B.Sc. Semester-IV
Core Course-VIII (CC-VIII)
Inorganic Chemistry-III

II. Transition Elements

4. Atomic Radii and Ionic Radii of Transition Elements

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Transition Elements: **12 Lectures**

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer & Bsworth diagrams). Difference between the first, second and third transition series.

Chemistry of Ti, V, Cr Mn, Fe and Co in various oxidation states (excluding their metallurgy)

Coverage:

1. Atomic Radii and Ionic Radii of Transition Elements

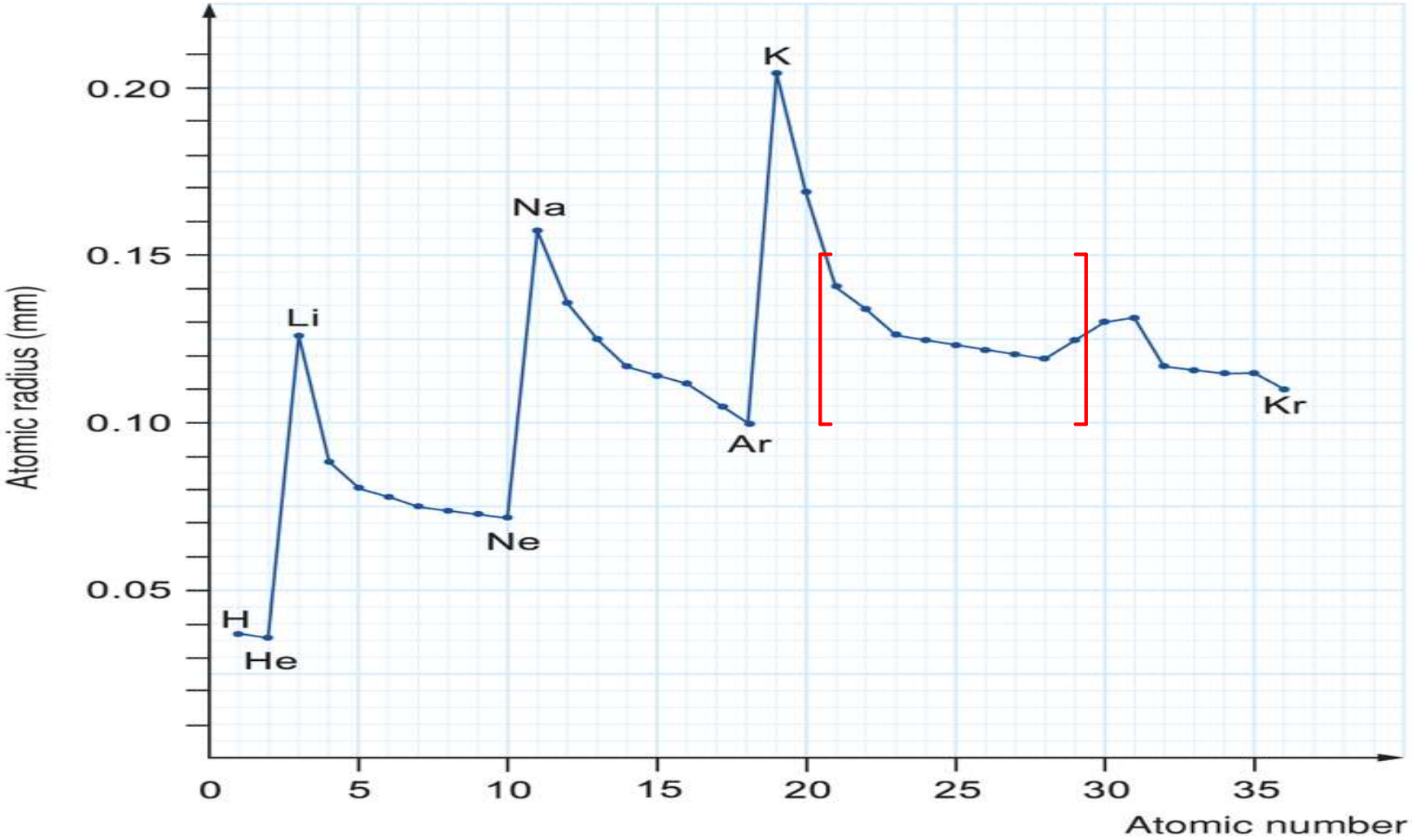
Atomic Radii and Ionic Radii

- **Two features can be observed:**

1. **The *d*-block elements have smaller atomic radii than the *s*-block elements**

