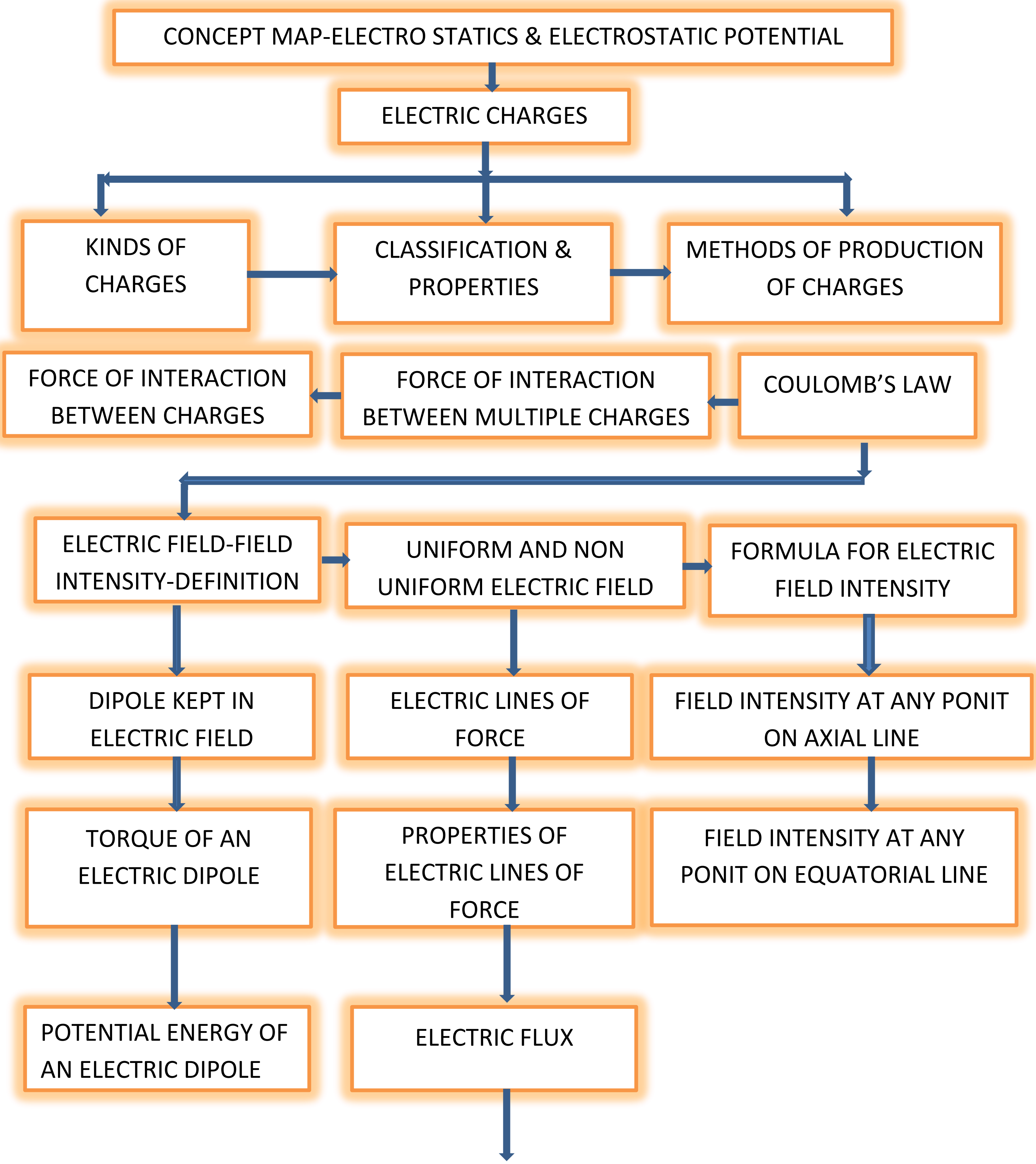
