# **Explore CHEMISTRY** with KALZIUM Dr Pratibha Kohli **Recipient of:**

**CBSE Teachers Award 2018-19** 

National Award for Innovative Practices and Experiments in Education for Schools by DTE, NCERT – 2018-19

State Teacher Award -2015

# Modern Periodic Table



• Elements are arranged according to their atomic number which is a more fundamental property of the elements.

• Systematic grouping of elements into four blocks; s-block, p-block, d-block and f-block

• The position of the elements in the Periodic Table makes it easy to predict and compare their properties,



# IYPT 2019



- The Periodic Table of Chemical Elements is one of the most significant achievements in science, capturing the essence not only of chemistry, but also of physics, medicine, earth sciences and biology.
- 1869 is considered as the year of discovery of the Periodic System, and Mendeleev had a major contribution. 2019 was the 150th anniversary of the Periodic Table of Chemical Elements and has therefore been proclaimed the "International Year of the Periodic Table of Chemical Elements (IYPT2019)" by the United Nations General Assembly and UNESCO.



#### KALZIUM



- Kalzium (German for: Calcium) is a periodic table of the elements for KDE Software Compilation 4. KDE is an international free software community.
- Kalzium is a tool for Subject Specific Resource creation.
- Kalzium is an open source Chemistry Application for school and college students.
- Operating System UBUNTU
- Or Log on to RollApp.com

#### How to download Kalzium

- Ubuntu
- Make a free account on RollApp Kalzium s available free on RollApp.com

### https://www.rollapp.com/app/kalzium



#### KALZIUM



This software contains information about chemical elements:

- Mass
- Charge
- Picture
- Discovery information
- Chemical and energy data
- Model of the atom

#### KALZIUM



- The table itself can be configured to display numeration, state of matter, and colour-coding in various ways.
- A date index is available, allowing only elements discovered up to a defined year to be shown.



Perform Calculations... Plot Data... Classic Periodic Table 👻 Scheme, Gradients, Isotope Table... Molecular Editor... Information ØX Search: Overview 8 9 10 11 15 18 5 12 13 16 17 6 14 Hydrogen H He Li Be Ne В 0 N 15 P 13 A 14 Si 16 17 18 Na Ma S CI Ar 123V 9 Mn Fe Cr Ga As Co Ni Sc Ge Ti Se Br K Ca Kr 39 Y 40 Zr <sup>42</sup>Mo <sup>45</sup>Rh Pd <sup>47</sup>Ag <sup>48</sup>Cd 53 <sup>41</sup>Nb <sup>43</sup>Tc <sup>44</sup> Ru <sup>49</sup>In Sn <sup>51</sup>Sb Xe Te Rb Sr <sup>79</sup> Au Hg Ta Re 76 Os Pb <sup>83</sup> Bi Hf Pt TI Cs Ba La W Ir Po At Rn Rf <sup>106</sup> Sg <sup>118</sup> Oq 105 Db HS 109 Mt <sup>110</sup>**Ds** Rg <sup>112</sup>Cn Mc 117 Ts Bh Nh FI Fr Ra Ac Eu Ťm Nd Pm Sm Gd Tb Pr Dv Ho Er Yb Lu Ce 1.00794 u Fm Th Pa Np Pu Am Cm Bk Cf Es Md No Lr View Legend Scheme: Blocks

s-Block d-Block p-Block f-Block

#### Information on Gold





#### Information on Bromine

Information	🔄 🖉 Search:																		
Overview		1	2	3	4	5	6	7	8	9	10	(11)	12	13	14	15	16	17	18
Bromme		1																	<sup>2</sup> He
		<sup>3</sup> Li	<sup>4</sup> Be											<sup>5</sup> B	<sup>6</sup> C	<sup>7</sup> N	<sup>8</sup> O	9 F	<sup>10</sup> Ne
		Na	<sup>12</sup> Mg											<sup>13</sup> AI	<sup>14</sup> Si	<sup>15</sup> <b>P</b>	<sup>16</sup> S	<sup>17</sup> CI	<sup>18</sup> Ar
		<sup>19</sup> K	<sup>20</sup> Ca	<sup>21</sup> Sc	<sup>22</sup> Ti	<sup>23</sup> V	<sup>24</sup> Cr	<sup>25</sup> Mn	<sup>26</sup> Fe	<sup>27</sup> Co	<sup>28</sup> Ni	<sup>29</sup> Cu	<sup>30</sup> Zn	<sup>31</sup> Ga	<sup>32</sup> Ge	<sup>33</sup> As	<sup>34</sup> Se	<sup>35</sup> Br	<sup>36</sup> Kr
35 Br		37 Rb	<sup>38</sup> Sr	<sup>39</sup> Y	<sup>40</sup> Zr	<sup>41</sup> Nb	<sup>42</sup> Mo	<sup>43</sup> Tc	<sup>44</sup> Ru	<sup>45</sup> Rh	<sup>46</sup> Pd	<sup>47</sup> Ag	<sup>48</sup> Cd	<sup>49</sup> <b>In</b>	<sup>50</sup> Sn	<sup>51</sup> Sb	<sup>52</sup> Te	53	<sup>54</sup> Xe
		55 Cs	56 Ba	57 La	<sup>72</sup> Hf	<sup>73</sup> <b>Ta</b>	74 W	<sup>75</sup> Re	<sup>76</sup> Os	<sup>77</sup> lr	<sup>78</sup> Pt	<sup>79</sup> Au	<sup>80</sup> Hg	<sup>81</sup> <b>TI</b>	<sup>82</sup> <b>Pb</b>	<sup>83</sup> Bi	<sup>84</sup> Po	<sup>85</sup> At	<sup>86</sup> Rn
		<sup>87</sup> Fr	<sup>88</sup> Ra	<sup>89</sup> Ac	<sup>104</sup> Rf	<sup>105</sup> <b>Db</b>	<sup>106</sup> Sg	<sup>107</sup> Bh	<sup>108</sup> Hs	<sup>109</sup> Mt	<sup>110</sup> Ds	<sup>111</sup> Rg	<sup>112</sup> Cn	<sup>113</sup> Nh	<sup>114</sup> FI	<sup>115</sup> Mc	<sup>116</sup> Lv	<sup>117</sup> <b>Ts</b>	<sup>118</sup> <b>Og</b>
															_	_			
70.00					<sup>58</sup> Ce	<sup>59</sup> <b>Pr</b>	<sup>60</sup> Nd	Pm	Ŝm	Eu	<sup>64</sup> Gd	<sup>65</sup> Tb	66 Dy	<sup>67</sup> Ho	<sup>68</sup> Er	<sup>69</sup> Tm	70 <b>Yb</b>	<sup>71</sup> Lu	
View	/4 u				90 Th	Pa	<sup>92</sup> U	<sup>93</sup> Np	<sup>94</sup> Pu	<sup>95</sup> Åm	<sup>96</sup> Cm	97 Bk	98 Cf	99 Es	<sup>100</sup> Fm	<sup>101</sup> Md	No	<sup>103</sup> Lr	
Legend Scheme: Blocks	<u> </u>							HHHI -											
s-Block								d f	-Block										

