



# ARJUNA NEET BATCH



## Classification of Elements & Periodicity in Properties

**LECTURE-08**

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Objective of today's class



## Summary + PYQs





## Summary:



Across the period

- (i) No. of shells: same
- (ii) Atomic size  $\downarrow$   
(till Gr 17 & then  $\uparrow$  goes to Gr 18)
- (iii) Tendency to gain  $e^-$   $\uparrow$
- (iv) Non-metallic char.  $\uparrow$
- (v) Acidic oxide char.  $\uparrow$
- (vi) Ionisation energy  $\uparrow$
- (vii) Electronegativity  $\uparrow$
- (viii) Electron Affinity  $\uparrow$

- (i) No. of shells  $\uparrow$
- (ii) Atomic size  $\uparrow$
- (iii) Tendency to lose  $e^-$   $\uparrow$
- (iv) Metallic / Electropositive Char.  $\uparrow$
- (v) Basic oxide char.  $\uparrow$  i.e.
- (vi) Ionisation energy  $\downarrow$
- (vii) Electronegativity  $\downarrow$
- (viii) Electron Affinity  $\downarrow$

Down the group



## Trend of Valency:



GROUP 1 (Valence  $e^-s = 1$ )  
Valency = 1

Li

Na

K

Rb

Cs

Down the group; valency remains same

Across the period

Gp 1

Gp 2

Gp 13

14

15

16

17

Valency = 1

2

3

4

(3, 5)

(2, 6)

(1, 7)

Gp 18  
(0, 8)

e.g.  $\text{XeF}_4$   
 $x - 1 \times 4 = 0$   
 $x = +4$





## Trend of Nature of Oxides:



Down the group; basic oxide char.  $\uparrow$  se

~~Gp 2~~



amphoteric oxide (both acidic & basic behaviour)  
( $\text{Al}_2\text{O}_3$ ,  $\text{ZnO}$ ,  $\text{PbO}$ ,  $\text{SnO}$ )



Basic oxide

most basic char.  $\uparrow$





Across the period;

3<sup>rd</sup> period:

$\text{Na}_2\text{O}$   
(most basic)

$\text{MgO}$   
(basic)

$\text{Al}_2\text{O}_3$   
(amphoteric)

$\text{SiO}_2$   
(weakly acidic)

$\text{P}_2\text{O}_5$   
(acidic)

$\text{SO}_3$   
(strongly acidic)

$\text{Cl}_2\text{O}_7$   
(most acidic)

Neutral: neither acidic nor basic  
oxide

e.g.  $\text{CO}$ ;  $\text{H}_2\text{O}$   
carbon monoxide

$\text{N}_2\text{O}$ ,  $\text{NO}$   
(Laughing gas)  
(Nitrous oxide)

