

Chapter 8 Periodic Table

Wednesday, August 23, 2023 9:46 AM

Periodic table of the elements

2 valence e^s 5 shells
4 valence e^s 3 shells
6 valence e^s, 4 shells?
Halogen group
O group

group 1*

Alkali metals
Alkaline-earth metals
Transition metals
Other metals
Other nonmetals
Halogens
Noble gases
Rare-earth elements (21, 39, 57–71) and lanthanoid elements (57–71 only)
Actinoid elements

1	2											3	4	5	6	7	8	9	10
1 H												5 B	6 C	7 N	8 O	9 F	10 Ne		
3 Li	4 Be											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar		
11 Na	12 Mg	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr		
19 K	20 Ca	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe		
37 Rb	38 Sr	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn		
55 Cs	56 Ba	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og		
87 Fr	88 Ra																		

lanthanoid series 6

58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
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actinoid series 7

90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr
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*Numbering system adopted by the International Union of Pure and Applied Chemistry (IUPAC). © Encyclopædia Britannica, Inc.

Horizontal Rows → Periods 1-7 Periods

Vertical Columns → Groups 1-8 groups

Group I
↓
Alkali Metals

Group VII
↓
Halogens

Group VIII
↓
Noble gases, Inert gases,
O Group

Period → shows number of shells

If an atom is from Period 1 → it will have 1 shell

" " " " " 2 → " " 2 shells

Group shows → number of valence electrons

Group 4 elements have atoms with 4 valence e^s

Question

There is an element having 4 valence electrons and 3 shells

electronic configuration 2, 8, 6 valence electrons

$_{16}\text{S}$ of $_{16}\text{Sulphur}$ $\rightarrow$ 6 group
3 Period

$_{15}\text{P} = 2, 8, \boxed{5}$

$_{17}\text{Cl} = 2, 8, \underline{7}$

Left to right means Period

Top to bottom means group

Metallic Character

metallic character decreases $\rightarrow$

Metals $\rightarrow$ Metalloids $\rightarrow$ Non metals
(left side) Right side

having properties of
both metals and non metals
(Si and Ge)

B
Si
Ge As
Te
At

Metals are more than
non metals.

IV

C $\rightarrow$ non metal
Si
Ge $\rightarrow$ metalloids
Sn
Pb $\rightarrow$ Metals

Metallic character increasing
down the group

Metals $\rightarrow$ (Metallic character $\propto$ Reactivity) $\downarrow$
e.g. Group 1 Group 2 Group

Na Fr

(more reactive)
more metallic character

In non metals going down the group,
reactivity decreases e.g. Group IV

Metals
↓
Basic oxide

Group III, Group IV
↓ Metalloids
Amphoteric oxide

Non metals
↓
Acidic oxide

⇒ Metallic character increases down the group
due to increase in atomic size and decrease
in the attraction between nucleus and
valence electrons.

Types of Ions formed by elements
related to group Number

Periodic table of the elements

group 1* +1 +2 +3 +4 -4 -3 -2 -1 0

period

1	2											3	4	5	6	7	8	9	10
1 H												13 B	14 C	15 N	16 O	17 F	18 He		
3 Li	4 Be											14 Si	15 P	16 S	17 Cl	18 Ar			
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LiCl
NaCl
KCl

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Similarities in the Chemical Properties of
elements in the Groups

⇒ In group elements have similar chemical
properties because they have same valence

properties
electrons.

Group 1 (1 valence electron)	Group 2 (2 valence e ^s)
LiCl	MgCl ₂
NaCl	CaCl ₂
KCl	SrCl ₂
RbCl	BaCl ₂
	AlCl ₃

Actually valence e^s are involved in bond making & they have same chemical properties in group

Position of element in Periodic table can be used to predict its properties

Information about the

① Structure

② Properties

③ Behaviour in chemical reaction

⇒ it tells you about electronic configuration

⇒ Atoms use their valence electrons to participate in chemical reactions

⇒ Predict the reactivity for example

Fr is located at the bottom and it is more reactive than Na

Similarly Fr is more reactive than Na why because Fr have 7 shells and more electrons and Na have 3 shells and less electrons.

✓ 1. more reactive

Group 1 MAXIMUM METALS

They are called alkali metals because they react with H_2O and form alkali.

Li

Na

K

Rb

Cs

Fr

They have similar chemical properties and physical properties (metals, shiny surface)

⇒ soft metals and can easily cut with the knife.

When freshly cut it will look shiny and silvery that ~~turns~~ tarnish (rust) in air.

② M.P and B.P

atomic radius decreases →							
H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar
K	Ca	Ga	Ge	As	Se	Br	Kr
Rb	Sr	In	Sn	Sb	Te	I	Xe
Cs	Ba	Tl	Pb	Bi	Po	At	Rn



Melting and B.P decreases down the group

Atomic size increases down the group.

⇒ Density of alkali metals increases down the group.

⇒ Reactivity increases down the group because

they have bigger atomic size it means they easily lose their valence electron.