#### Menu Bar

# <u>File View Tools Settings Help</u>



Information Search:

#### CLICK ON VIEW



#### **CLASSIC VIEW**



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
<sup>1</sup> H																	<sup>2</sup> He
<sup>3</sup> Li	Be											<sup>5</sup> B	<sup>6</sup> C	<sup>7</sup> N	80	<sup>9</sup> F	<sup>10</sup> Ne
Na	<sup>12</sup> Mg											<sup>13</sup> AI	<sup>14</sup> Si	<sup>15</sup> <b>P</b>	<sup>16</sup> S	<sup>17</sup> CI	<sup>18</sup> Ar
<sup>19</sup> K	<sup>20</sup> Ca	<sup>21</sup> Sc	<sup>22</sup> Ti	<sup>23</sup> V	<sup>24</sup> Cr	<sup>25</sup> Mn	<sup>26</sup> Fe	<sup>27</sup> Co	<sup>28</sup> Ni	<sup>29</sup> Cu	<sup>30</sup> Zn	Ga	<sup>32</sup> Ge	<sup>33</sup> As	<sup>34</sup> Se	<sup>35</sup> Br	<sup>36</sup> Kr
<sup>37</sup> Rb	<sup>38</sup> Sr	<sup>39</sup> Y	<sup>40</sup> Zr	<sup>41</sup> Nb	<sup>42</sup> Mo	<sup>43</sup> Tc	<sup>44</sup> Ru	<sup>45</sup> Rh	<sup>46</sup> Pd	<sup>47</sup> Ag	<sup>48</sup> Cd	<sup>49</sup> <b>In</b>	<sup>50</sup> Sn	<sup>51</sup> Sb	<sup>52</sup> Te	53	<sup>54</sup> Xe
55 <b>Cs</b>	Ba	La	<sup>72</sup> Hf	<sup>73</sup> Ta	<sup>74</sup> W	Re Re	76 <b>Os</b>	<sup>77</sup> lr	78 Pt	<sup>79</sup> Au	Hg	<sup>81</sup> <b>TI</b>	<sup>82</sup> <b>Pb</b>	<sup>83</sup> Bi	<sup>84</sup> Po	<sup>85</sup> At	<sup>86</sup> Rn
87 Fr	<sup>88</sup> Ra	<sup>89</sup> Ac	<sup>104</sup> Rf	Db	<sup>106</sup> Sg	<sup>107</sup> Bh	<sup>108</sup> Hs	<sup>109</sup> Mt	Ds	<sup>111</sup> Rg	<sup>112</sup> Cn	<sup>113</sup> Nh	<sup>114</sup> FI	<sup>115</sup> Mc	116 Lv	<sup>117</sup> Ts	<sup>118</sup> Og



#### s-Block and p-Block



#### **Transition Elements**



#### SCHEME of PERIODIC TABLE



ole 👻	Scheme, Gradients, Isotope
	<u>M</u> onochrome
	• <u>B</u> locks
	<u>I</u> conic
	<u>F</u> amily
	<u>G</u> roups
	<u>C</u> olors



# Classic Periodic Table (Monochrome)



#### **BLOCKS of PERIODIC TABLE**



4/4/5:5

# Each element is represented by an icon which represents its use (ICONIC VIEW)



#### **ICONIC VIEW**





#### Family in Periodic Table



#### **Groups in Periodic table**





#### Kalzium - Gradients



### **States of Matter**



### **Covalent Radius**



### Van der Waals Radius

Classic Periodic Table 🔻	Scheme_	Gradients,	Isotope Ta	ble	Molecu	lar Edi	tor	Perfor	m Calc	ulation	s P	lot Data	э								
Information	ØX	<u>N</u> one																			
Overview		<u>S</u> tate of	matter						<u> </u>		~									$\sim$	
Neptunium		<u>C</u> ovalent	t Radius			3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		• <u>v</u> an Der	Waals																	1	He
		<u>A</u> tomic M	4ass																		140
		<u>B</u> oiling P	oint													В	С	N	0	F	Ne
		<u>M</u> elting I	Point													180	170	160	155	150	154
		<u>E</u> lectron	egativity (Pa	auling)												Al	Si	P	S	CI	Ar
		Electron	affinity				-		1000 AL	-	-		(III)	-	-	210	210	192	180	100	100
(according)		<u>D</u> iscover	ry date			SC 230	TI 215	V 205	Cr 205	Mn 205	Fe 205	C0 200	Ni 200	200	210	Ga 210	Ge 210	AS 205	Se 190	Br 190	Kr 202
ND		<u>F</u> irst Ioni	ization			Y	71	Nb	Mo	TC	Ru	Rh	Pd	Aa	Cd	In	Sn	Sh	Te		Xe
93				290	255	240	230	215	210	205	205	200	205	210	220	220	225	220	210	210	216
				Cs	Ba	La	Hf	Та	W	Re	Os	Ir	Pt	Au	Hg	TI	Pb	Bi	Po	At	Rn
				300	270	250	225	.220	210	205	200	200	205	210	205	220	230	230	200	200	200
				Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	FI	Mc	Lv	Ts	Og
				200	200	200	200	200	200	200	200	200	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
							-		Care and	Constant	- and	-	-		-	Caracita de la		-	( m		
	and the second second						248	247	NG 245	243	242	240	238	237	235	233	232	1 m	228	Lu 227	
2	37 u						Th	Pa	11	No	Pu	Am	Cm	Bk	Cf	Fs	Em	Md	No	Ir	
View							240	200	230	200	200	200	200	200	200	200	200	200	200	200	
Legend																					
van Der Waals (linear)					Schem	e: Block	ks									d Block					
Maximum: 300 pm					p-l	Block									1	-Block					

