

RESPIRATION

**THIS IS AN ENZYME CONTROLLED CHEMICAL
BREAKDOWN OF FOOD THAT TAKES PLACE
IN ORGANISMS CELLS TO PRODUCE ENERGY.**

**THIS IS THE PROCESS WHERE FOOD IS
CHEMICALLY BROKEN DOWN IN THE BODY
TO RELEASE ENERGY**

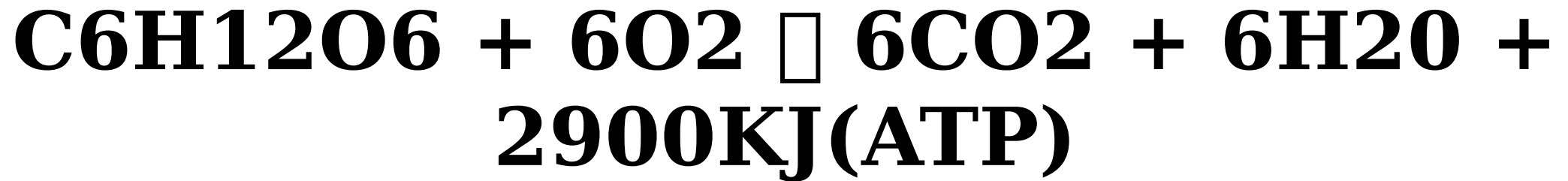
**THIS ENERGY IS OBTAINED BY OXIDIZING
THE ORGANIC COMPOUNDS I.E PROTEINS,
LIPIDS AND CARBOHYDRATES IN THE CELLS**

DURING OXIDATION OF THESE COMPOUNDS, CHEMICAL ENERGY IS RELEASED AND STORED IN FORM OF ADENOSINE TRIPHOSPHATE (ATP)

OXYGEN IS REQUIRED TO FACILLITATE THIS PROCESS WHEREAS CARBON (IV) OXIDE AND WATER ARE PRODUCED DURING THE PROCESS.

GLUCOSE IS THE MOST COMMON
SUBSTRATE.

THE OVERALL EQ FOR RESPIRATION IS;



IMPORTANCE OF RESPIRATION IN LIVING THINGS

RESPIRATION PROVIDES ENERGY FOR;

❖ **CELL DIVISION**

❖ **BODY SECREATIONS**

❖ **TRANSMISSION OF IMPULSE**

❖ **GROWTH AND DEVELOPMENT**

❖ **EXCRETION**

❖ **MOVEMENT AND LOCOMOTION**

THE MITOCHONDRION-□

THE MITOCHONDRION

#####DIAGRAM

**THIS IS WHERE RESPIRATION TAKES
PLACE**

ITS MADE UP OF;

- ❖ **OUTER MEMBRANE**
- ❖ **INNER MEMBRANE**
 - ❖ **CRISTAE**
 - ❖ **MATRIX**

STRUCTURE AND ADAPTATIONS OF THE MITOCHONDRION

- ❖ IT IS **SAUSAGE SHAPED** TO INCREASE S.A FOR RESPIRATION
- ❖ IT HAS **DOUBLE MEMBRANES** CONTROLLING WHAT ENTERS AND LEAVES THE MATRIX
- ❖ IT HAS **NUMEROUS CRISTAE** TO INCREASE S.A FOR RESPIRATION
- ❖ IT HAS **MATRIX** CONTAINING RESPIRATORY ENZYMES

TYPES OF RESPIRATION

1. ANAEROBIC RESPIRATION

2. AEROBIC RESPIRATION

**ANAEROBIC RESPIRATION
(RESPIRATION)**

- ❖ **THIS IS THE PROCESS WHEREBY FOOD IS CHEMICALLY BROKEN DOWN WITHOUT OXYGEN.**
- ❖ **IT TAKES PLACE IN THE CYTOPLASM.**

####DIAGRAM TO ILLUSTRATE

❖ **HERE, GLUCOSE IS INCOMPLETELY
BROKEN DOWN.**

**FOR THIS REASON, ETHANOL IN PLANTS
AND LACTIC ACID IN ANIMALS IS
PRODUCED.**

❖ **THIS INCOMPLETE BREAKDOWN
RESULTS TO LOW ENERGY PRODUCTION
AS COMPARED TO AEROBIC.**

IN THE **ABSENCE OF OXYGEN, PLANTS
AND ANIMALS RESPIRE
ANAEROBICALLY FOR A SHORT TIME.**

IN THE **PRESENCE OF OXYGEN, THE
LACTIC ACID AND ETHANOL SHOULD
BE BROKEN DOWN SINCE THEY ARE
TOXIC TO THE BODY.**

**ANAEROBIC RESPIRATION IS ALSO CALLED
FERMENTATION. WHY??**

❖ **ALCOHOLIC FERMENTATION INVOLVES
THE BREAKDOWN OF SIMPLE SUGARS
BY YEAST INTO ENERGY, CO₂ AND
ETHANOL.**

❖ **WHEN LACTIC ACID IS FORMED IN THE
ANIMAL TISSUE, THIS IS CALLED LACTIC
ACID FERMENTATION**

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**LACTIC ACID FERMENTATION ALSO
OCCURS IN MUSCLES DURING
STRENUOUS EXERCISE.**