acidic oxide  
Char.  $\uparrow$   
basic oxide  
Char.  $\downarrow$

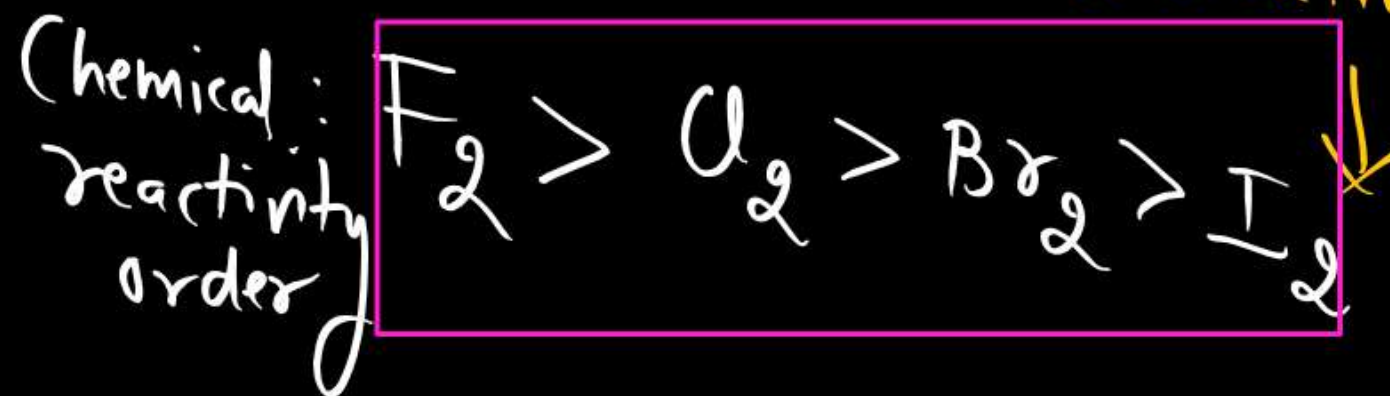
