VIVEKANANDA COLLEGE
THAKURPUKUR
KOLKATA-700063

NAAC ACCREDITED 'A' GRADE

Topic: f-block elements

Course Title: CC-4/ 10TH

Paper: 10

Unit: L-3

Semester: 4 (Hons)

Name of the Teacher: R Mondal

Name of the Department: Chemistry

Electronic configuration of Lanthanide elements:

Table 8.11 Outer Electronic Configuration of Lanthanum, Lanthanoid Atoms and Ions

Atomic number	Element	Symbol	Configuration of atoms		Configuration of ions		
			Predicted	Observed	M^{2+}	M^{3+}	M^{4+}
57	Lanthanum	La	$4f^0\,5d^1\,6s^2$	$4f^0\,5d^1\,6s^2$	$4f^0\,5d^1$	$4f^0$	—
58	Cerium	Ce	$4f^1\,5d^1\,6s^2$	$4f^2\,6s^2$	$4f^2$	$4f^1$	$4f^0$
59	Praseodymium	Pr	$4f^2\,5d^1\,6s^2$	$4f^3\,6s^2$	$4f^3$	$4f^2$	$4f^1$
60	Neodymium	Nd	$4f^3\,5d^1\,6s^2$	$4f^4\,6s^2$	$4f^4$	$4f^3$	$4f^2$
61	Promethium	Pm	$4f^4\,5d^1\,6s^2$	$4f^5\,6s^2$	$4f^5$	$4f^4$	—
62	Samarium	Sm	$4f^5\,5d^1\,6s^2$	$4f^6\,6s^2$	$4f^6$	$4f^5$	—
63	Europium	Eu	$4f^6\,5d^1\,6s^2$	$4f^7\,6s^2$	$4f^7$	$4f^6$	—
64	Gadolinium	Gd	$4f^7\,5d^1\,6s^2$	$4f^7\,5d^1\,6s^2$	$4f^7\,5d^1$	$4f^7$	—
65	Terbium	Tb	$4f^8\,5d^1\,6s^2$	$4f^9\,6s^2$	$4f^9$	$4f^8$	$4f^7$
66	Dysprosium	Dy	$4f^9\,5d^1\,6s^2$	$4f^{10}\,6s^2$	$4f^{10}$	$4f^9$	$4f^8$
67	Holmium	Ho	$4f^{10}\,5d^1\,6s^2$	$4f^{11}\,6s^2$	$4f^{11}$	$4f^{10}$	—
68	Erbium	Er	$4f^{11}\,5d^1\,6s^2$	$4f^{12}\,6s^2$	$4f^{12}$	$4f^{11}$	—
69	Thulium	Tm	$4f^{12}\,5d^1\,6s^2$	$4f^{13}\,6s^2$	$4f^{13}$	$4f^{12}$	—
70	Ytterbium	Yb	$4f^{13}\,5d^1\,6s^2$	$4f^{14}\,6s^2$	$4f^{14}$	$4f^{13}$	—
71	Lutetium	Lu	$4f^{14}\,5d^1\,6s^2$	$4f^{14}\,5d^1\,6s^2$	$4f^{14}\,5d^1$	$4f^{14}$	—

Table 8.12 Theoretical and Observed Magnetic Moments (in Bohr Magnetons) of Tripositive Cations of Lanthanum and Lanthanoids

Ion	No. of unpaired electrons	Theoretical value (Van Vleck) in BM	Observed value in $M_2(SO_4)_3 \cdot 8H_2O$ in BM
La^{3+}	0	0	—
Ce^{3+}	1	2.56	—
Pr^{3+}	2	3.62	3.47
Nd^{3+}	3	3.68	3.52
Pm^{3+}	4	2.83	—
Sm^{3+}	5	1.55 – 1.65	1.58
Eu^{3+}	6	3.40 – 3.51	3.54
Gd^{3+}	7	7.94	7.9
Tb^{3+}	6	8.7	8.6
Dy^{3+}	5	10.6	10.3
Ho^{3+}	4	10.6	10.4
Er^{3+}	3	8.7	8.4
Tm^{3+}	2	7.6	7.0
Yb^{3+}	1	4.5	4.3
Lu^{3+}	0	0	—