### **Atomic Mass**



#### **Boiling Point (Kelvin)**



74.9216 u

None

None																		
State of matter									als se									
<u>C</u> ovalent Radius			3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
<u>v</u> an Der Waals																		Не
Atomic Mass																		4.216
<u>B</u> oiling Point													B	C.	N	0	F	Ne
Melting Point													4275	5100	77.344	90.188	85	27.1
Electronegativity (Pauli	ng)												AI	Si	Р	5	CI	Ar
Electronaffinity				_	_	_	_	_	_	_	_	_	2740	2630	553	717.82	239.18	87.45
<u>D</u> iscovery date			SC 3109	TI 3560	V 3650	Cr 2945	Mn 2235	Fe 3023	E0 3148	Ni 3005	Cu 2840	Zn 1180	Ga 2478	Ge 3107	As 876	Se 958	Br 331.85	Kr 120.85
First Ionization			Y	75	ND	Mo	TT	Ru	Rh	Pd	An	Cd	In	Sn	Sh	Te		Xe
9	61	1655	3611	4682	-5015	49.10	4538	8485	3970	3240	2436	1040	2350	2876	1860	1261	457.5	165.1
	Cs	Ba 2078	La 3737	HT	Ta 5730	W 5825	R.0	OS 5500	17	P) As an	Au	Hg	TI 1746	Pb 2023	Bi 1837	Po n/a	At 610	Rn 211.4
	Fr 50	Ra 1413	Ac 3470	Rf n/a	Db n/a	Sg n/a	Bh n/a	Hs n/a	Mt n/a	Ds n/a	Rg n/a	Cn n/a	Nh n/a	Fl n/a	Mc n/a	Lv n/a	Ts n/a	Og n/a
			and the second se	the second se	and the second s	The Party of the P	and the second s	and the second s	Contraction of the local division of the loc	the second of the	the second se	and the second second	the second se		the second se			the second se

Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	H0	Er	Tm	Yb	LU
3245	3785	3347	3273	2067	1800	3545	3500	2840	2968	3140	2223	1469	3668
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
S050	(4800	14407	-4175	3505	2880	3383	983	1743	n/a	n/a	n/a	n/a	n/a

#### Melting Point (Kelvin)

Classic Periodic Table 👻 Scheme	Gradients, Isotope Ta	able	Molecu	ilar Edi	tor	Perfor	m Calc	ulation	s P	lot Dat	a								
Information 🛛 🕬	<u>N</u> one																		
Overview	State of matter											(i.s. 10)							
Xenon	<u>C</u> ovalent Radius <u>v</u> an Der Waals <u>A</u> tomic Mass			3	4	5	6	7	8	9	10	)[11]	) 12	) 13	14	15	16	(17)	18 He 0.95
	Boiling Point													B 2365	C 3825	N 63.15	0 54.8	F 53.55	Ne 24.55
	Electronegativity (P	auling)												AI 933.5	Si 1683	Р 317.3	5 392.2	Cl 172.17	Ar 83.95
N	<u>D</u> iscovery date			Sc 1814	Ti 1935	V 2163	Cr 2130	Mn 1518	Fe 1808	Co 1758	NI 1726	Cu 1355.6	Zn 692.73	Ga 302.92	Ge 1211.5	As 1090	Se 494	Br 265.95	Kr 116
54 <b>Xe</b>	<u>First Ionization</u>	312.63	1042	Y 1795	Z7 2128	Nb 2742	Mo 2696	TC 2477	Ru 2610	Rh 2236	Pd 1825	Ag 1235.1	Cd 594.26	In 429.78	Sn 505.12	Sb 903.91	Te 722.72	 386.7	Xe 161.39
		Cs 301.54	Ba 1902	La 1191	Hf 2504	1a -3244	W.	Re 3455	Os 9300	Ir 2720	Pt 2042.1	Au 1337.58	Hg 234.31	T] 577	Pb 600.65	Bi 544.59	Po 527	At 575	Rn 202
		Fr 300	Ra 973	AC 1324	Rf n/a	Db n/a	Sg n/a	Bh n/a	Hs n/a	Mt n/a	Ds n/a	Rg n/a	Cn n/a	Nh n/a	Fl n/a	Mc n/a	Lv n/a	Ts n/a	Og n/a
121 202 -					Ce 1071	Pr 1204	Nd 1294	Pm 1315	Sm 1347	Eu 1095	Gd 1585	Tb 1629	Dy 1685	H0 1347	Er 1802	Tm 1818	Yb 1092	LU 1936	
131.293 U View					Th 2028	Pa 1845	U 1408	Np 912	Pu 913	Am 1449	6m 1620	Bk 1258	Cf 1172	Es 1133	Fm 1125	Md 1100	No 1100	Lr 1900	
Legend Melting Point (logarithmic)			Schem	ie: Bloo	ks														
Minimum: 0.94 K			S-1	Block	endite									d-Block	2				
Maximum: 3825 K			p-	Block										f-Block					