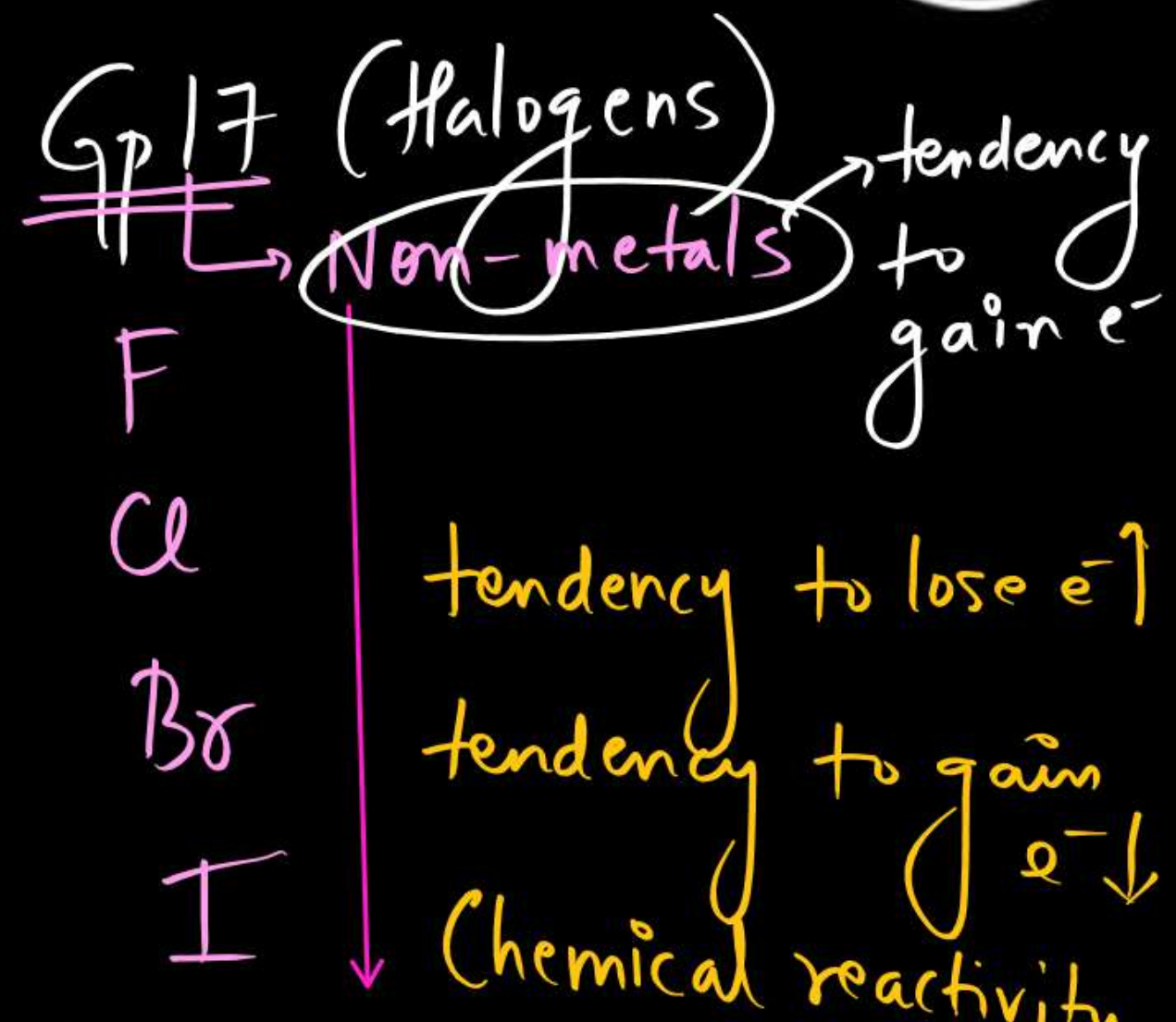
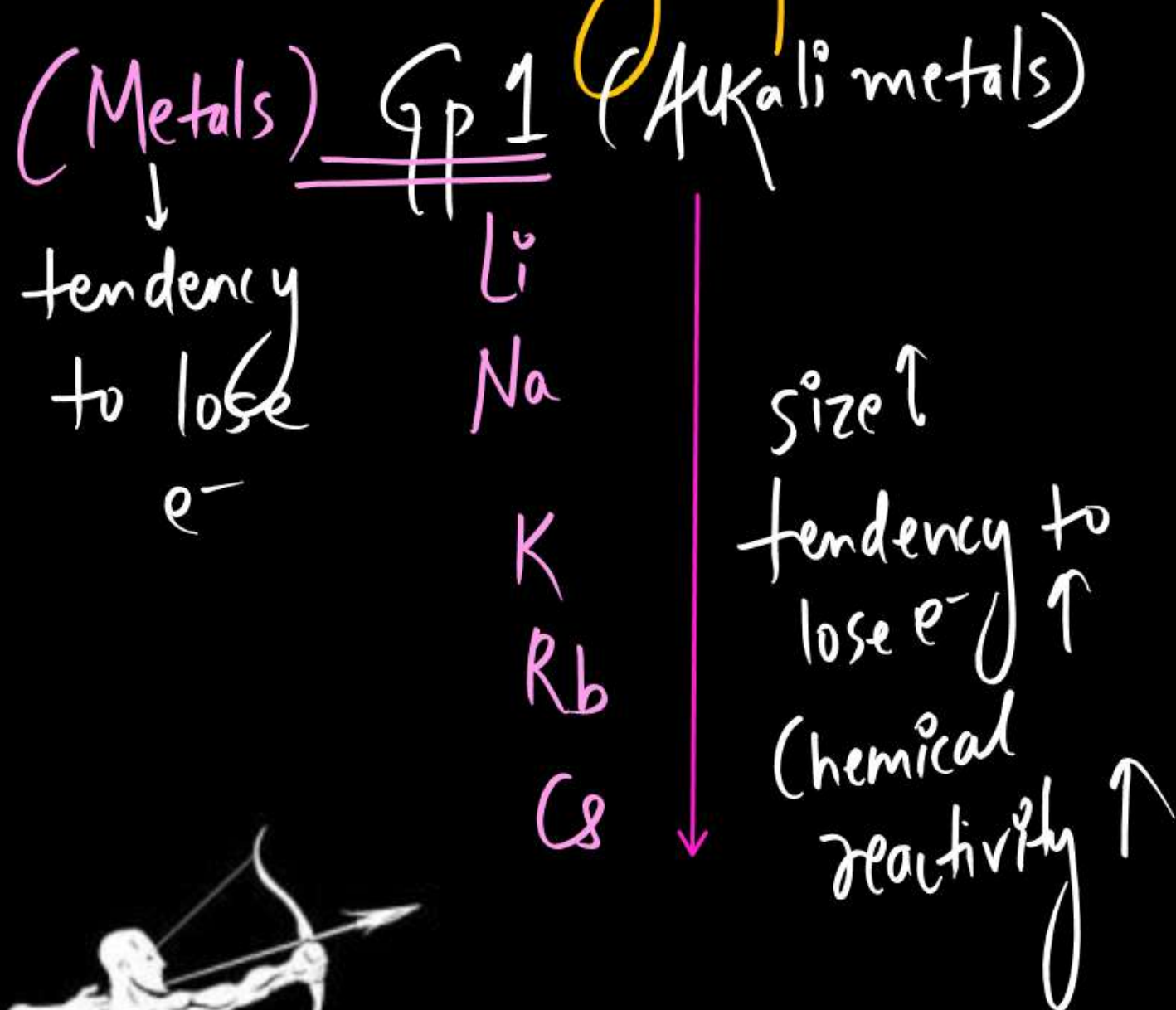




