1s
2s 2p
3s 3p 3d
4s 4p 4d 4f
(Order of filling)

For transition metals:-

1. Find Z_{eff} for 3d e⁻ in Fe

Fe(26):- $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$

⇓ Arrange it from ~~lowest to highest~~ highest to lowest n

$(n=1\to4)$ $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$ → not contributing

$S = [2\times1 + 8\times1 + 8\times1] + [5\times0.35]$

$\Rightarrow S = 18 + 1.75 \Rightarrow S = 19.75$

$Z_{eff} = 26 - 19.75$

$= 6.25$

1s
2s 2p
3s 3p 3d
4s 4p 4d 4f
5s

2. Find Z_{eff} for a 5s e⁻ in Sr

Sr(38):- $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2$

⇓

$1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 3d^{10}\ 4s^2 4p^6\ 5s^2$

$S = [2 + 8 + 8 + 10] + [8\times0.85] + [1\times0.35]$

$= 35.15$

$\therefore Z_{eff} = 38 - 35.15 = 2.85$

* When we are finding for s/p e⁻'s S value, then $n\to0.35, n-1=0.85, n-2=1$

" " " " d/f e⁻'s S value, then $n\to0.35, n-1=1, n-2=1$

∴ We took 0.35 for n & 0.85 for (n-1) ... in Sr

* Since, $Z_{eff} = 2.85$, That means 5s ~~will~~ cannot see anything from center (nucleus)

This is because we have so many orbitals blocking its view (5s is very far away from nucleus)

* S → Shielding constant

It represents the degree to which inner electrons reduce Z_{eff} felt by outer electrons

Exception :-

If you are asked for Z_{eff} of a 1s e^-, the total shielding is 0.3 (S)

3. Find Z_{eff} for 1s e^- in Nd

Nd(60) :- $(1s^2)[2s^2 \ldots\ldots\ldots]$ → doesn't contribute

$S = (1 \times 0.3)$ [S = 0.3 ~~0.35~~ (not 0.35)]

$= 0.3$

$\therefore Z_{eff} = Z - S$

$= 60 - 0.3$

$\Rightarrow Z_{eff} = 59.7$

[$Z_{eff} = 59.7$, $\therefore$ 1s e^- sees almost all of the protons (in front of nucleus)]

4. Find Z_{eff} for 1s e^- in H

H(1) :- $1s^1$

$S = 0 \times 0.35 = 0$

$\therefore Z_{eff} = Z - S$

$= 1 - 0 = 1$

Updated S-table :-

	Same group	Same n<l	n-1	≤ n-2
[1s]	0.3	—	—	—
[ns, np]	0.35	—	0.85	1
[nd] [nf]	0.35	1	1	1

Note :- n → outermost shell (based on question)

n-1 → shell just before n-shell

n-2 → shells lower than (n-1)