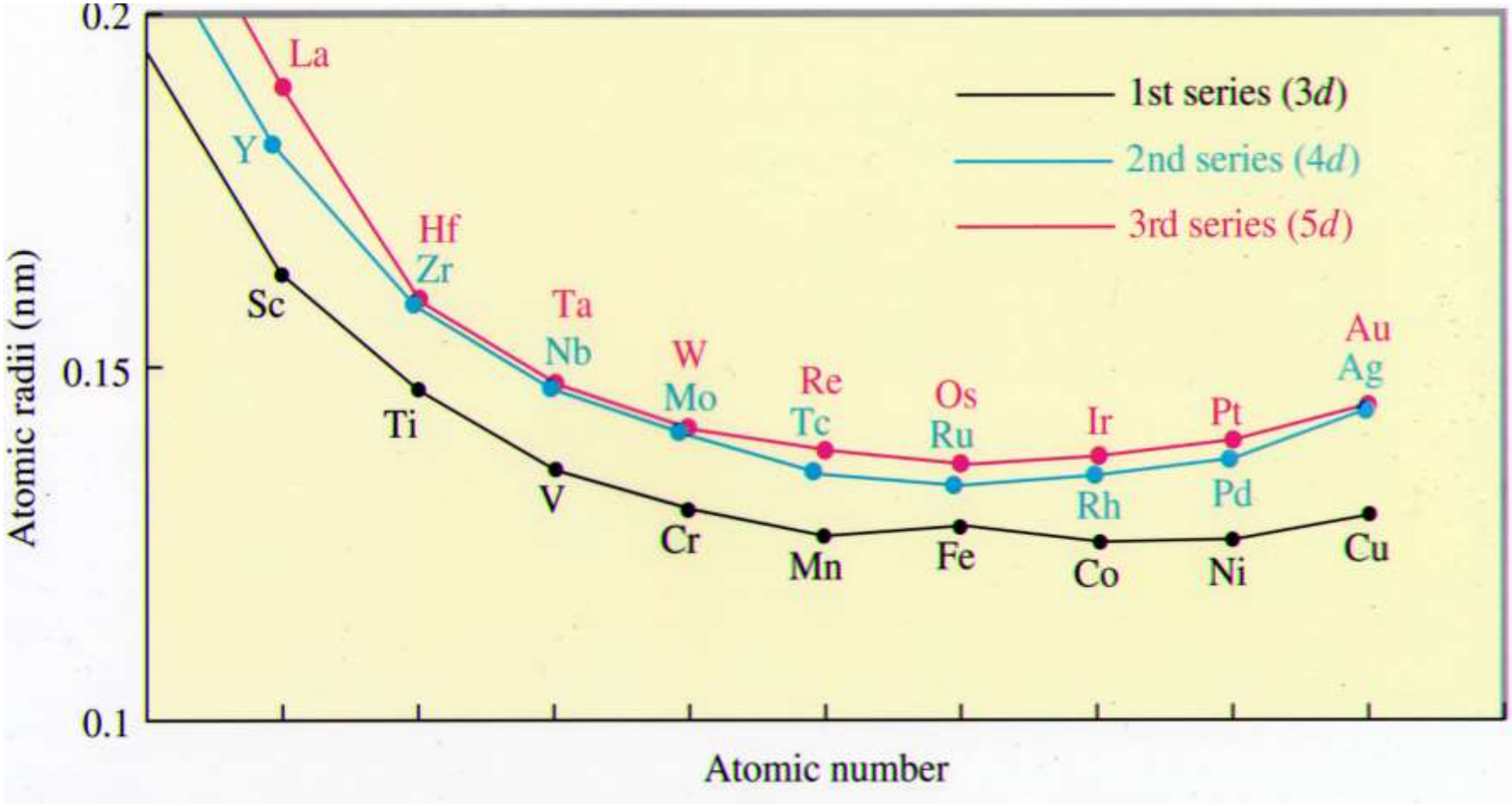
2. **The atomic radii of the *d*-block elements do not show much variation across the series**