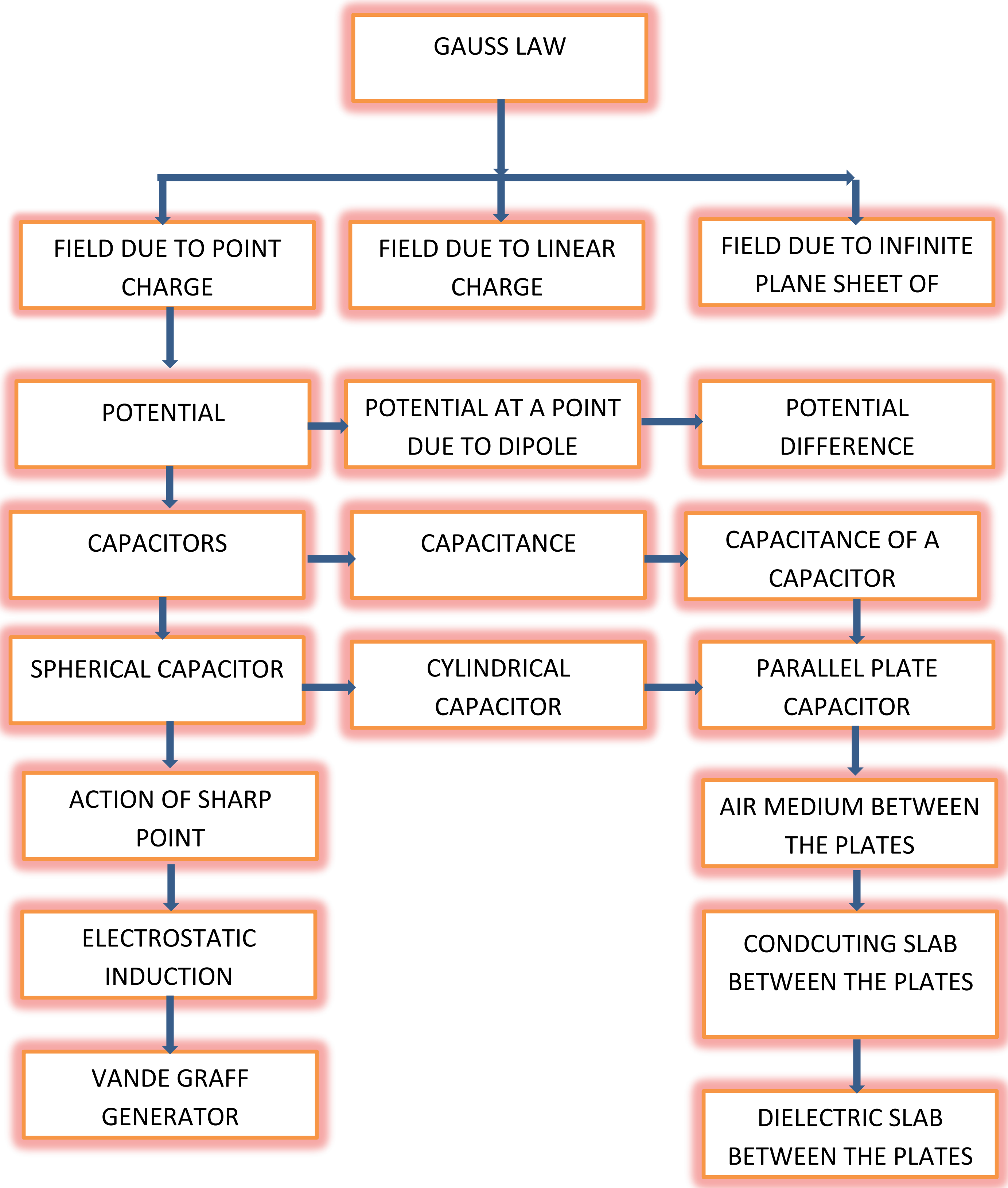