# Trend of Chemical Reactivity:



Down the group;



Across the period:

3<sup>rd</sup> period

Na

Mg

Al

Si

P

S

Cl

→ Chemical reactivity ↓ ses  
(tendency to lose  $e^-$  ↓)

→ Chemical reactivity ↑ ses  
(tendency to gain  $e^-$  ↑)

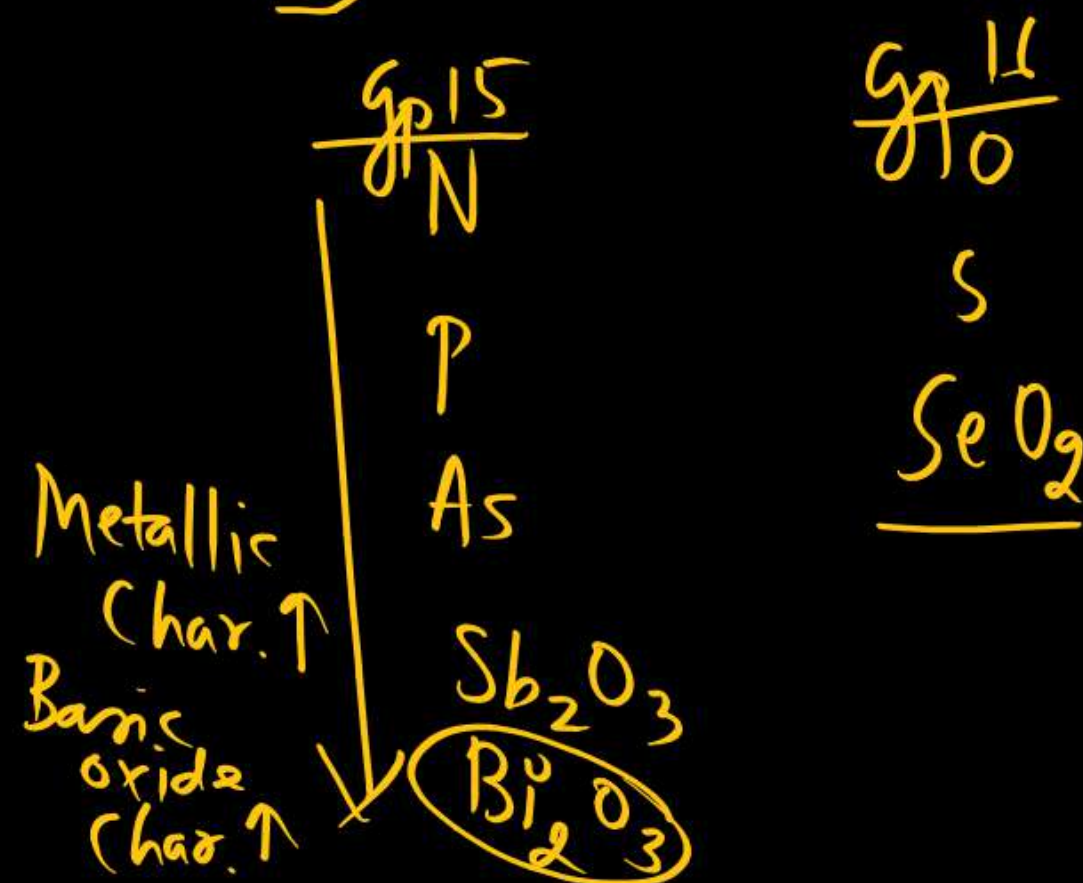




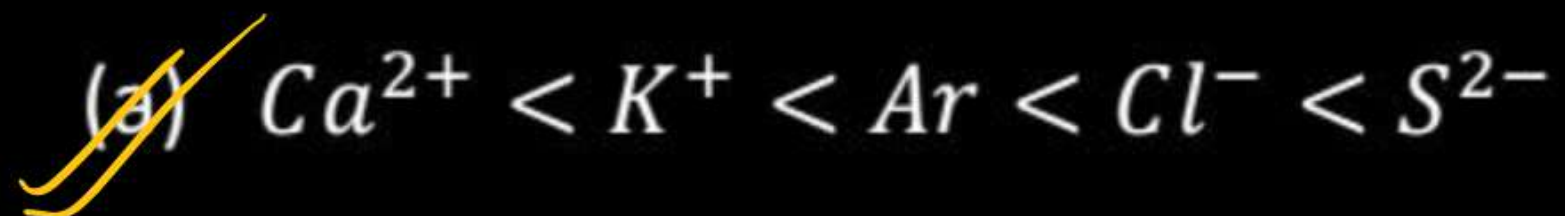
1. Which of the following is the most basic oxide?