Atomic Radii and Ionic Radii

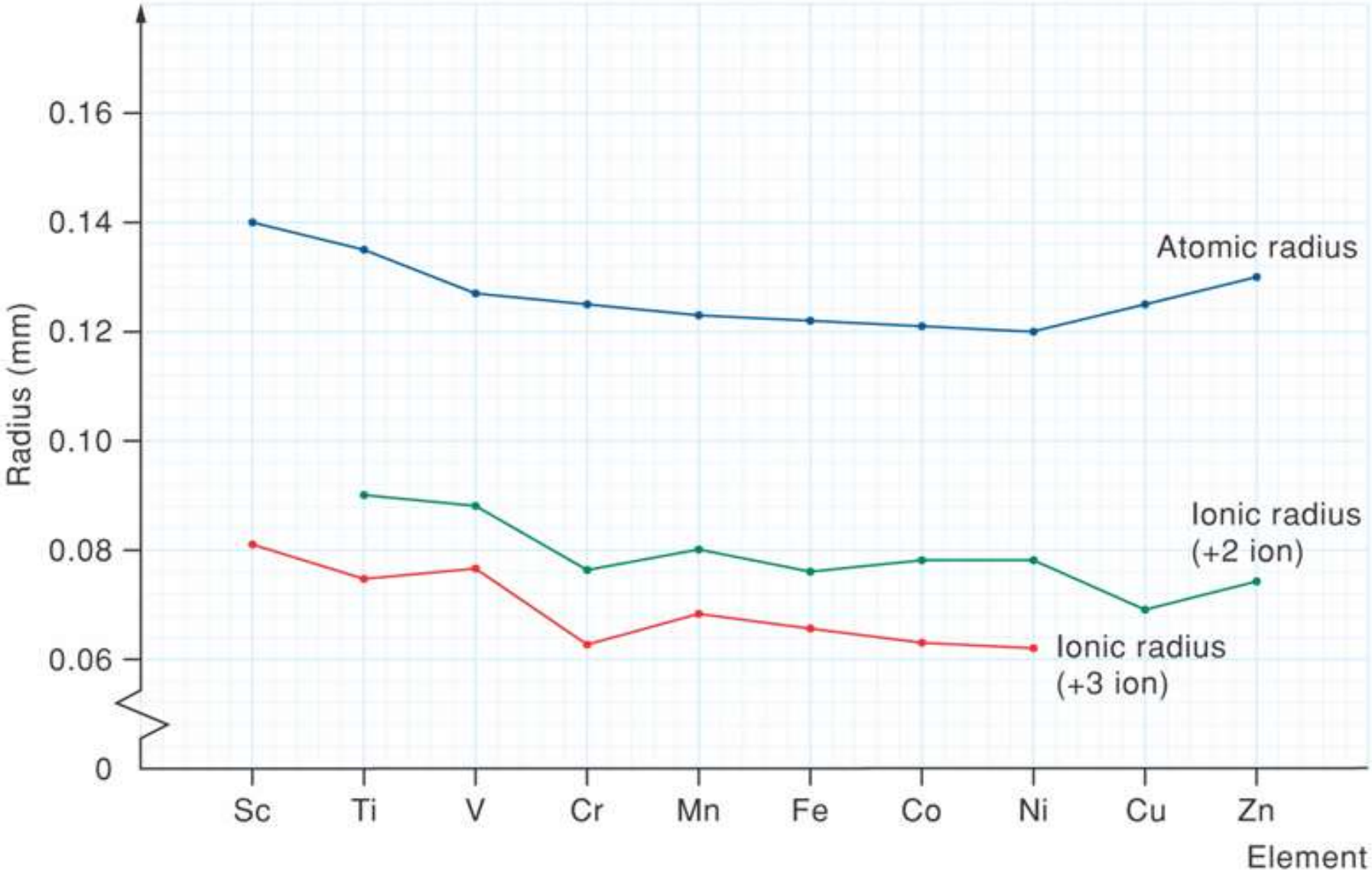


Variation in atomic radius of the first 36 elements

Atomic Radii and Ionic Radii



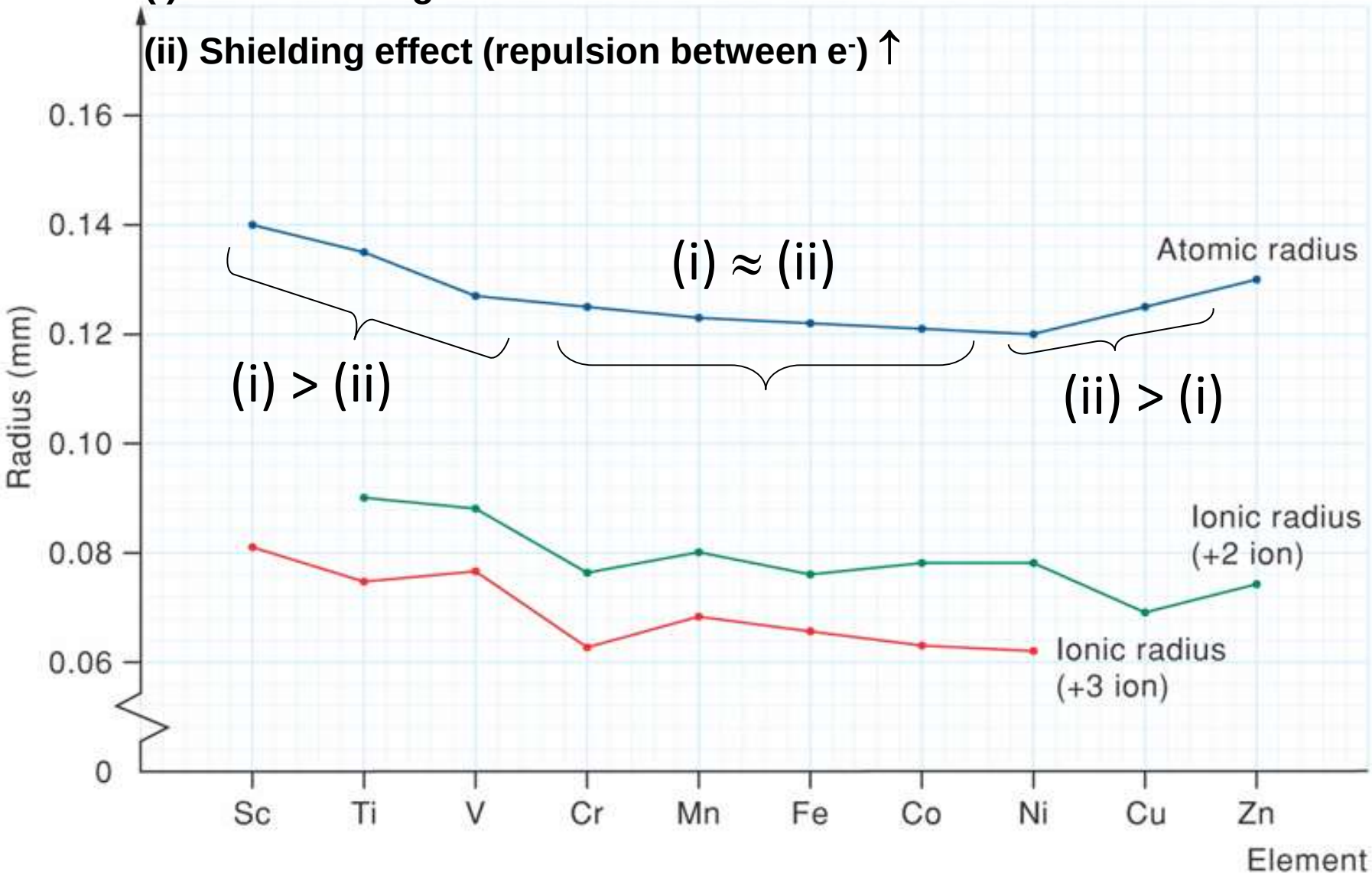
Atomic Radii and Ionic Radii



On moving across the Period,

(i) Nuclear charge ↑

(ii) Shielding effect (repulsion between e^-) ↑



Atomic Radii and Ionic Radii

- **At the beginning of the series**
  - ➔ **Atomic number ↑**
  - ➔ **Effective nuclear charge ↑**
  - ➔ **The electron clouds are pulled closer to the nucleus**
  - ➔ **Atomic size ↓**
- **In the middle of the series**
  - ➔ **more electrons enter the inner 3*d* sub-shell**
  - ➔ **The inner 3d electrons shield the outer 4s electrons effectively**
  - ➔ **the effective nuclear charge experienced by 4s electrons increases very slowly**
  - ➔ **only a slow decrease in atomic radius in this region**
- **At the end of the series**
  - ➔ **the screening and repulsive effects of the electrons in the 3*d* sub-shell become even stronger**
  - ➔ **Atomic size ↑**

Comparison of Some Physical and Chemical Properties between the *d*-Block and *s*-Block Elements

- **Many of the differences in physical and chemical properties between the *d*-block and *s*-block elements**

  ➔ **Explained in terms of their differences in electronic configurations and atomic radii**

- ***d*-block > *s*-block**

  ∵ **The atoms of the *d*-block elements**

  1. **Are generally smaller in size**
  2. **Are more closely packed (fcc/hcp vs bcc in group 1)**
  3. **Have higher relative atomic masses**

THANK YOU