CONCEPT MAP-ELECTRO STATICS & ELECTROSTATIC POTENTIAL
ELECTRIC CHARGES
KINDS OF CHARGES
CLASSIFICATION & PROPERTIES
METHODS OF PRODUCTION OF CHARGES
FORCE OF INTERACTION BETWEEN CHARGES
FORCE OF INTERACTION BETWEEN MULTIPLE CHARGES
COULOMB'S LAW
ELECTRIC FIELD-FIELD INTENSITY-DEFINITION
UNIFORM AND NON UNIFORM ELECTRIC FIELD
FORMULA FOR ELECTRIC FIELD INTENSITY
DIPOLE KEPT IN ELECTRIC FIELD
ELECTRIC LINES OF FORCE
FIELD INTENSITY AT ANY PONIT ON AXIAL LINE
TORQUE OF AN ELECTRIC DIPOLE
PROPERTIES OF ELECTRIC LINES OF FORCE
FIELD INTENSITY AT ANY PONIT ON EQUATORIAL LINE
POTENTIAL ENERGY OF AN ELECTRIC DIPOLE
ELECTRIC FLUX


GAUSS LAW
FIELD DUE TO POINT CHARGE
FIELD DUE TO LINEAR CHARGE
FIELD DUE TO INFINITE PLANE SHEET OF
POTENTIAL
POTENTIAL AT A POINT DUE TO DIPOLE
POTENTIAL DIFFERENCE
CAPACITORS
CAPACITANCE
CAPACITANCE OF A CAPACITOR
SPHERICAL CAPACITOR
CYLINDRICAL CAPACITOR
PARALLEL PLATE CAPACITOR
ACTION OF SHARP POINT
AIR MEDIUM BETWEEN THE PLATES
ELECTROSTATIC INDUCTION
CONDCUTING SLAB BETWEEN THE PLATES
VANDE GRAFF GENERATOR
DIELECTRIC SLAB BETWEEN THE PLATES

Points to remember

Positively Charged Particles: In this type of particles, numbers of positive ions are larger than the numbers of negative ions. In other words numbers of protons are larger than the number of electrons.

Negatively Charged Particles: In this type of particles, numbers of negative ions are larger than the numbers of positive ions. In other words numbers of electrons are larger than the number of protons.

Neutral Particles: These types of particles include equal numbers of protons and electrons. Be careful, they have both protons, neutrons and electrons however, numbers of "+" ions are equal to the numbers of "-" ions.

Atoms having same charge repel each other and atoms having opposite charges attract each other.

Types of Charging: Charging means gaining or losing electron. Matters can be charged with three ways, charging by friction, charging by contact and charging by induction.

Charging by Friction: When you rub one material to another, they are charged by friction. Material losing electron is positively charged and material gaining electron is negatively charged. Amount of gained and lost electron is equal to each other.

Charging by Contact: There are equal numbers of electrons and protons in a neutral matter. If something changes this balance we can say it is charged.

1. When charged object touches to a neutral object, they both have same charge.

2. When two charged matter touch each other, total charge of the system is conserved and they share the total charge according to their capacities. If they have same amount of different charges, when we touch one another they become neutral. If the amount of charges is different then, after flow of charge they are both negatively or positively charged. Having opposite charges after contact is impossible.

Charging by Induction:A and B conductors are neutral at the beginning. When we put a positively charged plate near them, it attracts the electrons in the conductors. Electrons move to the left part and protons stays. Thus, when we separate plates A and B they are charged by induction, A is negatively charged and B is negatively charged. Be careful, there is no contact; they are charged only by induction.

Electroscope: It is a device that is used for detecting whether an object is charged or uncharged. It is also determine the type of charge.

Electrical forces-Coulomb's Law:

$$F = k\frac{q_1 . q_2}{d^2}$$

where; q_1 is the amount of charge on object1
q_2 is the amount of charge on object2
k is the proportionality constant
d is the distance between two objects

If the objects have same type of charge then the force is repulsive, if they have opposite charges then force is attractive.

Repulsive or attractive electrical forces is equal in magnitude but opposite in direction, it does not depend on the magnitudes of charges.

Electric Field:A charged particle exerts a force on particles around it. The influence of this force on surroundings as electric field. $E= F/q=kq/r^2$.

Electric field is a vector quantity. And it decreases with the increasing distance. **k** $=9x10^9 N.m^2/C^2$

Force Acting on a Charged Particle inside Electric Field:

E=F/q

F=E.q where; F is the force acting on the charge inside the electric field E. Using this equation we can say that;

If **q** is positive then **F=+E.q** and directions of Force and Electric Field are same

If **q** is negative then **F=-E.q** and directions of Force and Electric Field are opposite.

