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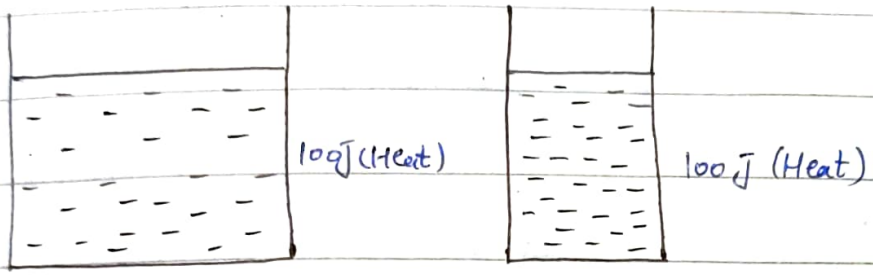
Basic concepts for plasma physics:-

Heat ⇒ Form of energy which flows from hot body to cold body. (J, eV)

Temperature ⇒ Degree of hotness (K, °C)



⇒ If we give both of them the same heat/energy than smaller Jar (2) will be hotter that Larger Jar (1).

⇒ Therefore, degree of hotness is called temperature.

⇒ For microscopic or subatomic particles, we eV as energy unit. For macroscopic bodies we use (J).

Gradient:- Gradient tells us about maximum rate of change. e.g

$$\vec{E} = -\vec{\nabla}V = -\frac{\partial V}{\partial r}\hat{r}$$

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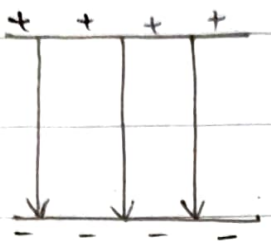
⇒ Gradient of potential (V) gives us the Electric field.

⇒ For maximum change '∂r' must be small.



Divergence:- Divergence tells us about the flux (leaves or enter) through infinitesimal volume. e.g

$$\vec{\nabla} \cdot \vec{E} = \frac{\rho}{\varepsilon_0} \qquad \because \rho = \frac{\text{charge}}{\text{volume}}$$

⇒ So divergence of $\vec{E}$ tells us how much charge is in that infinitesimal volume.

⇒ If charge is zero i.e $\rho = 0$ then

$$\vec{\nabla} \cdot \vec{E} = 0$$

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Curl:- Tendency of vector field to rotate about a point.

⇒ curl is a vector operator that describes the infinitesimal circulation of vector field.

$$\bar{\nabla} \times \bar{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ B_x & B_y & B_z \end{vmatrix}$$

Electric force:- The repulsive or attractive interaction between any two charged bodies.

The Formula for electric force is

$$\vec{F} = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{r^2} \hat{r} \quad \text{(Coulomb's force)}$$

and $k = \frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \ N m^2 c^{-2}$

(Coulomb's constant)

Gravitational force:- "Pulls objects with mass towards each other."

$$\vec{F} = G \frac{m_1 m_2}{r^2} \hat{r}$$

Here $G = 6.67 \times 10^{-11} \ N m^2 kg^{-2}$

(Gravitational constant)

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⇒ Electric force is Stronger than Gravitational force because of its Constant i.e. Value of Constant of electric force is larger than Gravitational force.

Matter:-

Anything that has mass and occupy Volume.

Matter has three types

- Solid e.g ice
- Liquid e.g water
- Gas e.g water vapours

⇒ If we heat ice, it will get energy and atoms will move far from each other and ice will become liquid (water).

⇒ On further heating the liquid (water), it becomes gas and have no specific shape.

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⇒ If we further heat the gas, electrons in the atom will move from lower to higher shells it is called "excitation".

⇒ Further increase in heat, will allow the electrons to escape from atom it is called ionization.

⇒ Hence, gas is ionized.

"Plasma is actually ionized gas, in which there are electron, ions (positive) and neutral atoms".