The amount of energy needed to make electrons jump depends upon the central metal ion, its oxidation no, the ligands and coordination no.

Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
	+2	+2	+2	+2	+2	+2	+2	+2	+2
+3	+3	+3	+3	+3	+3	+3	+3	+3	
	+4	+4	+4	+4	+4	+4	+4		
	+5	+5	+5	+5	+5	+5			
			+6	+6	+6				
				+7					

The splitting causes some frequencies to be absorbed and the rest of frequencies of light are transmitted. They combine to make the complement of the colour of the absorbed frequencies -this is the colour you see (complementary to the colour absorbed).

A colour wheel shows complimentary colours.

If there are no 3d electrons or the 3d subshell if full then no electrons will jump, so no energy will be absorbed. If that's the case the compound will look white or colourless.

When a solid containing a transition metal is dissolved in water, the ion will form an aqueous complex in solution. The colour can help to identify the transition metal.

Vanadium

Properties of aquo vanadium ions

Reduction reaction	Oxidation state	Colour	Reduction potential (V vs SHE)
$V^{2+} + 2e^- \rightarrow V(s)$	2+	Violet	- 1.13
$V^{3+} + e^- \rightarrow V^{2+}$	3+	Green	- 0.26
$VO^{2+} + e^- + 2H^+ \rightarrow V^{3+} + H_2O$	4+	Blue	0.34
$VO_2^+ + 2H^+ + e^- \rightarrow VO^{2+} + H_2O$	5+	Yellow	1.00

- Forms stable ions with different oxidation no. (+2, +3, +4, +5)
- Reduction potentials can be used to see if the reactions are likely to happen.

Chromium

Oxidation No	Formula of ion	Colour of ion in water
+6	$Cr_2O_7^{2-}$	Orange
+6	CrO_4^{2-}	Yellow
+3	Cr^{3+}	Green (violet)
+2	Cr^{2+}	Blue

- Usually exist with ON of +3, +6, +2.
- It forms two ions with oxygen in the +6 ON. Chromate (VI) ions CrO_4^{2-} and dichromate (VI) ions $Cr_2O_7^{2-}$. They are good oxidising agents because they are easily reduced to Cr^{3+}.
- The green colour is due to the impurities.
- Dichromate (VI) ions can be reduced using a reducing agent such as zinc and dilute acid.