AIPMT 2006



2. Identify the correct order of the size of the following ?



AIPMT 2007



+ve charge ↑, size ↓  
-ve charge ↑, size ↑





3. The correct order of decreasing second ionization enthalpy of  $Ti(22)$ ,  $V(23)$ ,  $Cr(24)$  and  $Mn(25)$  is :



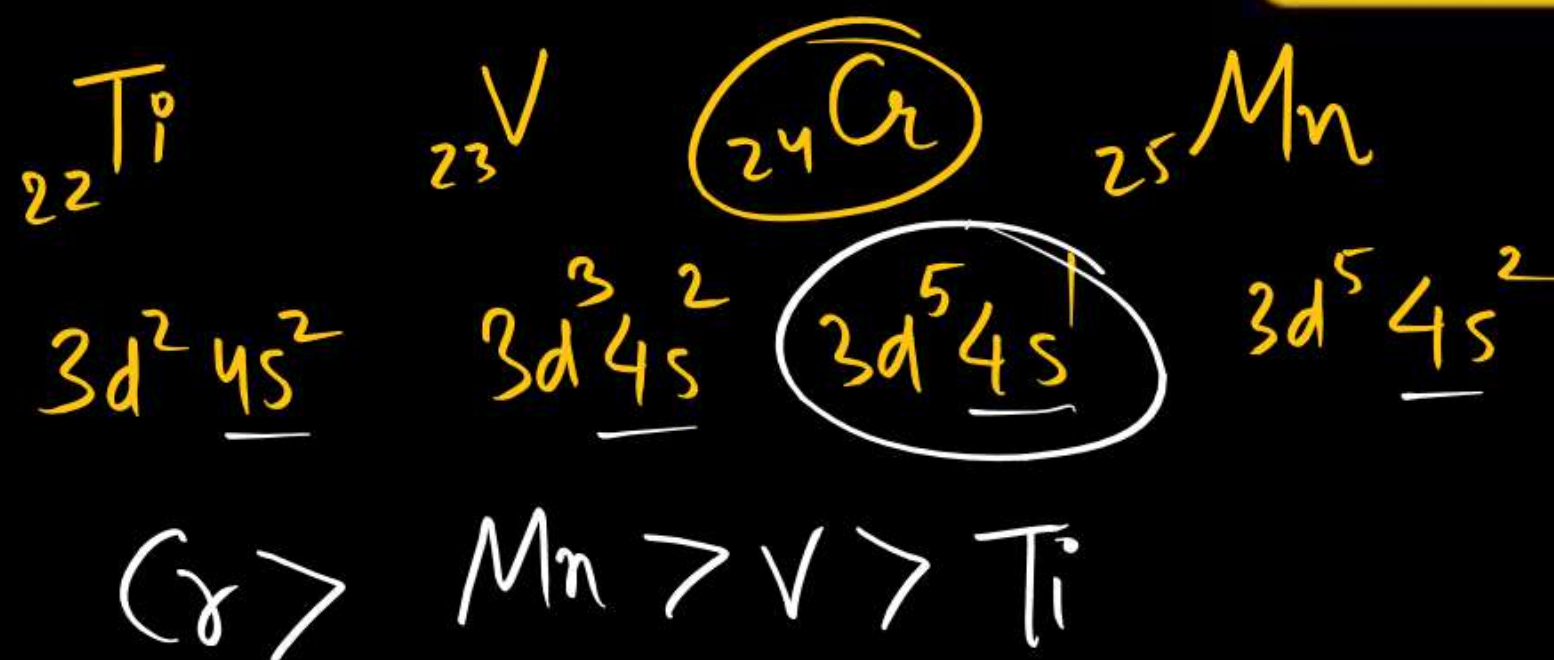
AIPMT 2008

(a)  $Mn > Cr > Ti > V$

(b)  $Ti > V > Cr > Mn$

✓ (c)  $Cr > Mn > V > Ti$

(d)  $V > Mn > Cr > Ti$



4. Which of the following oxides is not expected to react with sodium hydroxide?



(a)  $BeO$  : *base*  
*amphoteric*

(b)  $B_2O_3$  (acidic)  
*non-metal*

AIPMT 2009

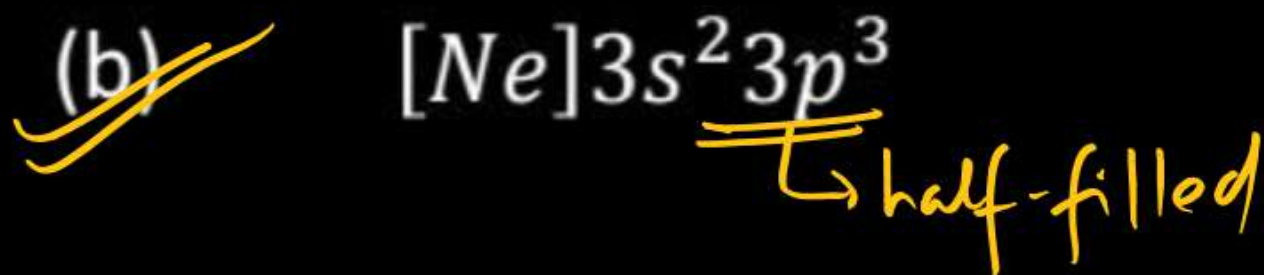
☒ (c)  $CaO$  (basic)

(d)  $SiO_2$  (acidic)

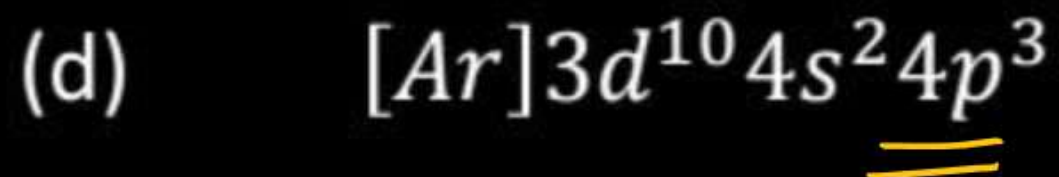




5. Amongst the elements with following electronic configurations, which one of them may have the highest ionization energy?