### Electronegativity (Pauling scale)

State of matter       3       4       5       6       7       8       9       10       11       12       13       14       15       16       17       1         yan Der Waals	<u>N</u> one																		
Covalent Radius       3       4       5       6       7       8       9       10       11       12       13       14       15       16       17       1         yan Der Waals       Atomic Mass       Atomic Mass       Image: Covalent Radius       Image:	<u>S</u> tate of matter				-	10								-				· · · · · · · · · · · · · · · · · · ·	
yan Der Waals       Atomic Mass         Atomic Mass       Boiling Point         Melting Point       Signal         Ejectronegativity (Pauling)       Signal         Signal       Signal         Obsolvery date       Signal         First Ionization       Y         Value       Y         O.82       O.95         I.22       I.33         I.22       I.33         I.22       I.33         I.23       I.24         I.24       I.25         I.25       I.22         I.22       I.33         I.22       I.33         I.23       I.24         I.24       I.25         I.25       I.24         I.25       I.24         I.24       I.25         I.25       I.24         I.25       I.25         I.25	<u>C</u> ovalent Radius			3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Atomic Mass       Boiling Point       B       C       N       O       F       N       O       F       N       O       F       N       O       F       N       O       F       N       O       F       N       O       F       N       O       F       N       O       F       N       N       O       F       N       N       O       F       N       N       O       F       N       N       O       F       N       N       O       F       N       N       O       F       N       N       O       F       N       N       O       F       N       N       O       F       N       N       O       F       N       N       N       O       F       N       N       N       O       F       N       N       N       N       N       N       N       S <td><u>v</u>an Der Waals</td> <td></td> <td>He</td>	<u>v</u> an Der Waals																		He
Boiling Point       Melting Point       B       C       N       O       I       N<	<u>A</u> tomic Mass																		n/a
Melting Point       2.04       2.55       3.04       3.44       1.98       nd         Electronegativity (Puing)       -	<u>B</u> oiling Point													В	С	N	0	F	Ne
Electronegativity (Pauling)       Image: Constraint of the con	<u>M</u> elting Point													2.04	2.55	3:04	3.44	3.98	n/a
Electronaffinity       Discovery date       Sc       Ti       V       Cr       Mn       Fe       Co       Ni       Cu       Zn       Ga       Ge       As       Se       Br       K         Discovery date       1.36       1.54       1.63       1.66       1.55       1.83       1.88       1.91       1.9       1.65       Ga       Ge       As       Se       Br       K       Se       1.81       2.01       2.18       2.55       2.96       3.16       Ni       Se       1.81       2.01       2.18       2.55       2.96       3.16       3.16       3.16       1.55       1.83       1.88       1.91       1.9       1.65       1.81       2.01       2.18       2.55       2.96       3.16       3.16       3.16       3.16       1.91       2.2       2.28       2.2       1.93       1.65       1.81       2.01       3.16       2.16       3.16       1.91       2.2       2.28       2.2       1.93       1.69       1.69       1.78       1.96       2.05       2.1       2.66       2.96       2.96       2.96       2.96       2.96       2.96       2.96       2.96       2.96       2.96       2.96       2.96	<ul> <li><u>E</u>lectronegativity</li> </ul>	(Pauling)												AI	Si	Ρ	S	Cl	Ar
Discovery date       Sc       Ti       V       Cr       Mn       Fe       Co       Ni       Cu       Zn       Ga       Ge       As       Se       Br       K         First Ionization       Y       Zr       Nb       Mo       Tc       Ru       Rh       Pd       Ag       Cd       In       Sn       Sb       Te       I       X         0.82       0.95       1.22       1.33       1.66       2.16       1.9       2.2       2.28       2.2       1.93       1.69       1.78       1.96       2.05       2.16       2.16       2.28       2.2       2.93       1.69       1.78       1.96       2.05       2.1       2.66       2.2         0.82       0.95       1.22       1.33       1.6       2.16       1.9       2.2       2.28       2.2       1.93       1.69       1.78       1.96       2.05       2.1       2.66       2         0.82       0.95       1.22       1.33       1.6       2.16       1.9       2.2       2.28       2.2       1.93       1.69       1.78       1.96       2.05       2.1       2.66       2         Cs       Ba       La	Electronaffinity			_					_		_			1.61	1.9	2.19	2.58	3.16	n/a
Eirst Ionization       Y       Zr       Nb       Mo       Tc       Ru       Rh       Pd       Ag       Cd       In       Sn       Sb       Te       I       X         0.82       0.95       1.22       1.33       1.6       2.16       1.9       2.2       2.28       2.2       1.93       1.69       1.78       5.6       Te       I       X       2.66       2.05       2.11       2.66       2.02       2.22       2.28       2.54	Discovery date			SC 136	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
1.00       0.1       Y       2.7       ND       M0       1C       Ru       Rn       Pd       Ag       Cd       In       Sn       SD       Te       T       X         0.82       0.95       1.22       1.33       1.6       2.16       1.9       2.2       2.28       2.2       1.93       1.69       1.78       1.96       2.05       2.1       2.66       2.         Cs       Ba       La       Hf       Ta       W       Re       Os       Ir       Pt       Au       Hg       Tl       Pb       Bi       Po       At       R         0.79       0.89       1.1       1.3       1.5       2.36       1.9       2.2       2.2       2.28       2.54       2       1.62       2.33       2.02       2       2.2       n/a         Fr       Ra       Ac       Rf       Db       Sg       Bh       Hs       Mt       Ds       Rg       Cn       Nh       Fl       Mc       Lv       Ts       O         0.7       0.9       1.1       n/a       n/a<	<b>First Ionization</b>			1.50		NIL	*****	And a	2.00	P.L			E.d.	4.04		Ch			
Cs       Ba       La       Hf       Ta       W       Re       Os       Ir       Pt       Au       Hg       Ti       Pb       Bi       Po       At       R         0.79       0.89       1.1       1.3       1.5       2.36       1.9       2.2       2.2       2.28       2.54       2       1.62       2.33       2.02       2       2.2       1.6         Fr       Ra       Ac       Rf       Db       Sg       Bh       Hs       Mt       Ds       Rg       Cn       Nh       FI       Mc       Lv       Ts       O         0.7       0.9       1.1       n/a       n/a <t< td=""><td></td><td>0.82</td><td>0.95</td><td>1.22</td><td>1.33</td><td>1.6</td><td>2.16</td><td>1.9</td><td>2.2</td><td>2.28</td><td>2.2</td><td>Ag 1.93</td><td>1.69</td><td>1.78</td><td>5n 1.96</td><td>2.05</td><td>2.1</td><td>2.66</td><td>2.6</td></t<>		0.82	0.95	1.22	1.33	1.6	2.16	1.9	2.2	2.28	2.2	Ag 1.93	1.69	1.78	5n 1.96	2.05	2.1	2.66	2.6
0.79 0.89 1.1 1.3 1.5 2.36 1.9 2.2 2.2 2.28 2.54 2 1.62 2.33 2.02 2 2.2 n/ Fr Ra Ac Rf Db Sg Bh Hs Mt Ds Rg Cn Nh Fl Mc Lv Ts O 0.7 0.9 1.1 n/a		Cs	Ва	La	Hf	Та	W	Re	Os	Ir	Pt	Au	Hg	TI	Pb	Bi	Po	At	Rn
Fr     Ra     Ac     Rf     Db     Sg     Bh     Hs     Mt     Ds     Rg     Cn     Nh     Fl     Mc     Lv     Ts     O       0.7     0.9     1.1     n/a		0.79	0.89	1.1	1.3	1.5	2.36	1.9	2.2	2.2	2.28	2.54	2.00	1,62	2.33	2.02	2	2.2	n/a
0.7 0.9 1.1 n/a		Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	FI	Mc	Lv	Ts	Og
		0.7	0.9	1.1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
					Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Но	Er	Tm	Yb	Lu	
Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu					1.12	1.13	1.14	n/a	1.17	n/a	1.2	n/a	1.22	1.23	1.24	1.25	n/a	1.27	
Ce         Pr         Nd         Pm         Sm         Eu         Gd         Tb         Dy         Ho         Er         Tm         Yb         Lu           1.12         1.13         1.14         n/a         1.17         n/a         1.2         1.23         1.24         1.25         n/a         1.27					Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	
Ce       Pr       Nd       Pm       Sm       Eu       Gd       Tb       Dy       Ho       Er       Tm       Yb       Lu         1.12       1.13       1.14       n/a       1.17       n/a       1.2       n/a       1.23       1.24       1.25       n/a       1.27         Th       Pa       U       Np       Pu       Am       Cm       Bk       Cf       Es       Fm       Md       No       Lr					1.3	1.5	1.38	1.36	1.28	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	n/a	

