

Definitions and Laws

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DEFINITIONS & LAWS

PHYSICS

WAVES, SOUND & AIR

- **AMPLITUDE** – The vertical displacement between the equilibrium position of the wave and the crest or trough.
- **DIFFRACTION** – The ability of a wave to spread out in the wave front and to bend when it moves through a small opening or around a sharp edge.
- **DOPPLER EFFECT** – The change in frequency of a sound (and thus also the pitch of the sound) when the sound source and the listener move with regards to one another.
- **FREQUENCY** – The amount of whole waves that pass a fixed point in 1 second (f).
- **WAVELENGTH** – The distance between two consecutive crests or troughs (or any two consecutive points that are in phase).
- **HUYGENS'S PRINCIPLE** – Each point on a wave front act as a source of secondary waves that spread out into every direction at the same speed as the original wave. A new wave front exists and is obtained by a tangent on the secondary waves.
- **INTERFERENCE** – The merging (super positioning) of two or more waves that lead to a new wave pattern.
- **REFLECTION** – When a wave hits an obstruction and it is reflected at the same angle as it invaded at.
- **REFRACTION** – When a wave from one medium enters another medium with a new optic density and a change in speed and direction of the wave takes place.

MECHANICS

- **PRINCIPLE OF CONSERVATION OF ENERGY** – The total energy of a closed system remains constant.
- **CONSERVATION OF MECHANICAL ENERGY** – The total mechanical energy ($E_p + E_k$) in a closed system remains constant (e.g. during freefall).
- **POWER** – It is the tempo at which work is done (or the tempo at which energy is transferred).
- **ENERGY** – The ability to do work (scalar size).
- **EQUILIBRIUM** – Forces in equilibrium if the vector sum of all the forces acting in on an object is equal to zero.
- **IMPULSE** – It is the vector size that represents the change in momentum of an object due to a net force that acts in on the object at a given time.
- **JOULE** – It is the unit for work done or energy transferred. (work done = force x displacement)
- **KINETIC ENERGY** – It is the amount of mechanical energy an object possesses due to its movement.
- **MOMENTUM** – It is a vector size and is given by the product of the mass and the velocity of the object.
- **NEWTON** – It is the unit of force. 1 Newton is a resultant force that accelerates a body with a mass of 1 kg at $1\text{m}\cdot\text{s}^{-1}$.
- **NEWTON'S FIRST LAW OF MOVEMENT** – A body will remain in a stationary condition or move forward at a uniform/constant velocity in a straight line, unless an external, unbalanced force acts in on it.
- **NEWTON'S SECOND LAW OF MOVEMENT** – When an unbalanced force acts in on an object, the object will experience constant acceleration. The acceleration is directly proportional to the size of the force and inversely proportional to the mass of the object.
- **NEWTON'S THIRD LAW OF MOVEMENT** – In case a body A exercise a force onto body B, then B will exercise a force onto A that is equal in size, but inverted in direction.

- **NEWTON'S UNIVERSAL LAW OF GRAVITY** – Each body in the universe exercises a gravitational force onto every other body. The force is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres.
- **POTENTIAL ENERGY** – It is the energy an object possesses due to its height above the ground (also known as gravitational potential energy).
- **RESULTANTS** – The single vector that represents the sum of two or more other vectors and indicates the joint effect of the vectors.
- **SCALAR SIZE** – A size comprising only size and not direction.
- **VELOCITY** – A vector size that indicates the tempo of change of displacement.
- **SPEED** – A scalar size that indicates the tempo at which a distance is covered.
- **VECTOR** – A straight line segment of which the length and the orientation in the space respectively indicate the size and the direction of the size.
- **VECTOR SIZE** – A physical size that possesses both size and direction.
- **DISPLACEMENT** – A vector size that indicates the change in position of an object. It is given by the size and direction of the straight line that connects the start and end positions of the object.
- **ACCELERATION** – The tempo of change in velocity of a body in terms of time (in vector).
- **WORK** – A scalar size that indicates the product of the force and displacement of an object and the direction of the applied force ($W = F \times \Delta x$).