Charges at rest produces EF

Direction of Electric Field is from +ive charge to –ive charge

Path followed by test charge in electric field-originate from +ive and terminates at –ive-no two lines never intersect each other-tangent at any point direction of electric field.

Two equal and opposite charges separated by a short distance forms dipole

+ charge in the dipole experiences force in the direction of EF and – charge in the dipole experiences force in the opposite direction of EF

Properties:Mass of a body is always positive whereas a charge can be either positive or negative

Total charge of the isolated system is always conserved

Electric charge is always an integral multiple of e is termed as quantisation of charge

Axial line

$$\mathbf{E} = \frac{2\,\mathbf{p}}{4\pi\varepsilon_o r^3}$$

Equatorial line

$$\mathbf{E} = -\frac{\mathbf{p}}{4\pi\varepsilon_o r^3}$$

Torque : $\boldsymbol{\tau} = \mathbf{p} \times \mathbf{E}$

Potential energy: - **p** . **E** = - pEcosθ

Line integral of EF Intensity over a length of a curve depends on position not of the path followed.

Workdone in moving a unit test charge from i)one point to another is potential difference ii) infinity to a point against the EF is potential

Electric Potential and Electric Potential Energy:

Electric Potential Energy= $k \frac{q_1 . q_2}{d}$

Electric Potential: Electric potential is the electric potential energy per unit charge. It is known as voltage in general, represented by V and has unit volt (joule/C).

V=k.q/d

V is a scalar quantity. If q is negative then V becomes negative, or if q is positive then V becomes positive.

$$V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$$

$$V = \frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r_1} - \frac{q}{r_2}\right)$$

<u>Axial Line</u>

$$V = \pm\frac{1}{4\pi\varepsilon_0}\frac{p}{r^2}$$

Surfaces having equal potentials are called **equipotential surfaces.**

Surface integral of EF intensity over a closed surface is equal to $(1/\varepsilon_0)$ times the charge enclosed.

$$\phi \simeq \Sigma\, \mathbf{E} \cdot \Delta\mathbf{S}$$

$$E = q/4\pi\varepsilon_0 r^2$$

$$E = \sigma/\varepsilon_0$$

Capacitance and Capacitors: Capacitance is the ratio of charged gained per potential gained of the conductors. Unit of capacitance is Coulomb per Volt and it is called as Farad (F).

$$C = \frac{Q}{V}$$

where; C is the capacitance of the conductor, Q is the amount of charge gained and V is the potential gained.

Capacitance is a scalar quantity.

Capacitors: Capacitors are devices designed for storing charge.

The capacitance of the plates is found with the following formula;

$$C = \varepsilon \frac{A}{d}$$

Ability to store charges is capacitance

Amount of charge to be stored depends on PD

More difference in PD,more amount of charges stored

If Q is fixed then C is inversely proportional to V-V depends on the value of C-in series

If V is fixed the Q is directly proportional to C-Charge flows depends on the value of C-in parallel

Linear charge density is charge per unit length
Surface Charge density is charge per unit area
Volume charged density is charge per unit volume

Area of a sphere-Spherical and Pointed end conductor-r is less-A is less-surface charge density is more

More charges in less space-discharges or sprays or leaks to the surrounding-Carona discharge.

<u>Effective Value of Capacitance in Series</u>

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots + \frac{1}{C_n}$$

<u>Effective Value of Capacitance in Parallel</u>

$$C = C_1 + C_2 + \ldots C_n$$

Energy Stored

$$W = \frac{Q^2}{2C} = \frac{1}{2}CV^2 = \frac{1}{2}QV$$

Dielectric constant

$$K = \frac{\varepsilon}{\varepsilon_0}$$

$$K = \frac{C}{C_0}$$

Capacitance of a parallel plate capacitor

1. $C=\varepsilon_0 A/d$ in air

2. $C=\varepsilon_0 A/(d-t)$-conducting slab between the plates of a capacitor

3. $C=\varepsilon_0 A/(d-t+t/\varepsilon_r)$-dielectric slab between the plates of a capacitor