# **Electron Affinity**

Classic Periodic Table 💌	Scheme_	Gradients, Iso	tope Table	II	Molecu	lar Edi	tor	Perfor	m Calc	ulation	s P	lot Data	ə								
Information	Øx	<u>N</u> one																			
Rhodium		<u>S</u> tate of mat <u>C</u> ovalent Ra van Der Waa	tter dius als			3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		– <u>A</u> tomic Mass <u>B</u> oiling Point Melting Poin	s t													B 1.27972	C 1.26212	N -0.07	0 1.46111	F 3.40119	Ne 0
		<ul> <li><u>E</u>lectronegat</li> <li>Electronaffir</li> </ul>	tivity (Pauli nitv	ing)												Al 0.43283	Si 1.38952	P 0.7465	5 2.0771	CI 3.61272	Ar 0
Rh		<u>D</u> iscovery da First Ionizati	ate ion			Sc 0.188	Ti 0.084	V 0.525	Cr 0.67584	Mn 0	Fe 0.151	Co 0.6633	Ni 1.15716	Cu 1.23578	Zn	Ga 0.41	Ge 1.23271	As 0.814	Se 2.02067	Br 3.36359	Kr 0
45			1.4	8591	0.05206	Y 0.307	Zr 0.426	Nb 0.893	Mo 0.7472	TC 0.55	Ru 1.04638	Rh 1.14289	Pd 0.56214	Ag 1.30447	Cd 0	In 0.404	Sn 1.11207	Sb 1.0474	Te 1.97087	i 3.05904	Xe 0
			1,4	Cs 71620	Ba 0.14462	La 0.47	Hf 0	Ta 0:322	W 0:815	Re 0.15	Os 1.0778	lr 1.56436	Pt 2.1251	Au 2.30861	Hg	TI 0.377	Pb 0.364	Bi 1.94236:	P0 1.9	At 2.8	Rn 0
				Fr 0	Ra 0	Ac 0	Rf 0	Db 0	Sg 0	Bh 0	HS 0	Mt 0	Ds 0	Rg 0	Cn 0	Nh 0	FI 0	Mc 0	LV	Ts 0	Og 0
							Ce	Pr	Nd	Pm	Sm	Fu	Gd	ТБ	Dv	Ho	Er	Tm	Yb	- lu	
102.90	55 u						0.5 Th	0.5 Pa	0.5	0.5 No	0.5 Pu	0.5 Am	0.5 Cm	0.5 Bk	0.5 Cf	0.5 Es	0.5 Em	0.5 Md	0.5 No	0.5	
View		-					0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Legend	-)				Schem	e: Bloc	ks														

lectronalinity (logarithinic)	Scheme, Blocks	
Minimum: -0.07 eV	s-Block	d-Block
Maximum: 3.7 eV	p-Block	f-Block

