Here's a detailed, easy-to-understand guide for your study plan. Each topic is broken down into simple, clear explanations, including the coaching-level tips and tricks mentioned, so you can master today's sessions efficiently.

Physics: Electrostatics — Electric Field & Field Lines

Electric Field Due to a Point Charge

- Every charge creates an electric "influence" called an electric field in the space around it.
- The field at a point is the force per unit charge experienced by a tiny positive test charge placed there.
- Formula:

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\hat{r}$$

where $q$is the charge, $r$is the distance from the charge, and $\varepsilon_0$is permittivity of free space.

Electric Field due to Multiple Charges (Superposition Principle)

- When more than one charge is present, the field at any point is the **vector sum** of the fields due to each charge separately.
- Always add field vectors, not the charges themselves. Directions matter — use head-to-tail or component methods for addition.

Properties of Electric Field Lines

- Lines start at positive and end at negative charges.
- They never cross each other (crossing would mean two directions at one point, which isn't possible).
- More lines = stronger field (lines closer together).
- Lines come out perpendicular to the surface of conductors.

Electric Dipole and Dipole Moment

- **Electric Dipole:** A pair of equal & opposite charges separated by a small distance (like +q and –q separated by 2a).
- **Dipole Moment ($\vec{p}$):**

$$\vec{p} = q \times 2a$$

The direction of $\vec{p}$is from negative (–) to positive (+) charge by convention, NOT the direction of force experienced by the dipole.

- Dipoles create characteristic field patterns with curved field lines.

Physics Tips & Tricks

- Zero electric field occurs where the VECTOR sum of fields is zero, not where charges simply “cancel out.”
- Field lines never intersect.
- Field lines are packed more closely in regions of stronger electric field.
- For a dipole, always remember the formula for the dipole moment and its direction.

Quick Revision: Day 1 Physics Topics

- **Charge:** Property of matter (positive/negative) responsible for electric force.
- **Coulomb’s Law:** Force between two charges varies by product of magnitudes and inversely as square of distance.
- **Superposition Principle:** Net field at a point = sum of individual fields (vectors).
- **Electric Field Definition:** Force per unit positive charge at a point.

Chemistry: Solid State — Unit Cell Details

Types of Unit Cells

- **Primitive (Simple Cubic, SC):** Atoms only at the corners.
- **Body-Centered Cubic (BCC):** Atoms at corners + one atom in the center.
- **Face-Centered Cubic (FCC):** Atoms at corners + one at each face’s center.

Number of Atoms per Unit Cell

- Corner atom shared by 8 cells, so each contributes 1/8 to a cell.
- Face-centered atom shared by 2 cells, so each contributes 1/2.
- Body-centered atom belongs entirely to one cell.
- **SC:** 8corners × $\frac{1}{8}$= **1 atom**
- **BCC:** 8corners × $\frac{1}{8}$+ 1 center = **2 atoms**
- **FCC:** 8corners × $\frac{1}{8}$+ 6 faces × $\frac{1}{2}$= **4 atoms**.

Coordination Number Basics

- Number of “nearest neighbors” an atom touches in the structure.
- SC: 6, BCC: 8, FCC: 12.

Packing Efficiency (Concept Only)

- Tells us how much of the total unit cell volume is actually filled with atoms (rest is empty space).

- For now, just remember: efficiency increases from SC < BCC < FCC.

Chemistry Tips & Tricks

- Corner atom = 1/8 to each cube, face atom = 1/2, body atom = 1.
- Know the coordination numbers and packing order.

Quick Revision: Day 1 Chemistry Topics

- **Types of Solids:** Ionic, covalent, metallic, molecular, etc.
- **Lattices:** The regular repeating pattern in which unit cells are stacked.
- **Unit Cell Basics:** Smallest repeating unit to build a crystal.

Maths: Relations & Functions — Part 2

Reflexive, Symmetric, Transitive Relations

- **Reflexive:** Every element relates to itself.
  (For all a, $(a, a)$is in the relation.)
- **Symmetric:** If $a$relates to b, then $b$relates to a.
  (If $(a, b)$is in, $(b, a)$is in too.)
- **Transitive:** If $a$relates to $b$and $b$to c, then $a$must relate to c.
  (If $(a, b)$and (b, c)in, then (a, c)in too.)

Equivalence Relation

- A relation that is **reflexive, symmetric, and transitive** all together.

Functions: Definition, Domain, Co-Domain, Range

- **Function:** A rule that assigns every input exactly one output.
- **Domain:** Set of all possible inputs.
- **Co-domain:** Set that includes all possible outputs (not always achieved).
- **Range:** Set of actual outputs produced.

Example (NCERT 1.3 Style)

Suppose $f(x) = x^2$, with domain $\{1,2,3\}$, co-domain $\mathbb{R}$:

- Outputs: $\{1,4,9\}$(this is the range).
- $\mathbb{R}$is the co-domain, but only a few values are achieved as the range.
