



Chem!stry

Name: ()

Class:

Date: / /

Transition Metals

The transition metals are found towards the centre of the Periodic Table in-between Groups 2 and 13. The group of transition metals contains the elements that we think of as “*typical*” metals, for example, iron, copper, titanium and gold. The position of the transition metals is highlighted in the Periodic Table below:

1	2	Group										13	14	15	16	17	18	
H																		He
Li	Be											B	C	N	O	F	Ne	
Na	Mg	↓	↓	↓	Transition Metals			↓	↓	↓		Al	Si	P	S	Cl	Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn*	Ga	Ge	As	Se	Br	Kr	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	

***Note:** Although zinc is a d-block metal, it is not always considered to be a transition metal because it only has one oxidation state (+2 in Zn²⁺) and does not form coloured compounds.

Question 1:

The transition metals are considered to be “*typical*” metals. What are the typical physical and chemical properties of metals?

.....

.....

.....

.....

.....

Question 2:

The table below lists the melting points, boiling points and densities of the elements in the first Period of the transition metals:

Element:	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
Melting Point / °C:	1540	1675	1900	1890	1240	1535	1492	1453	1083	420
Boiling Point / °C:	2730	3260	3000	2482	2100	3000	2900	2730	2595	907
Density / g cm ⁻³ :	2.99	4.54	5.96	7.19	7.20	7.86	8.90	8.90	8.92	7.14

- a) Briefly comment on the melting points of the transition metals. To help you answer the question, you may wish to compare the melting points of the transition metals to the melting points of Group 1 metals. Is it possible to melt any of the transition metals in a non-luminous Bunsen burner flame (800°C)?

.....

.....

.....

.....

- b) Briefly comment on the densities of the transition metals. To help you answer the question, you may wish to compare the densities of the transition metals to the densities of Group 1 metals. Do any of the transition metals float on water?

.....

.....

.....

.....

Question 3:

The table below gives the properties of some selected transition metals:

Element:	Vanadium	Iron	Nickel
Characteristic Colour of Compounds:	VCl ₂ – Green, VCl ₃ – Pink VCl ₄ – Red, V ₂ O ₄ – Blue V ₂ O ₅ – Orange	FeSO ₄ – Pale green FeCl ₃ – Yellow	NiO – Green NiCl ₂ – Yellow
Charge on Ions / Oxidation State:	V ²⁺ , V ³⁺ , V ⁴⁺ and V ⁵⁺	Fe ²⁺ and Fe ³⁺	Ni ²⁺ , Ni ³⁺ and Ni ⁴⁺
Use of Element / Compound:	V ₂ O ₅ is used to speed up the reaction: $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$ SO ₃ is used in the manufacture of H ₂ SO ₄ .	Fe is used to speed up the reaction: $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ NH ₃ is used in the manufacture of explosives and fertilisers.	Ni is used to speed up the reaction: $\text{C}_2\text{H}_4 + \text{H}_2 \rightarrow \text{C}_2\text{H}_6$ This type of reaction is used in the manufacture of margarine.

- a) • What is the colour of sodium chloride?
- What is the colour of calcium carbonate?
- What general observation can you make about the colour of the Group 1 metal and Group 2 metal compounds?
- What do you observe about the colour of the transition metal compounds?
.....
- Briefly explain why some chemicals are coloured:
.....
.....
- b) • What is the charge on a sodium ion?
- Does sodium form more than one type of ion?
- What do you notice about the number of ions formed by each transition metal?
.....
- c) • What name is given to a substance that speeds up the rate of a chemical reaction?
.....
- d) • Briefly explain why the transition metals are important in industrial chemistry:
.....
.....