ELECTRICITY & MAGNETISM

- **AMPÈRE** – The ampère is the unit of electrical current strength. One ampère current flows when a potential difference of 1V exists over a resistance of 1Ω .
- **COULOMB** – The unit of electrical charge. A charge of 1 coulomb is transferred through a current of 1 ampère in 1 second.
- **COULOMB'S LAW** – The gravitational or repulsive force between charges is directly proportional to the product of the charges and inversely proportional to the square of the distance between their centres.
- **ELECTRICAL POTENTIAL ENERGY** – The energy a charge possesses due to its position relative to other charges.
- **ELECTRICAL FIELD** – The area (space) around a charge wherein another charge experiences an electrostatic force.
- **ELECTRICAL FIELD STRENGTH** – It is the force that a point in an electrical field experiences divided by the size of the charge (i.e. the force per unit charge).
- **EMF (ELECTROMOTORIC FORCE)** – The maximum amount of energy a battery can transfer per Coulomb charge.
- **FARADAY'S LAW** – In case the magnetic field around a conductor (loop) changes, a potential difference (emf) is induced over the conductor. The induced emf is directly proportional to the tempo of change of the magnetic flood of the conductor.
- **JOULE** – The unit of electrical energy transferred or work done. 1 Joule work is done if a current of 1A moves through a resistance of 1Ω for 1s.
- **CAPACITANCE** – The capacitance of the capacitor is the amount charge stored per unit potential difference (per 1V).
- **FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD** – When a current-carrying conductor is displaced rectangular with regards to a magnetic field, it experiences a force. The size of the force is directly proportional to the length of the conductor (amount turns/windings), the strength of the magnetic field and the strength of the electrical current through the conductor. The direction of the force is perpendicular to the level of the current and the magnetic field.
- **MAGNEETVELD** – The area/space around magnetic substances wherein an object with magnetic characteristics will experience a force.

- **OHM** – The unit of electrical resistance. A resistor has a resistance of 1Ω in case the potential difference over its sides are 1 V and the current that flows through it is 1A.
- **OHM'S LAW** – The potential difference between two points in a conductor is directly proportional to the current in the conductor, if the temperature remains constant.
- **POTENTIAL DIFFERENCE** – The difference in potential energy (potential difference) between two points in an electrical field is the work done to move a positive test charge from one point of low potential to a point of higher potential.
- **CURRENT** – The tempo at which charges move i.e. the amount of charge divided by time.
- **VOLT** – The unit of potential difference. The potential difference between two points is 1 volt in case 1 joule work is done per 1 coulomb charge that is moved from one point to another in an electrical field.
- **WATT** – The unit of power. It is thus the tempo at which electrical energy is transferred. 1 Watt is equal to 1 joule per second. A power of 1 Watt is obtained if the potential difference over a conductor is 1V and a current of 1A flows through it.
- **RESISTANCE** – The relation between potential difference over a resistor and the current that flows through the resistor (a material's resistance against the flow of electrical current).

MATTER & MATERIALS

- **PHOTO-ELECTRICAL EFFECT** – The release of electrons from the surface of a metal when electron magnetic radiation (like light) radiates into the metal.

CHEMISTRY

MATTER & MATERIALS

- **ADDITION REACTIONS** – A reaction where atoms are added to a molecule by breaking the double or triple bindings between the carbon atoms. The new atoms are added to both side of the two carbon atoms of the double and triple bindings to form a more saturated product.
- **ELIMINATION REACTION** – A reaction where atoms or atom groups of abutting atoms are removed in a molecule in order for a double binding to form.
- **FUNCTIONAL GROUP** – An atom or group of atoms connected to a molecule and are responsible for the trademark chemical reactions and characteristics of the molecule.
- **HOMOLOGOUS SERIES** – A series of organic compounds with the same general formula and the same chemical characteristics due to the presence of the same functional groups. The members in the series indicate an increase in physical characteristics e.g. boiling points, due to an increase in molecular size and mass.
- **ISOMERS** – Compounds with the same molecular formula and mass, but different structure formulas.
- **UNSATURATED COMPOUNDS** – Compounds with double or triple bindings between C-atoms. It is possible that the bindings can break and more atoms bind to the molecule during a reaction.
- **SUBSTITUTION REACTION** – A reaction during which an atom or group of atoms are replaced by another.
- **SATURATED COMPOUNDS** – Compounds with only single covalent bindings between the carbon atoms and each C-atom has the maximum amount of bindings (4) with other atoms.