Chemical Properties

(1) Reaction with water
Li react quickly with H_2O . Li floats on water, No flame.



Na reacts very quickly, Na melt. A yellow flame is seen.



K reacts violently, K melts. A lilac flame is seen.



Rb Explodes with the spark



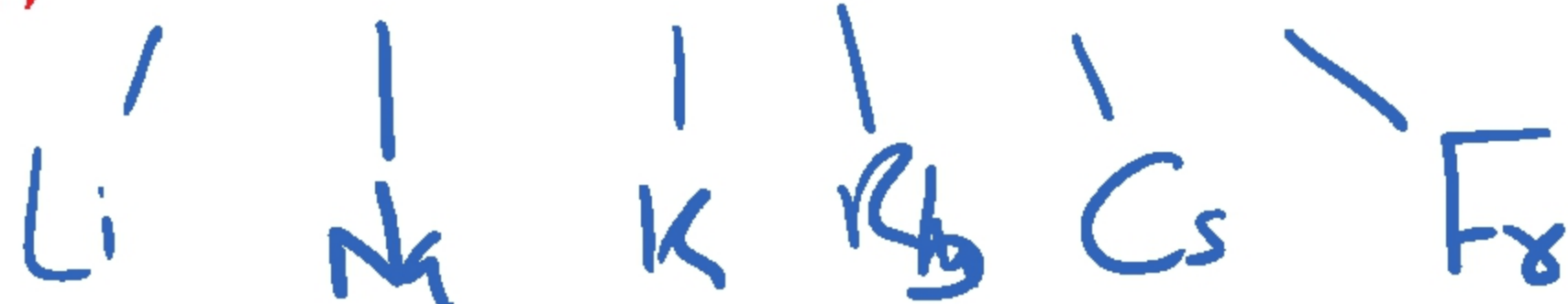
Cs Violent explosion due to rapid production of heat and H_2

Fr. Too reactive to predict

Li is the least reactive and Fr is most reactive element of Group 1

(1) Little Naive Kids Rub Cat's Fur

Memorise



2) Little, Naughty Kids Run Cs From home.

Group VII

Memoristics

Fried Chicken Brings Incredibly Aroma

For Clever Brains, It's A

They are halogen
because they make
salts

F, Cl, Br, I, At

7 Group is also called Halogen Group

⇒ Non metals

⇒ Diatomic state F_2, Cl_2, Br_2, I_2

Halogen have 7 valence electrons

They need 1 electron to complete their octet

~~NaCl~~, HCl, HBr

$\bar{F} \bar{Cl} \bar{Br} (\bar{X})$ Halides (they have complete octet)

Colours in solution

F_2 Gas Yellow

Cl_2 Gas Pale green

Green blue

Br_2 Liquid Reddish brown

Orange

I_2 Solid Black

Dark Brown

(sublimation)

$I_2(s) \rightleftharpoons I_2(g)$

Black

Purple

in aqueous solution

Exam Tip

Hydrogens have intermolecular forces (van der Waals forces) **increases** down the group

F_2 (1st member is for

$$I_2(\text{solid})$$

M.P and B.P increase down the group

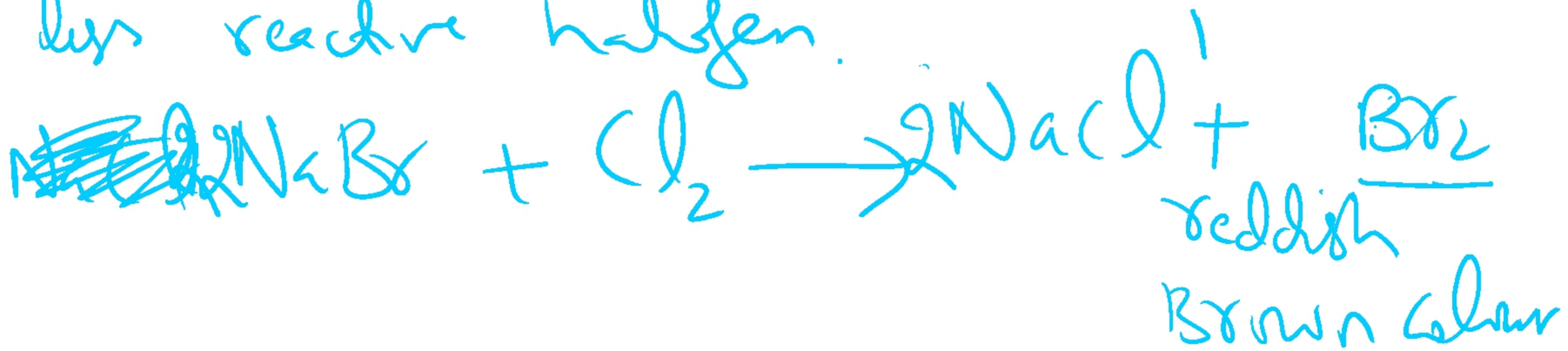
M.P and B.P $\propto$ intermolecular forces