AIPMT 2009



6. Among the elements Ca, Mg, P and Cl, the order of increasing atomic radii is :

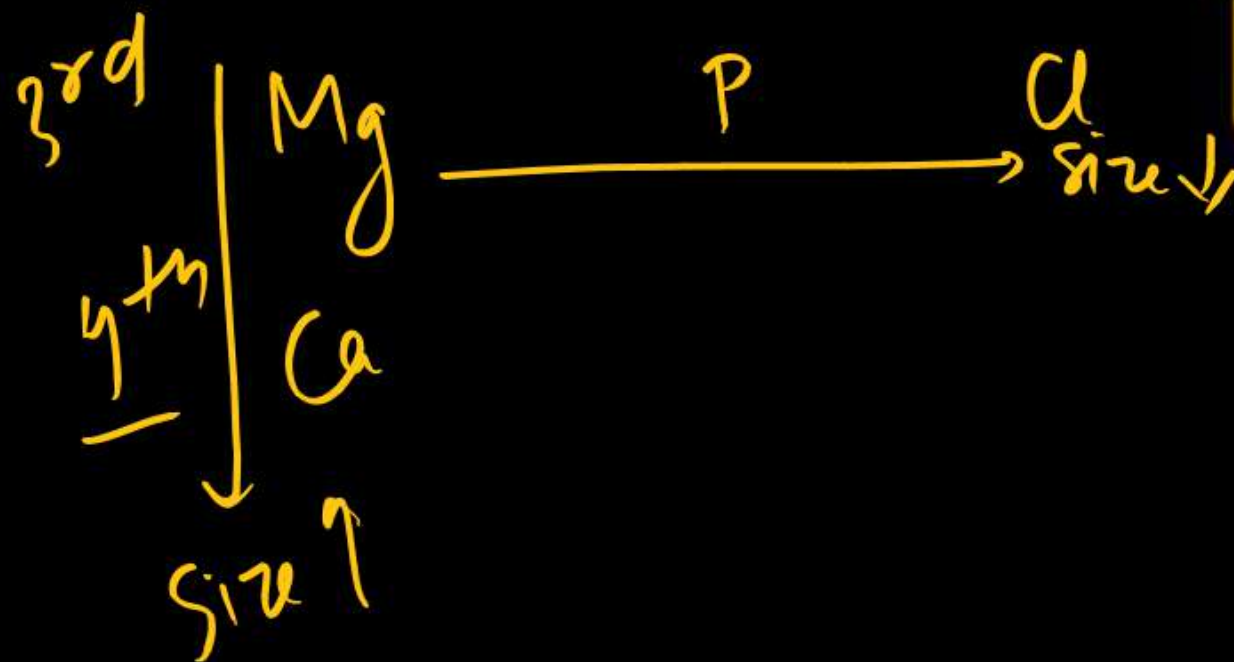


(a)  $Cl < P < Mg < Ca$

(b)  $P < Cl < Ca < Mg$

(c)  $Ca < Mg < P < Cl$

(d)  $Mg < Ca < Cl < P$



AIPMT 2010

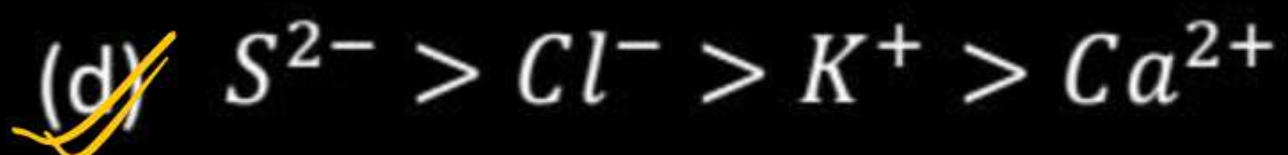
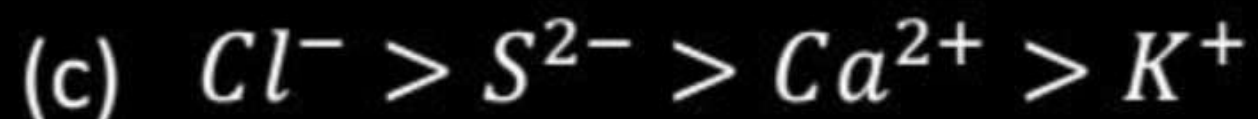
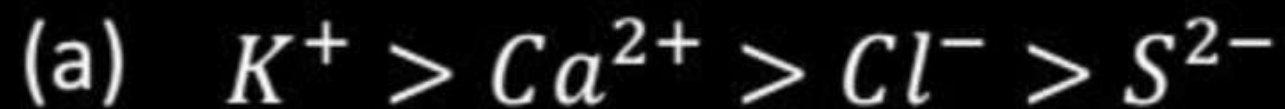




7. The correct order of the decreasing ionic radii among the following isoelectronic species is :



AIPMT 2010



8. Which of the following represents the correct order of increasing electron gain enthalpy with negative sign for the elements O, S, F and Cl?



