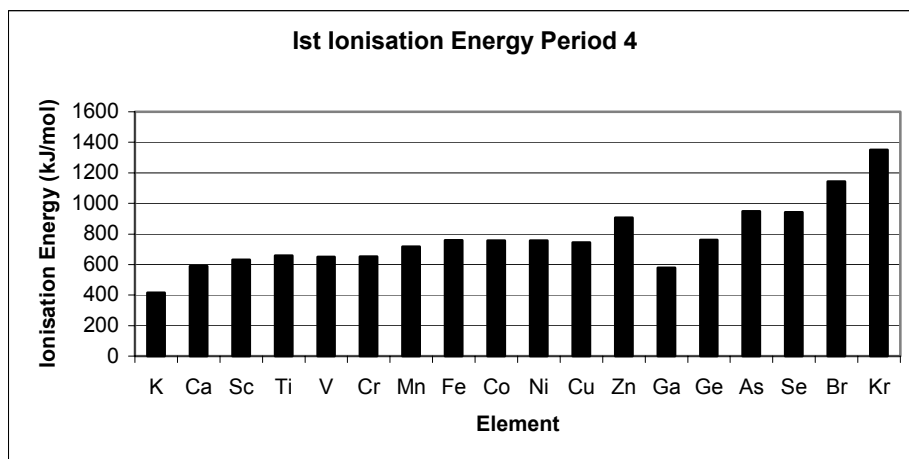
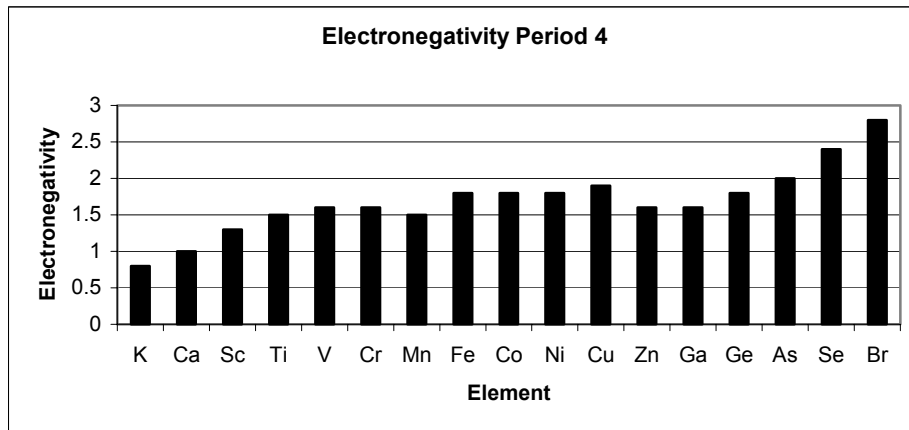
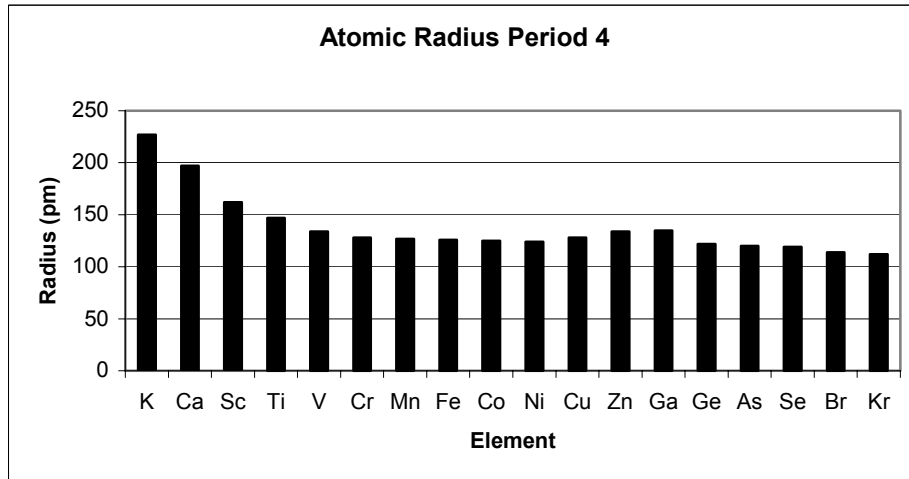
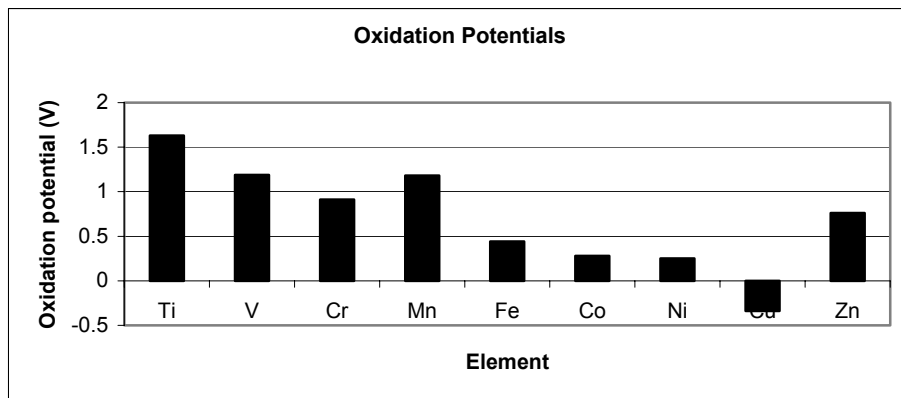


Physical Properties of Period 4 Elements





(for the oxidation: $M \rightarrow M^{2+} + 2 e^-$)

Oxidation States (most important underlined)

State	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
Isolated atom	s^2d^1	s^2d^2	s^2d^3	s^1d^5	s^2d^5	s^2d^6	s^2d^7	s^2d^8	s^1d^{10}	s^2d^{10}
0	d^3	d^4	d^5	d^6	d^7	d^8	d^9	d^{10}	s^1d^{10}	s^2d^{10}
+1			d^4	d^5	d^6	d^7	d^8	d^9	d^{10}	
+2		d^2	d^3	<u>d^4</u>	<u>d^5</u>	<u>d^6</u>	<u>d^7</u>	<u>d^8</u>	<u>d^9</u>	<u>d^{10}</u>
+3	<u>d^0</u>	d^1	d^2	<u>d^3</u>	d^4	<u>d^5</u>	<u>d^6</u>	d^7	d^8	
+4		<u>d^0</u>	<u>d^1</u>	d^2	<u>d^3</u>	d^4	d^5	d^6		
+5			<u>d^0</u>	d^1	d^2		d^4			
+6				<u>d^0</u>	d^1	d^2				
+7					<u>d^0</u>					

Sources and abundance of first-row transition metals

Element	Abundance in crust (ppm)	Important ore(s)	Composition
Sc	25	Thortveitite	$Sc_2Si_2O_7$
Ti	6320	Ilmenite Rutile	$FeTiO_3$ TiO_2
V	136	Vanadinite	$Pb_3(VO_4)_2$
Cr	122	Chromite	$FeCr_2O_4$
Mn	1060	Rhodocrosite	$MnCO_3$
Fe	62000	Haematite Magnetite	Fe_2O_3 Fe_3O_4
Co	29	Smalite Cobaltite	$CoAs$ $CoAsS$
Ni	99	Garnierite Pentlandite	$Ni_6Si_4O_{10}$ Ni_9S_8
Cu	68	Chalcopyrite	$CuFeS_2$
Zn	76	Zinc blende	ZnS