**LACTIC ACID CAN FURTHER BE BROKEN
DOWN TO RELEASE ENERGY IF OXYGEN
BECOMES AVAILABLE.**

**THIS IS MAINLY BROUGHT ABOUT BY
OXYGEN DEBT.**

OXYGEN DEBT

**THIS IS THE EXTRA AMOUNT OF OXYGEN
REQUIRED TO GET RID OF LACTIC ACID
THAT ACCUMULATES IN THE BODY
TISSUES WHEN OXYGEN SUPPLY IS LESS
THAN THE DEMAND.**

**UNDER OXYGEN DEBT, THE ORGANISM
RESPIRE ANAEROBICALLY.**

**THE LACTIC ACID FORMED CAUSED
FATIGUE RESULTING TO MUSCLE CRUMPS.**

E.G A RUNNER AFTER RUNNING

❖ **A PANTING ATHLETE BREATHS FASTER AS THE HEARTBEAT ALSO INCREASES TO TRANSPORT OXYGEN FASTER TO THE MUSCLE CELLS AND LACTIC ACID FROM MUSCLES TO THE LIVER TO BE OXIDISED TO CO₂ AND H₂O OR CONVERTED TO GLUCOSE THEN GLYCOGEN FOR STORAGE.**

APPLICATIONS OF ANAEROBIC RESPIRATION

- ❖ **BAKERY** - YEAST BREAKS DOWN THE SUGARS IN DOUGH INTO ETHANOL AND CO₂.
- ❖ **BIOGAS PRODUCTION** - METHANOGENS METABOLISE CARBOHYDRATES BY ANAEROBIC RESPIRATION THEREBY PRODUCING METHANE.
- ❖ **SEWAGE TREATMENT** - SAPROPHYTIC BACTERIA BREAKS DOWN THE SEWAGE BOTH AEROBICALLY AND ANAEROBICALLY.
- ❖ **BREWERY** - YEAST FERMENTS THE SUGARS IN CEREALS RELEASING ETHANOL.

- ❖ **EXTRACTION OF MINERAL ORES** - SOME BACTERIUM ARE USED IN THE EXTRACTION OF MINERALS LIKE IRON AND MANGANESE
- ❖ **YOUGHRT PREPARATION** - STREPTOCOCCUS AND LACTOBACILLUS SPP ARE USED IN THE FERMENTATION OF MILK TO MAKE YOUGHRT.

#####AEROBIC RESPIRATION--□

AEROBIC RESPIRATION

❖ **THIS IS WHERE FOOD IS CHEMICALLY
BROKEN DOWN IN THE PRESENCE OF
OXYGEN TO RELEASE ENERGY.**

**C₆H₁₂O₆ + 6O₂ → 6CO₂ + 6H₂O +
ENERGY (ATP)**

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❖ IN THE **FORMATION OF ATP**, THE ENERGY CAUSES A REACTION WHEREBY TWO PHOSPHATE MOLECULES, COMBINES WITH AN INORGANIC PHOSPHATE MOLECULE TO FORM ATP.

ADP + INORGANIC PHOSPHATE + ENERGY → ATP

ENERGY IS RELEASED IN **SMALL AMOUNT** TO AVOID BURNING OF THE CELLS. **###-□**

❖ **HOWEVER IT SHOULD BE NOTED THAT THE AEROBIC RESPIRATION IS A SERIES OF CHEMICAL REACTIONS CATALYSED BY DIFFERENT ENZYMES.**

❖ **AEROBIC RESPIRATION HAS TWO PHASES;**

***GLYCOLYSIS**

***KREBS CYCLE**

GLYCOLYSIS

- ❖ **THE FIRST PART OF RESPIRATION**
- ❖ **TAKES PLACE WITHOUT OXYGEN**
- ❖ **IT OCCURS IN THE CYTOPLASM**
- ❖ **GLUCOSE IS BROKEN DOWN FORMING 3 CARBON MOLECULES CALLED PYRUVIC ACID AND ENERGY.**
- ❖ **HERE, 2ATP MOLECULES ARE FORMED FROM ONE MOLECULE OF GLUCOSE.**