AIPMT 2010

(a)  $S < O < Cl < F$

(b)  $Cl < F < O < S$

(c)  $O < S < F < Cl$

(d)  $F < S < O < Cl$





9. Which is correct order of  $IP_1$ :



(a)  $Na > Al$

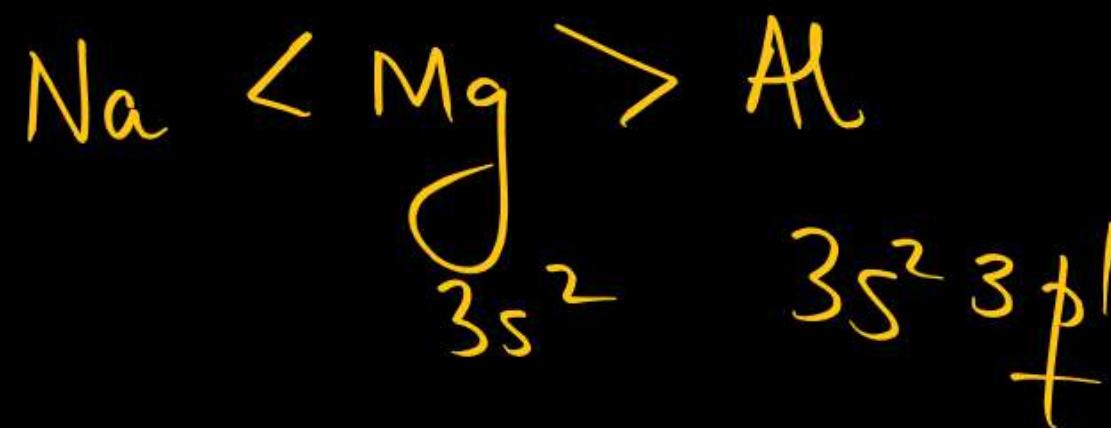
~~(b)~~

$Mg > Al$

AIIMS 2010

(c)  $Ga > Ca$

(d)  $Mg > Be$



10. What is the value of electron gain enthalpy of  $\text{Na}^+$  if  $\text{IE}_1$  OF Na =  $5.1 \text{ eV}$ :



(a)  $+0.2 \text{ eV}$

~~(b)~~  $-5.1 \text{ eV}$

AIPMT  
Mains-2011

(c)  $-10.2 \text{ eV}$

(d)  $+2.55 \text{ eV}$

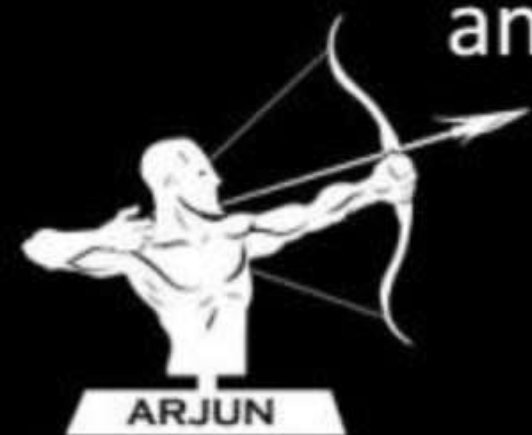




11. Identify the wrong statement in the following:



- (a) Atomic radius of the elements increases as one moves down the first group of the periodic table ✓
- (b) Atomic radius of the elements decreases as one moves from left to right in the 2<sup>nd</sup> period of the periodic table. ✓
- ✓ (c) Amongst isoelectronic species, smaller the positive charge on the cation, smaller is the ionic radius. *+ve charge ↑, size ↓*
- (d) Amongst isoelectronic species, greater the negative charge on the anion, larger is the ionic radius. ✓ *-ve charge ↑; size ↑*



AIPMT Pre-  
2012

12. The 1<sup>st</sup> ionization enthalpy of Na, Mg, and Si are 496, 737, 776 kJmol<sup>-1</sup> respectively then what will be the 1<sup>st</sup> ionization enthalpy of Al in kJmol<sup>-1</sup>