CHEMICAL CHANGE

- **ACTIVATION ENERGY** – The minimum kinetic energy needed to let a chemical reaction take place (E_a).
- **ANODE** – The electrode where oxidation takes place (release of electrons).
- **CHEMICAL EQUILIBRIUM** – A stage during a chemical reaction when the tempo of the forward reaction is equal to the tempo of the backward reaction.
- **DYNAMIC EQUILIBRIUM** – The forward and backward reactions still continue in both directions at the same tempo (even though the concentrations remain constant).
- **ELECTROLYTE** – A solution or a melted substance that conducts electricity due to the presence of free moving ions.
- **ELECTROLYTIC CELL** – An appliance with which a chemical compound can be broken down using an electrical current. A non-spontaneous redox reaction takes place and electrical energy is converted to chemical potential energy.
- **ELECTROLYSIS** – A chemical decomposition reaction using an electrical current that flows through an electrolyte (solution or melted substance with free moving ions).
- **ENDOTHERMIC REACTION** – A chemical reaction where the energy of the products is higher than the energy of the reactants ($\Delta H > 0$).
- **EXOTHERMIC REACTION** – 'A chemical reaction where the energy of the products is lower than the energy of the reactants ($\Delta H < 0$).
- **GALVANIC CELL** – An electrochemical cell that delivers electrical energy due to chemical reactions that take place in the cell.
- **CAPACITY** – The ability of a battery to deliver a certain amount of electricity (electrical current in ampere for a certain time). (It is measured in ampere-hour – Ah).
- **CATALYST** – A substance that increases the tempo of a chemical reaction by decreasing the activation energy of the reaction without undergoing its own change.
- **CATHODE** – The electrode where reduction takes place.

- **LE CHATELIER'S PRINCIPLE** – In case one of the conditions (concentration, pressure, temperature) of an equilibrium reaction in a closed system is disturbed, the reaction opposing the change will be benefitted by shifting the equilibrium into that direction.
- **OXIDATION** – The process during which a substance releases electrons.
- **OXIDATION-REDUCTION (REDOX) REACTION** – A chemical reaction where a transfer of electrons takes place.
- **OXIDISING AGENT** – The substance that absorbs the electrons itself and causes the other substance to release electrons.
- **PRIMARY CELLS** – Non-rechargeable battery cell thrown away as soon as it is flat.
- **REDUCTION** – The process during which a substance absorbs electrons.
- **REDUCING AGENT** – The substance that releases electrons itself and causes the other substance to absorb the electrons.
- **SECONDARY CELLS** – Cells that can be recharged by sending an external current through the battery. Electrical energy is converted to chemical energy and the chemical reaction in the cell is inverted.
- **STANDARD ELECTRODE POTENTIAL** – The voltmeter reading obtained when a given half-cell and the standard hydrogen half-cell are combined under standard conditions (temperature, pressure and concentration).
- **TEMPO OF REACTION** – Indicates the change in concentration of the reactants or the products per time unit.
- **CHANGE IN ENTHALPY/REACTION WARMTH** – The amount of energy absorbed or released during a chemical reaction (ΔH).

CHEMICAL SYSTEMS

- **EUTROPHICATION** – An excess in nutrients in dams, lakes, rivers and other water masses, usually derivative of runoff water with nutrient (animal waste, fertilizer substances, sewage) from farmlands. It causes dense plant growth. The decomposition of the plants exhaust the oxygen stock in the water and thus the eradication of animal life happens.

GENERAL

- **DEPENDENT VARIABLE** – The variable that must be measured during an experiment and of which the value is dependent on the independent variable.
- **CONTROLLED VARIABLE** – The variable(s) that must be kept constant during a scientific investigation so they do not influence the results (also known as the **fixed variable**).
- **HYPOTHESIS** – An informed prediction on the outcome of the experiment.
- **INDEPENDENT VARIABLE** – The variable chosen and changed and that is not dependent on the outcome of the experiment.