#### **Discovery Year**



#### First Ionization Energy (eV)

Classic Periodic Table 👻	Scheme_	Gradients, Isotope Ta	ble	Molecu	lar Edi	tor	Perform	n Calci	lation	s Pl	lot Data	a								
Information	ØX	<u>N</u> one																		
Overview		<u>S</u> tate of matter																		
Rhodium		<u>C</u> ovalent Radius			3	4	5	6	7	8	9	10		12	13	_14_	15	16		18
		<u>v</u> an Der Waals																		He
		Atomic Mass													_	_		_		24 5874
		Boiling Point													B 298	C	N	0	F	Ne 21 5645
		Melting Point	1 1251 12												AL	C:	D	6		
		Electronegativity (Pa	auling)												5.9858	8.1517	10.4867	10.36	12.9676	15.7596
		Electronaffinity			Sc	Ti	v	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
D Lo		Discovery date			6.5615	6.8281	6.7462	6.7665	7.434	7.9024	7.881	7.6398	7.7264	9.3942	5.9993	7.8994	9.7886	9.7524	11.8138	13.9996
45 <b>R</b> N	i.	<u>First Ionization</u>	140	- 21	Y	Zr	Nb	Мо	Тс	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Те	I	Xe
			4.1771	5.6949	6.2173	6.6339	6.7589	7.0924	7.28	7.3605	7.4589	8.3369	7.5762	8.9938	5.7864	7.3439	8.6084	9.0096	10.4513	12.1298
			CS	Ba	La	Hf 6.8251	Ta 7 5496	W	Re	OS 8 4382	Ir 8.967	Pt 8 9588	Au 9 2255	Hg	TI 6 1082	Pb	Bi 7 2855	P0	At	Rn
			Er	Ba	A.c.	Df	Dh	Ea	Ph	He	Mt	De	Pa	Cn	Nh	E	Mc		<b>T</b> C	
			4.0727	5.2784	5.17	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						-														
						Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Но	Er	Tm	Yb	Lu	
102.90	55 u					5.5387	5.473	5.525	5.582	5.6437	5.6704	6.1498	5.8638	5.9389	6.0215	6.1077	6.1843	6.2542	5.4259	6
						Th 6.3067	Pa 5.89	U 6.1941	Np 6.2657	Pu 6.026	Am	Cm	Bk	Cf 6 2817	Es 6.42	Fm 6.5	Md 6.58	No 6.65	Lr 4.9	
view		_				Canadi		(all all all all all all all all all all				Constanting of the	and a state							-
Legend First Ionization (logarithmic	:)			Schem	e: Bloo	ks														
Minimum: 3.89 eV				s-E	Block									0	d-Block	2				
Maximum: 25 eV				p-l	Block									f	-Block					

#### Double Click on an element

H 20.28																	He 4.216
Li 1615	Be 3243											B 4275	C 51,00	N 77.344	0 90.188	F 85	Ne 27.1
Na 1156	Mg 1380											Al 2740	5i 2630	P 553	S 717.82	Cl 239.18	Ar 87.45
K 1033	Ca 1757	Sc 3109	TI 3560	V 3650	Cr 2945	Mn 2235	Fe 3023	Co 3143	NI 3005	Cu 2840	Zn 1180	Ga 2478	Ge 3107	As 876	Se 958	Br 331.85	Kr 120.85
Rb 961	Sr 1655	Y 3611	Zr 4682	Nb 5015	Mo 4912	Tc 4538	KU 4425	Rh 3970	Pd 3240	Ag 2436	Cd 1040	in 2350	Sn 2876	Sb 1860	Te 1261	 457.5	Xe 165.1
Cs 944	Ba 2078	La 3737	Hf 4875	.Ta 5730	W 5825	Re 5870	Os 5300	IF 4700	Pt 4100	Au 3130	Hg 629.88	TI 1746	Pb 2023	Bi 1837	Po n/a	At 610	Rn 211.4
Fr 950	Ra 1413	Ac 3470	Rf n/a	Db n/a	Sg n/a	Bh n/a	Hs n/a	Mt n/a	Ds n/a	Rg n/a	Cn n/a	Nh n/a	FI n/a	Mc n/a	Lv n/a	Ts n/a	Og n/a
			Ce 3715	Pr 3785	Nd 3347	Pm 3273	Sm 2067	Eu 1800	Gd 3545	Tb 3500	Dy 2840	Ho 2968	Er 3140	Tm 2223	Yb 1469	Lu 3668	
			Th 5060	Pa 4300	U 4407	Np 4175	Pu 3505	Am 2880	Cm 3383	Bk 983	Cf 1743	Es n/a	Fm n/a	Md n/a	No n/a	Lr n/a	

#### Double Click on an Element – Data Overview

- Melting Point
- Boiling Point
- Electron Affinity
- Electronic Configuration
- Covalent Radius
- Van der Waals Radius
- Atomic Radius
- First Ionization Energy
- Electronegativity
- Oxidation States

#### Double-click on Fe

Fe	Iron	
<b>?</b>	Melting Point	1808 K
	Boiling Point	3023 K
88	Electron Affinity	0.151 eV
$\boxtimes$	Electronic configuration	[Ar] 3d <sup>6</sup> 4s <sup>2</sup>
	Covalent Radius	125 pm
	van der Waals Radius	205 pm
i i	Atomic mass	55.845 u
8	First Ionization energy	7.902 eV
$\boxtimes$	Electronegativity	1.83
8	Oxidation states	6, 3, 2, 0, -2

#### **Double-click on Chromium**

Data Overview	Data Ov	verview	
Atom Model	Cr	<u>Chromium</u>	Block: d
	<b>?</b>	Melting Point	2130 K
Isotopes	<b>See</b>	Boiling Point	2945 K
Miscellaneous	8	Electron Affinity	0.6758 eV
	$\boxtimes$	Electronic configuration	[Ar] 3d <sup>5</sup> 4s <sup>1</sup>
Spectrum		Covalent Radius	127 pm
Extra information		van der Waals Radius	205 pm
	1	Atomic mass	51.9961 u
	8	First Ionization energy	6.767 eV
	$\boxtimes$	Electronegativity	1.66
	8	Oxidation states	6, 3, 2, 0