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IN PLANTS

**GLUCOSE --- ENZYME --> PYR ACID -
ENZYME > ETHANOL + CO2 + 2ENERGY**

IN ANIMALS

**GLUCOSE --- ENZYME --> PYR ACID-
ENZYME >
LACTIC + 2ENERGY**

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**WHAT HAPPENS AFTER PYRUVIC ACID
IS FORMED DEPENDS ON WHETHER
OXYGEN IS PRESENT OR NOT.**

**IF NOT PRESENT, PYRUVIC ACID IS
PARTIALLY BROKEN DOWN TO LACTIC
ACID IN ANIMALS AND ETHANOL AND
CO₂ IN PLANTS**

KREB'S CYCLE

TAKES PLACE IN THE MATRIX OF THE MITOCHONDRION.

PYRUVIC ACID FROM GLYCOLYSIS COMBINES WITH OXYGEN FORMING ENERGY, CARBON (IV) OXIDE AND WATER.

HERE, ONE MOLECULE OF GLUCOSE FORMS 38 ATP MOLECULES.

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**GLUCOSE $\rightarrow$ PYRV ACID + OXYGEN --
ENZYMES $\rightarrow$ CO₂ + H₂O + ENERGY**

**C₆H₁₂O₆ $\rightarrow$ CH₃COCOOH + 6O₂ $\rightarrow$ 6CO₂ +
6H₂O + 38ATP**

ANAEROBIC RESPIRATION	AEROBIC RESPIRATION
❖ CYTOPLASM	CYTOPLASM AND MITOCHONDRIUM
❖ ABSENCE OF O₂	PRESENCE OF O₂
❖ LACTIC ACID AND ETHANOL PRODUCED	CO₂ AND WATER
❖ PRODUCTS FURTHER	PRODUCTS CANNOT BE

RELEASES 2 ATP

RELEASES 38 ATP

**❖ FOOD
SUBSTRATE
PARTIALLY
BROKEN**

**FULLY BROKEN
DOWN**

**❖ HAS TWO
STAGES;
GLYCOLYSIS AND
FERMENTATION**

**HAS THREE
STAGES;
GLYCOLYSIS,
KREBS AND
ELECTRON
TRANSPORT CHAIN**

RESPIRATORY SUBSTRATE

**THESE ARE FOOD SUBSTANCES WHICH
WHEN OXIDIZED **RELEASE ENERGY**. E.G**

❖ CARBOHYDRATES

❖ FATS

❖ PROTEINS

****CARBOHYDRATES** ARE THE MAIN
SOURCE OF ENERGY IN RESPIRATION**

RESPIRATORY QUOTIENT

**THIS IS THE RATIO SHOWING THE
RELATIONSHIP BETWEEN THE AMOUNT
OF CO₂ PRODUCED AGAINST OXYGEN
CONSUMED.**

$$\text{RQ} = \text{CO}_2 / \text{O}_2$$

**THIS GIVES THE TYPE OF SUBSTRATE
BEING OXIDIZED AND WHETHER AEROBIC
OR ANAEROBIC IS TAKING PLACE.**

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❖ **THE RQ OF FATS IS 0.7. THIS MEANS THAT THE AMOUNT OF CARBON (IV) OXIDE PRODUCED IS LESS THAN OXYGEN USED.**

❖ **THE RQ OF SUGARS IS 1.0**

❖ **THE RQ OF PROTEINS IS 0.9**

RQ OF VALUES ABOVE 1.0 INDICATED ANAEROBIC RESPIRATION

IN RESPIRATION;

❖ **CARBOHYDRATES** YIELD LEAST ENERGY
17KJ

❖ **THEN PROTEINS** 22KJ

❖ **THEN FATS** 38KJ

EXAMPLE;

CALSULATE RQ FROM THE EQUATION;



$$18/26 = 0.6923 = \mathbf{0.7(FATS)}$$

FACTORS AFFECTING RESPIRATION RATE

- ❖ **OXYGEN CONCENTRATION**
- ❖ **SUBSTRATE CONCENTRATION I.E GLUCOSE**
- ❖ **SA TO VOLUME RATIO**
- ❖ **HORMONES - THYROXINE AND ADRENALINE INCREASES RESPIRATION.**

**THYROXINE INCREASES METABOLIC RATE
REGULATING GROWTH AND DEVELOPMENT**

**ADRENALINE IS PRODUCED IN AN
EMERGENCY TO PREPARE FOR FIGHT OR
FLEE.**

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- ❖ **AGE**
- ❖ **TEMPERATURE**
- ❖ **GENDER**
- ❖ **HEALTH CONDITION**
- ❖ **OCCUPATION**
- ❖ **RESPIRATION TYPE**
- ❖ **TYPE OF SUBSTRATE**

###END

