Atomic and ionic radii

25. (c) $Be > C > F > Ne$. Atomic size decreases across a period.

26. (d) As the nuclear charge per electron is maximum in P^{5+}. Therefore its size is smallest.

27. (c) $Na^+ - 10$ electron ; $Li^- - 4$ electron

28. (b) Ionic radius of trivalent lanthanide's almost remains constant with increase in the atomic number.

30. (c) Halogens are most electronegative elements.

31. **(c) Å** Atomic and ionic radii are usually measured in **Ångström (Å = 10^{-10} m)** or **nanometres (nm = 10^{-9} m)**.

Most standard MCQs expect **Å**.

32. **(b) Increases**

Across a period **left → right**: atomic radius **decreases** (increasing Z, stronger pull).

So if we move **right → left**: atomic radius **increases**.

33. (d) On moving from left to right in a period value of radius decreases.

34. (a) $Sc^{3+} > Cr^{3+} > Fe^{3+} > Mn^{3+}$ the correct order is $Cr^{+3} > Mn^{+3} > Fe^{+3} > Sc^{+3}$

35. (d) $Na^+ > Mg^{2+} > Al^{3+} > Si^{4+}$. All are isoelectronic but nuclear charge per electron is greatest for Si^{4+}. So it has smallest size and nuclear charge per electron for Na^+ is smallest. So it has largest size.

36. (a) $N^{3-} > O^{2-} > F^-$. All are isoelectronic but nuclear charge per electron is highest for F^-, so it has smallest size.

37. **(d) For potassium, the atomic radius > ionic radius but for bromine, the atomic radius < ionic radius**

Potassium (K, Z = 19):

Neutral atom: $1s^2 \ldots 4s^1$

When it loses 1 electron → K^+ ($18e^-$, same as Ar).

Loss of outermost shell + stronger nuclear pull → **ionic radius < atomic radius**.

Bromine (Br, Z = 35):

Neutral atom: $1s^2 \ldots 4p^5$

When it gains 1 electron → Br^- ($36e^-$, same as Kr).

Extra electron increases repulsion → **ionic radius > atomic radius**.

38. (a) Cation has small size than parent atom and anion has greater size than parent atom.

39. (b) Ionic radii decreases significantly from left to right in a period among representative elements.

40. (d) H^- is most stable due to its full filled 1s-orbital.

41. **(b) F > K > Na > Li**

General rule:

Cations (Li^+, Na^+, K^+): radius **decreases** as nuclear charge ↑, and **increases down the group**.

→ Order: **$K^+ > Na^+ > Li^+$**.

Anions (F^-): radius **larger than neutral atom** (because extra electron → repulsion).

So combined order: **$F^- > K^+ > Na^+ > Li^+$**

42. **(d) Helium**

Li (152 pm) → largest.

H (53 pm) → small.
He (31 pm) → smaller.
Li^+ (76 pm) → **larger than H and He** because although it lost one electron, its **Z is 3** pulling only 2 e^-, so radius is much smaller than Li atom but still bigger than He atom.
Therefore, the **smallest species** is still **Helium (31 pm)**.

43. (a) C^{4-} has largest radius due to least nuclear charge per electron.

44. (d) For ionic bond formation low I.E., high electron affinity and high lattice energy is needed.

45. (a) Ionic radii increases in a group.

46. (d) Size of elements decreases across a period.

47. (a) X^- ion larger in size than X atoms. Because of low effective nuclear charge on X^-, X has a bigger size.

48. (c) Fe, Co, Ni, Cu. Due to shielding of *d*-electrons, the effect of increased nuclear charge due to increase in atomic no. neutralised. Consequently atomic radius remains almost unchanged after chromium.