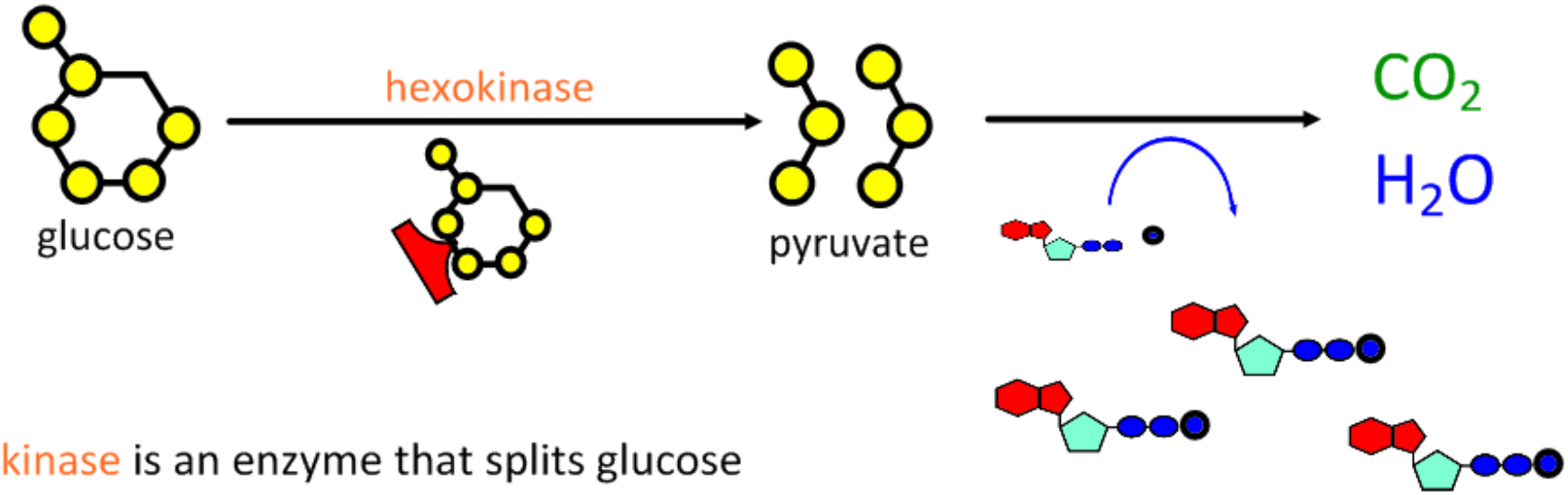
Both produce ATP

Both produce CO_2

Differences

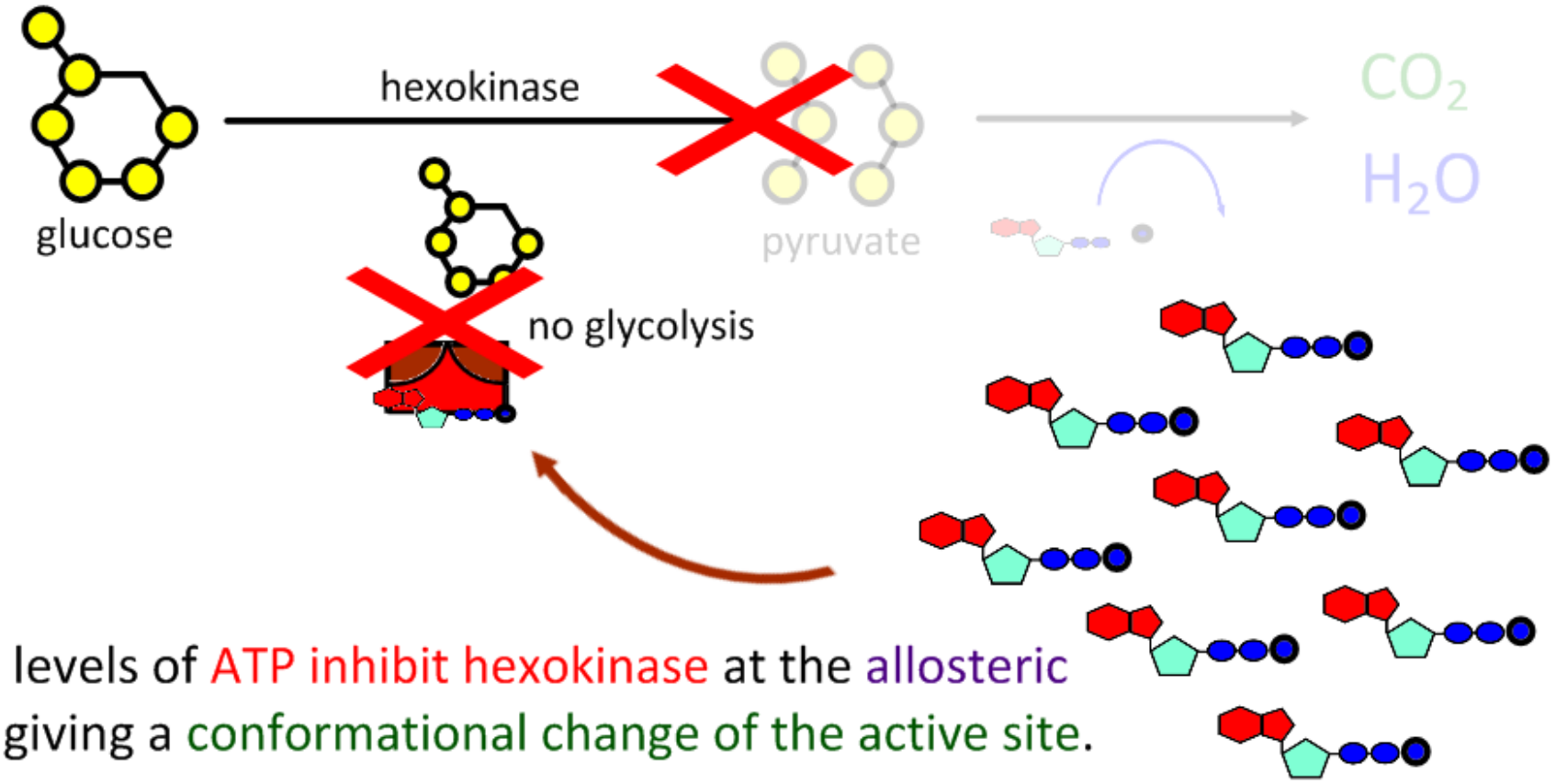
Aerobic	Anaerobic
Uses oxygen	No oxygen
High yield of ATP	Low yield of ATP
Waste products: CO_2 and water	Waste products: CO_2 and ethanol (yeast) Lactic acid (animals)
Pyruvate carried to mitochondria	Occurs in cytoplasm only
Can metabolise other molecules	

