

UNIT 4 • d- AND f-BLOCK ELEMENTS

Formation of Coloured Ions

Decoding the visible spectrum of transition metals through electron transitions.



d-d Transition

The excitation of an electron from a lower-energy d-orbital to a higher-energy d-orbital upon absorbing specific wavelengths of visible light.



Complementary Colour

The colour perceived by the observer. It consists of the wavelengths of visible light that are transmitted or reflected (not absorbed) by the ion.



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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Practice Now

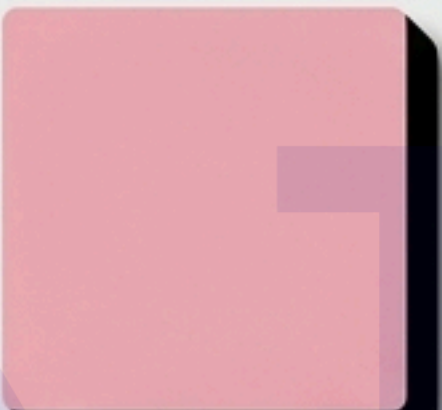


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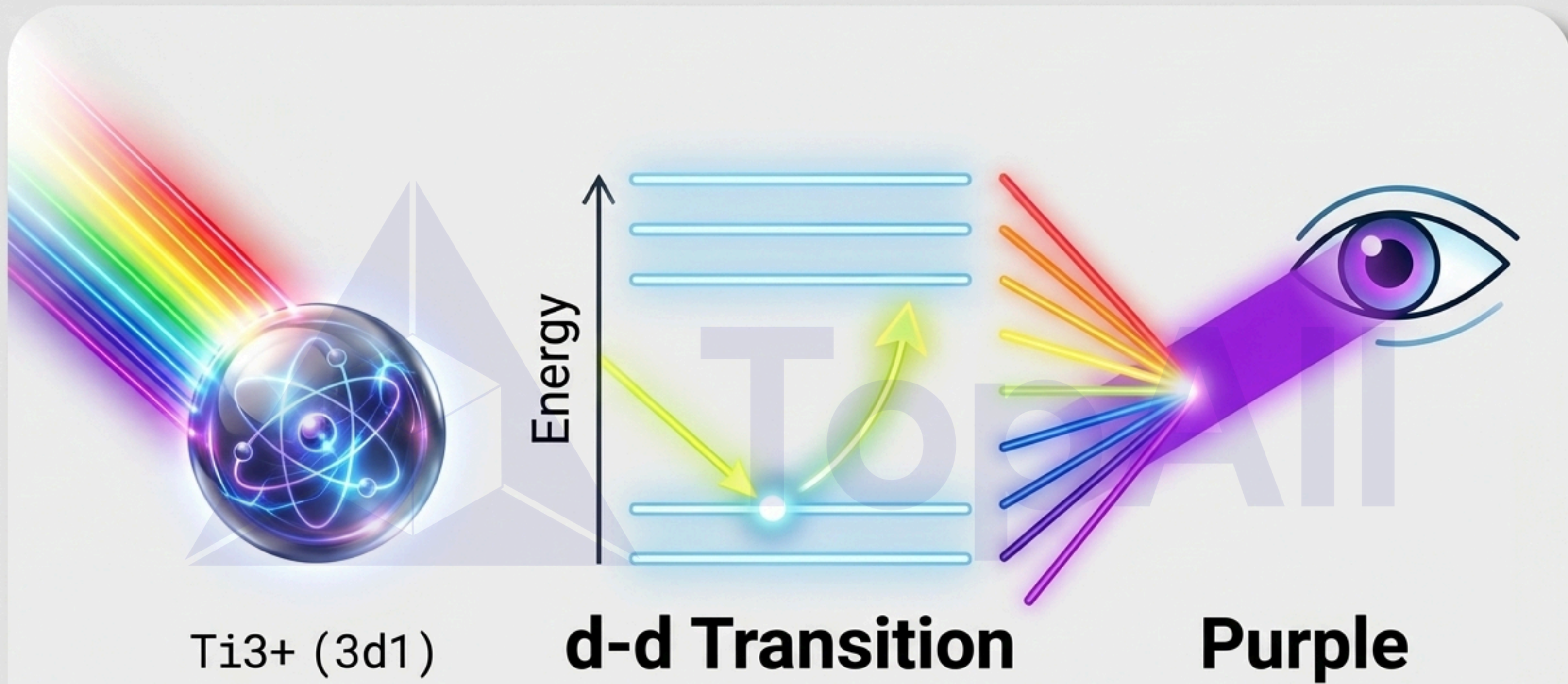
Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
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$\text{Sc}^{3+} (3d^0)$	$\text{Ti}^{3+} (3d^1)$	$\text{Mn}^{2+} (3d^5)$	$\text{Fe}^{2+} (3d^6)$	$\text{Cu}^{2+} (3d^9)$	$\text{Zn}^{2+} (3d^{10})$
					
Colourless	Purple	Pink	Green	Blue	Colourless

***Ions with partially filled d-orbitals act as pigments.
Empty or completely full orbitals act as clear glass.***



Watch for this:

Colourless means d^0 or d^{10} .

Don't assume all transition metal ions are coloured.

If an ion has lost all its d-electrons (like Sc^{3+} or Ti^{4+} , both $3d^0$), there is no electron to jump.

If the d-subshell is completely full (like Zn^{2+} , $3d^{10}$), there is no empty space for an electron to jump into.

If $1 \leq n \leq 9$ in $d^n \rightarrow$ Coloured.

Based on electronic configurations, which of the following ions is expected to be colourless in an aqueous solution?

A Cu^{2+}

B Ti^{3+}

C Sc^{3+} ✓

Correct! Sc ($Z=21$) is $[\text{Ar}] 3d^1 4s^2$. Sc^{3+} is $[\text{Ar}] 3d^0$.
With no d-electrons, d-d transitions are impossible.

D Fe^{2+}

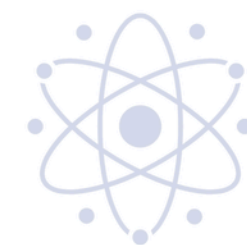
Key Takeaways

- The vivid colours of transition metal complexes are caused by **d-d transitions**—electrons absorbing visible light to jump between split d-orbitals, revealing the complementary colour.
- Ions with **d0** (e.g., Sc^{3+} , Ti^{4+}) or **d10** (e.g., Zn^{2+}) configurations are entirely **colourless** because electron transitions within the d-subshell are impossible.



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