✓ Reactivity decreases down the group

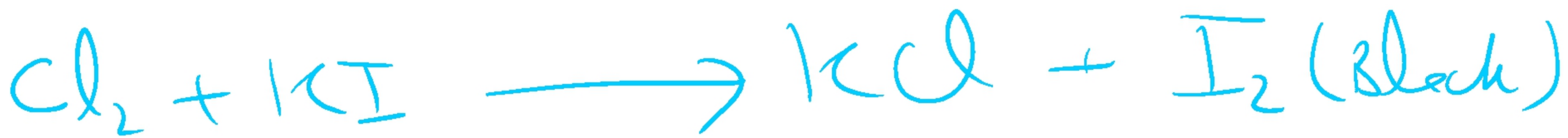
Displacement Reactions of Halides

is a reaction in which one element takes the place of another element in compound

A more reactive halogen will displace
less reactive halogen.



Cl is more reactive than Bromine
it displaces the bromine.



BY is xes,

Reactivity decreases down the group

More reactive $\rightarrow$ F_2

Least " $\rightarrow$ I_2

F_2, Cl_2, Br_2, I_2

Now we have to discuss Astatine
M.P and B.P Solid state

F_2 have lowest M.P and B.P

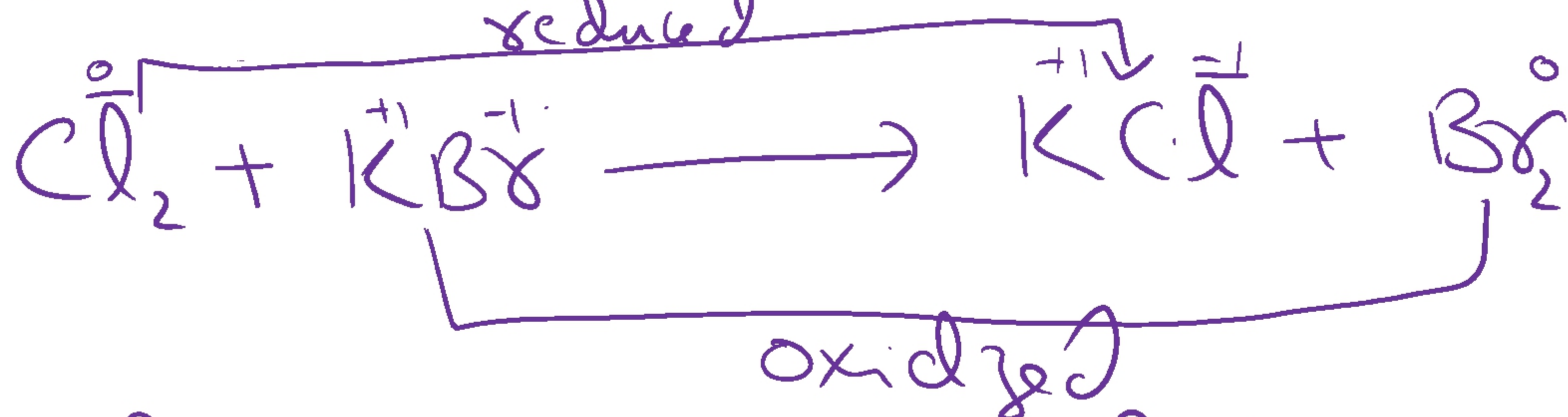
At have highest M.P and B.P

Colour of Astatine is darker Colour Black
The top member of Group 7 are lighter in colour

Halogens are powerful oxidizing agents



The displacement reaction b/w halogen and other halide ion ~~and~~ can also be called Redox reaction



Displacement Reaction (Redox reaction)

Reducing agent - KBr (Br^- Halide)
O.N

Oxidizing agent — $\sim x_2$

Transition elements Fe

They are called transition elements b/c their properties are transitioning from Group 1, 2 to 3, 4, 5, 6, —

⇒ All are metals (Hard)

⇒ High m.p and they have more density

⇒ They are coloured compounds

⇒ Their oxidation states are different



Used as
⇒ Catalysts

Variable oxidation states.

Vanadium
V

Cr

+2, +3, +4, +5
↓
Purple green blue yellow

+2 +3 +6
↓ ↓
Purple green orange

Mn
/ \
+2 +7
light pink pink

Fe
/ \
+2 +3
very light pink pink

Ni
+2
green colour

Co^{+2}
light red

Transition elements are used as catalysts because they show variable oxidation state.

Exam tip ✓

⇒ Transition elements must form colored compounds but ~~the~~ Sc (Scandium) and Zn they do not form colored compounds. They are in transition metal area but they are not considered transition elements.

Noble gases VIII Group

He ⇒ They have complete octet

Ne ⇒ Monatomic

Ar ⇒ They are gases so they have low M_r and B.P

Xe ⇒ Their electronic configuration is extremely stable

Rn ⇒ Unreactive and inert

Use of He → in balloons because it is less dense

Ne, Ar, Xe → Advertising signs, they

for inerting
Ar $\rightarrow$ inert atmosphere and it
is also used in ~~metal~~ welding
Ar $\rightarrow$ fill electric light bulbs