Cell Respiration is an enzyme-controlled metabolic pathway which can be controlled by end-product inhibition.



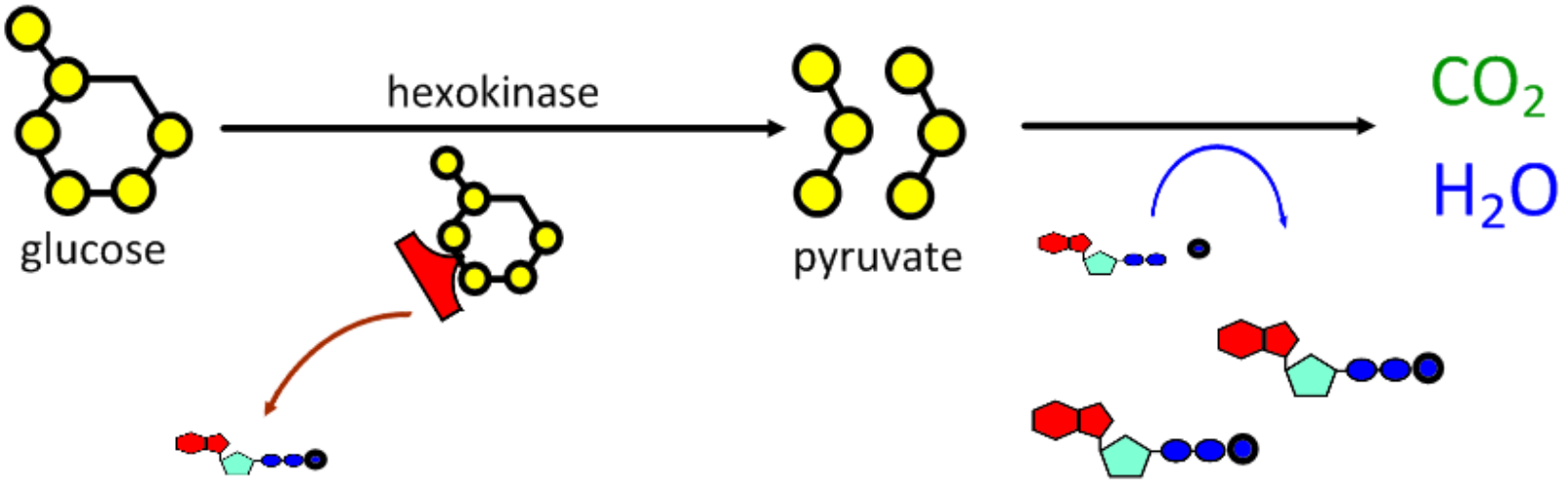
hexokinase is an enzyme that splits glucose into pyruvate molecules (glycolysis).

Cell Respiration is an enzyme-controlled metabolic pathway which can be controlled by end-product inhibition.



High levels of ATP inhibit hexokinase at the allosteric site, giving a conformational change of the active site.

Cell Respiration is an enzyme-controlled metabolic pathway which can be controlled by end-product inhibition.



High levels of ATP inhibit hexokinase at the allosteric site, giving a conformational change of the active site.
This is reversed when ATP levels return to normal.

For more IB Biology resources:

http://sciencevideos.wordpress.com