Introduction

Transition metal, occupy the middle portions of the periodic table of elements between the groups on the left-hand side and the groups on the right, Whose inner d and f orbitals are not completely filled.

General Properties of transition elements

The most striking similarities of elements are that they are all metals and that most of them are hard, strong, and lustrous, have high melting and boiling points, and are good conductors of heat and electricity.

- Many of the elements are technologically important: Titanium, Iron, Nickel, and Copper for example, are used structurally and in electrical technology.
- Second, the transition metals form many useful alloys , with one another and with other metallic elements. Third, most of these elements dissolve in mineral acids, although a few, such as Platinum, Silver and Gold, are called "noble"—that is, are unaffected by simple (nonoxidizing) acids.
- Without exception, the elements of the main transition series (i.e., excluding the lanthanoids and actinoids as specified below) form stable compounds in two or more formal oxidation states.

The transition metals may be subdivided according to the electronic structures of their atoms into three main transition series, called the First, Second, and Third transition series, and two inner transition series, called the Lanthanoids and the Actinoids.

i) The first main transition series begins with either Scandium (symbol Sc, At. No. 21) or titanium (symbol Ti, atomic number 22) and ends with zinc (symbol Zn, atomic number 30).

ii) The second series includes the elements Yttrium (symbol Y, atomic number 39) to Cadmium (symbol Cd, atomic number 48).

iii)The third series extends from Lanthanum (symbol La, atomic number 57) to Mercury (symbol Hg, atomic number 80).

These three main transition series are included in the set of 30 elements often called the *d*-block transition metals. Because scandium, yttrium, and lanthanum actually do not form compounds analogous to those of the other transition metals because they have quite homologous chemistry to that of the lanthanoids, they are excluded from the present discussion of the main transition metalsThe remaining *d*-block transition metals and some of their characteristic properties are listed in the Table.

Some properties of the transition elements

		symbol	atomic number	atomic mass	density (grams per cubic centimetre, 20 °C)	melting point (°C)	boiling point (°C)
1st main series	titanium	Ti	22	47.867	4.54	1,668	3,287
	vanadium	V	23	50.942	6.11	1,910	3,407
	chromium	Cr	24	51.996	7.14	1,907	2,672
	manganese	Mn	25	54.938	7.21–7.44	1,246	2,061
	iron	Fe	26	55.845	7.87	1,538	2,861
	cobalt	Co	27	58.933	8.9	1,495	2,927
	nickel	Ni	28	58.693	8.9	1,455	2,913
	copper	Cu	29	63.546	8.92	1,085	2,927
2nd main series	zirconium	Zr	40	91.224	6.51	1,855	4,409
	niobium	Nb	41	92.906	8.57	2,477	4,744
	molybdenum	Mo	42	95.94	10.22	2,623	4,639
	technetium	Tc	43	98	11.5	2,157	4,265
	ruthenium	Ru	44	101.07	12.41	2,334	4,150
	rhodium	Rh	45	102.906	12.41	1,964	3,695
	palladium	Pd	46	106.42	12.02	1,555	2,963
	silver	Ag	47	107.868	10.49	962	2,162
3rd main series	hafnium	Hf	72	178.49	13.31	2,233	4,603
	tantalum	Ta	73	180.948	16.65	3,017	5,458
	tungsten	W	74	183.84	19.3	3,422	5,555
	rhenium	Re	75	186.207	21.02	3,186	5,596
	osmium	Os	76	190.23	22.57	3,033	5,012
	iridium	Ir	77	192.217	22.56	2,446	4,428
	platinum	Pt	78	195.084	21.45	1,768	3,825
	gold	Au	79	196.967	~19.3	1,064	2,856

iv) The first of the inner transition series includes the elements from Cerium (symbol Ce, atomic number 58) to Lutetium (symbol Lu, atomic number 71). These elements are called the lanthanoids (or lanthanides) because the chemistry of each closely similar that of lanthanum. Lanthanum itself is often regarded as one of the lanthanoids.

v) The actinoid series consists of 15 elements from Actinium (symbol Ac, atomic number 89) to Lawrencium (symbol Lr, atomic number 103). These inner transition series are rare-earth elements and actinoid elements.

Theories of transition-metal complexes

As has been noted, partially filled *d* orbitals account for the characteristic chemical properties of the regular transition metals, both as a class and as individuals. The interpretation and understanding of the chemical and physical properties of these elements thus depends heavily upon the description of these d^n (n is one or more but fewer than ten) electron configurations. The five orbitals of each *d* shell, regardless of principal quantum number, have the shapes and designations shown in the Figure. The radial extent or size changes with principal quantum number, but the shapes are characteristics for all the sets