#### **Atomic Model**



### Isotopes of Chromium

Data Overview	Isotopes						
Atom Model	Cr		<u>Chromi</u>	im sotopo-Tabl	0		Block: d
Isotopes	Mass	Neutrons	Percentage	Half-life period	Energy and Mode of Decay	Spin and Parity	Magnetic Moment
Miscellaneous	42.0064 u	18					
Spectrum	42.9977 u	19		0.021 s			
Extra information	43.9856 u	20		0.053 s			
	44.9796 u	21		0.05 s			
	45.9684 u	22		0.26 s			
	46.9629 u	23		0.5 s			
	47.954 u	24		77616 s			
	10 0512				1		I I

#### **Miscellaneous Information**



#### Spectrum of Chromium



View Tools Settings Help																			
s Tables	Gradients_ Isotope Table	e 🕸	/olecu	lar Edil	tor	Perfor	m Calo	ulatior	ns I	Plot Da	ta								
m <u>N</u> umeration ▶	<u>N</u> o Numeration																		
v <u>S</u> cheme	• <u>I</u> UPAC	-																	
<u>G</u> radients ▶	<u>C</u> AS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
<ul> <li>✓ Legend</li> <li>✓ Information</li> </ul>	Old IUPAC	H 20.28																	He 4.216
Table Information		Li 1615	Be 3243											8 4275	C 5100	N 77.344	O 90.188	F 85	Ne 27.1
		Na 1156	Mg 1380											Al 2740	Si 2630	P 553	S 717.82	CI 239.18	Ar 87.45
		K 1033	Ca 1757	Sc 3109	Ti 3560	V 3650	Cr 2945	Mn 2235	Fe 3023	Co 3143	Ni 3005	CU 2840	Zn 1180	Ga 2478	Ge 3107	As 876	Se 958	Br 331.85	Kr 120.85
116		Rb 961	Sr 1655	Y 3611	Zr 4682	Nb 5015	Mo (4912	Tc 4538	Ru 4425	Rh 3970	Pd 3240	Ag 2436	Cd 1040	in 2350	Sn 2876	Sb 1860	Te 1261	l 457.5	Xe 165.1
		Cs 944	Ba 2078	La 3737	.Hf 4875	Ta 5730	W 5825	Re 5870	Os 5300	1r 4900	Pt 4100	AU 3130	Hg 629.88	TI 1746	Pb 2023	Bi 1837	Po n/a	At 610	Rn 211.4
		Fr 950	Ra 1413	Ac 3470	Rf n/a	Db n/a	Sg n/a	Bh n/a	Hs n/a	Mt n/a	Ds n/a	Rg n/a	Cn n/a	Nh n/a	Fl n/a	Mc n/a	Lv n/a	Ts n/a	Og n/a
293 1					Ce 3715	Pr 3785	Nd 3347	Pm 3273	Sm 2067	Eu 1800	Gd 3545	Tb 3500	Dy 2840	H0 2968	Er 3140	Tm 2223	Yb 1469	Lu 3668	
					Th 5960	Pa 4300	U 4487	Np 4425	Pu 3505	Am 2680	Cm 3983	Bk 983	Cf 1743	Es n/a	Fm n/a	Md n/a	No n/a	Lr n/a	

#### Menu Bar - Perform Calculations

1	Perfor	m Calc	ulatior	ns I	Plot Da	ta			
	) 5	6	7	8	9	10	11	12	[1
									42
									4 27
1	V 3650	Cr 2945	Mn 2235	Fe 3023	Co 3143	Ni 3005	Cu 2840	Zn 1180	G 24
	Nb	Mo	Te	Ru	Rh	Pd	Aq	Cd	1

#### The Kalzium Calculators

- Molecular Mass Calculator
- Concentration Calculator
- Nuclear Calculator
- Gas Calculator
- Equation Balancer
- Titration Calculator

#### The Kalzium Calculators

#### Calculators

#### Introduction

Molecular mass Calculator Concentration Calculator Nuclear Calculator Gas Calculator Titration Calculator Equation Balancer

#### The Kalzium Calculators

This calculator contains a variety of calculators for different tasks performing different calculations.

You can find the following calculators in Kalzium:

#### Molecular mass calculator

This calculator helps you calculate the molecular masses of different molecules. You can specify short form of the molecule names add more such aliases.

#### Concentrations calculator

You can calculate quantities which include:

Amount of substance

Volume of solvent

Concentration of substance

There are a wide range of units to choose from and different methods to specify quantities.

#### Nuclear calculator

This calculator makes use of the nuclear data available in Kalzium to predict the expected masses of a material after time.

Gas calculator

This calculator can calculate the values of Temperature, pressure, volume, amount of gas etc. for various ideal as well as nonideal gases.

Equation Balancer

This calculator can balance chemical equations.

Titration calculator

This calculator tries to find out the equivalence point of a pH-meter followed titration best fitting it with an hyperbolic tangent. You can also let it solve an equilibrium system of equations and see how the concentration of a species changes in function of another one



#### **Molecular Mass Calculator**

H2SO	04							
					H <sub>2</sub> 9	5 <sub>1</sub> O <sub>4</sub>		
Molec	ular mass:	98.07	85 u					
Detail	ls							
Com	nposition						Aliases used	
	Element		Atoms	Atomic mass	Total mass	Percentage	aliases	
1 H	lydrogen	2		1.00794	2.01588	2.05537		
2 S	Sulfur	1		32.065	32.065	32.6932		
з с	Dxygen	4		15.9994	63.9976	65.2514		



#### **Concentration Calculator**

Calculate:	-		
Amount of solute:	117.0000	grams (g) 👻	Mass 👻
Molar mass of solute:	58.5000	(g/mol)	
Equivalent mass of solute:	\$8.5000	(g/mole)	
Density of solute:	2.7000	grams per liter 👻	
Amount of Solvent:	1.0000	liters (l) 👻	Volume 👻
Molar mass of solvent:	18.0000	(g/mole)	
Density of Solvent:	1000.0000	grams per liter 👻	
Concentration:	2.0000	molar 👻	

#### **Nuclear Calculator**

Element Name:	Uranium	-			
Isotope mass:	239.054	•			
Half-life:	1407.0000	\$	year (y)	•	
Atomic mass:	239.054		grams / mole		
Other data					
Calculate:	Time	•			
Initial amount:	6.0000	\$	grams (g)	-	]
Final amount:	3.0000	•	grams (g)	-	1

¢

year (y)

777

Time: 1407.0000

#### **Gas Calculator**



#### **Titration Calculator**



#### **Equation Balancer**

Equation:	
aCH3(CH2)3COOH + bO2 -> cH2O + dCO2	
C <u>a</u> lculate	Enter the equation you want to balance in this field.
	Copy <u>t</u> o Clipboard
The equation solver allows you to balance a chemical equation.	
<b>Using Variables</b> To express variable quantities of an element, put a single character in front of the elem <i>aH</i> + <i>bO</i> -> <i>5H2O</i> (Result: <b>10</b> H + <b>5</b> O -> <b>5</b> H <sub>2</sub> O) Solving this expression will give you the needed amount of Hydrogen and Oxygen.	nent's symbol, as shown in this example:
Defining electric charges	

#### Use box brackets to specify the electric charge of an element, as shown in this example: $4H[+] + 2O \rightarrow cH2O[2+]$ (Result: **4** H<sup>+</sup> + **2** O $\rightarrow$ **2** H<sub>2</sub>O<sup>2+</sup>)

#### Plot Data – Atomic Number vs Atomic Mass



#### Plot Data – Atomic Radius vs Covalent Radius



Atomic Radius [pm]

#### View with Gradient



Legend

#### **Numeric Prefixes**



Greek alphabet	Nume	ric Prefixes ar	nd Roman Num	nerals
	Number	Prefix	Roman Numerals	
Numbers	0.5	hemi		
	1	mono	I	
	1.5	sesqui		
	2	di, bi	П	
	2.5	hemipenta		
	3	tri	ш	
	4	tetra	IV	
	5	penta	v	
	6	hexa	VI	
	7	hepta	VII	
	8	octa	VIII	
	9	nona, ennea	IX	
	10	deca	x	
	11	hendeca, undeca	хі	
	12	dodeca	хш	
	13	trideca	хш	
	14	tetradeca	XIV	

#### Risk & Safety Phrases

			-
9 - Explos	ive when mixed with co	mbustible material	-
S-Phra	ses:		
1 - Keep l	ocked up		
2 - Keep o	out of the reach of childr	ren	
3 - Keep i	n a cool place		
4 - Koon :	way from living quarter		
- Keep	way nom nying quarter		CONTRACTOR OF A DESCRIPTION
5 - Keep o	contents under ( appr	opriate liquid to be spe	cified
5 - Keep o by the ma	contents under ( appr nufacturer )	opriate liquid to be spe	cified
5 - Keep o by the ma 6 - Keep o	inder ( inert gas to be	opriate liquid to be spe e specified by the manu	cified Ifacturer
5 - Keep o by the ma 6 - Keep o ) 7 - Keep o	contents under ( appr inufacturer ) inder ( inert gas to be container tightly closed	opriate liquid to be spe specified by the manu	cified Ifacturer
5 - Keep o by the ma 6 - Keep o ) 7 - Keep o 8 - Keep o	contents under ( appr nufacturer ) under ( inert gas to be container tightly closed container dry	opriate liquid to be spe e specified by the manu	cified Ifacturer
5 - Keep ( by the ma 6 - Keep ( ) 7 - Keep ( 8 - Keep ( 9 - Keep (	contents under ( appr nufacturer ) under ( inert gas to be container tightly closed container dry container in a well-ventil	opriate liquid to be spe e specified by the manu lated place	cified Ifacturer
5 - Keep o by the ma 6 - Keep o ) 7 - Keep o 8 - Keep o 9 - Keep o	contents under ( appr nufacturer ) under ( inert gas to be container tightly closed container dry container in a well-ventil	opriate liquid to be spe e specified by the manu lated place	ecified Ifacturer
5 - Keep ( by the ma 6 - Keep ( ) 7 - Keep ( 8 - Keep ( 9 - Keep ( <u>8</u> - Keep (	inder ( inert gas to be ontainer tightly closed ontainer dry ontainer in a well-ventil	opriate liquid to be spe e specified by the manu lated place	ecified Ifacturer
5 - Keep o by the ma 6 - Keep o 7 - Keep o 8 - Keep o 9 - Keep o 2 - Phrases:	inder ( inert gas to be container tightly closed container dry container in a well-ventil 1-2-3-4-5-6-7-8-9	opriate liquid to be spe e specified by the manu lated place	facturer

### **Risk & Safety Phrases**



### References

- <a href="https://teacher-network.in/OER/index.php/Learn-Kalzium">https://teacher-network.in/OER/index.php/Learn-Kalzium</a>
- <u>https://www.youtube.com/watch?v=6XutQzXCBSw</u>
- <u>https://www.youtube.com/watch?v=8\_4x40QNgVc</u>
- <u>https://kde.org/applications/en/education/org.kde.kalzium</u>
- <u>https://teacher-</u> <u>network.in/OER/index.php/Learn\_Kalzium#From\_Software\_center</u>
- <u>https://kde.org/applications/en/education/org.kde.kalzium</u>
- <u>https://chemistry-</u> europe.onlinelibrary.wiley.com/doi/10.1002/ejic.201801409