(a)  $> 766 \text{ kJmol}^{-1}$  ✗

~~(b)~~  $> \underline{496} \text{ and } < 737 \text{ kJmol}^{-1}$

(c)  $> 737 \text{ and } < 766 \text{ kJmol}^{-1}$  ✗

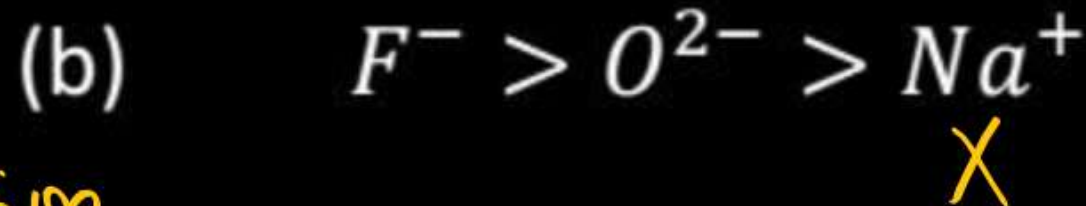
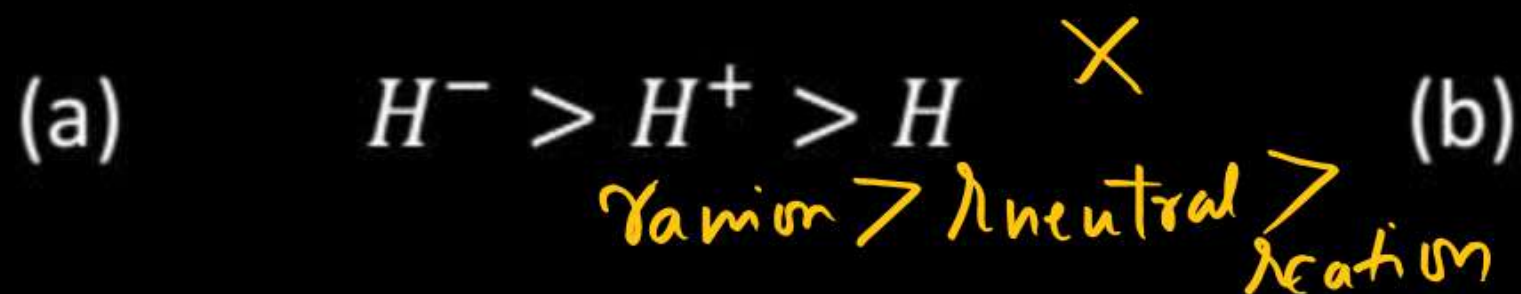
(d)  $> \underline{496} \text{ kJmol}^{-1}$

AIIMS 2013

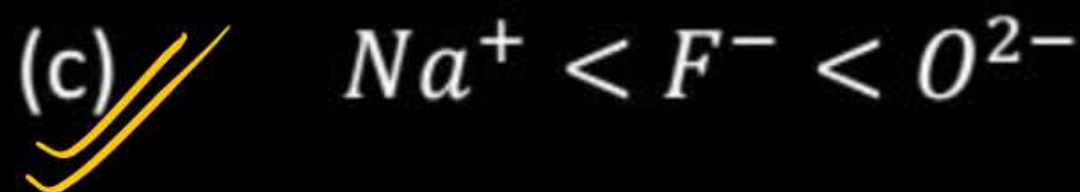
$\text{Na} < \text{Mg} > \text{Al} < \text{Si}$   
(in kJmol<sup>-1</sup>) 496      737      776



13. Which of the following orders of ionic radii is correctly represented?

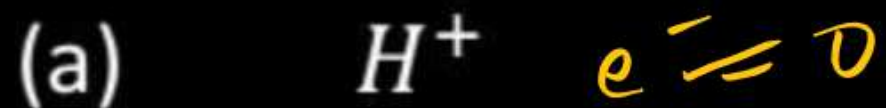


AIPMT 2014





14. Be<sup>2+</sup> is isoelectronic with which of the following ions?



(b) ✓



AIPMT 2014



(d)



15. Acidity of diprotic acids in aqueous solutions increases in the order:  $\rightarrow 2 \text{ H}^+ \text{ ions}$



AIPMT 2014

- (a)  $H_2S < H_2Se < H_2Te$
- (b)  $H_2Se < H_2S < H_2Te$
- (c)  $H_2Te < H_2S < H_2Se$
- (d)  $H_2Se < H_2Te < H_2S$

Gp 16  
 $H_2O$   
 $H_2S$   
 $H_2Se$   
 $H_2Te$

size  $\uparrow$   
Bond-length  $\uparrow$   
ease of losing

$H \uparrow$   
Acidity  $\uparrow$



16. Reason of lanthanoid contraction is:



☒ (a) Negligible screening effect of 'f' orbitals

(b) Increasing nuclear charge

(c) Decreasing nuclear charge

(d) Decreasing screening effect

AIPMT 2014

Screening power:  $s > p > d > f$





17. Correct order of atomic radius is :-



(a)  $V > Ti$  ~~X~~  
 $Sc \xrightarrow{Ti \ V \ Cr \ Mn} \text{size} \downarrow$

(b)  $Cl > S$  ~~X~~  
 $S \xrightarrow{Cl} \text{size} \downarrow$

AIIMS 2014

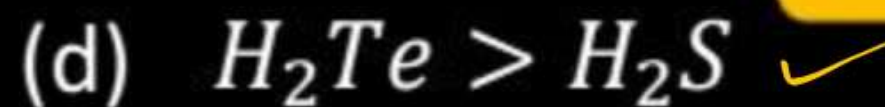
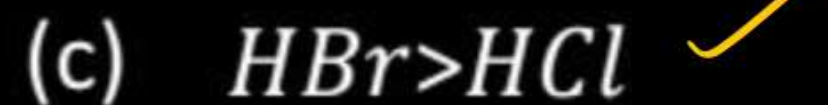
(c)  $Rb > Cs$  ~~X~~

~~(d)~~  $Ne > Be$

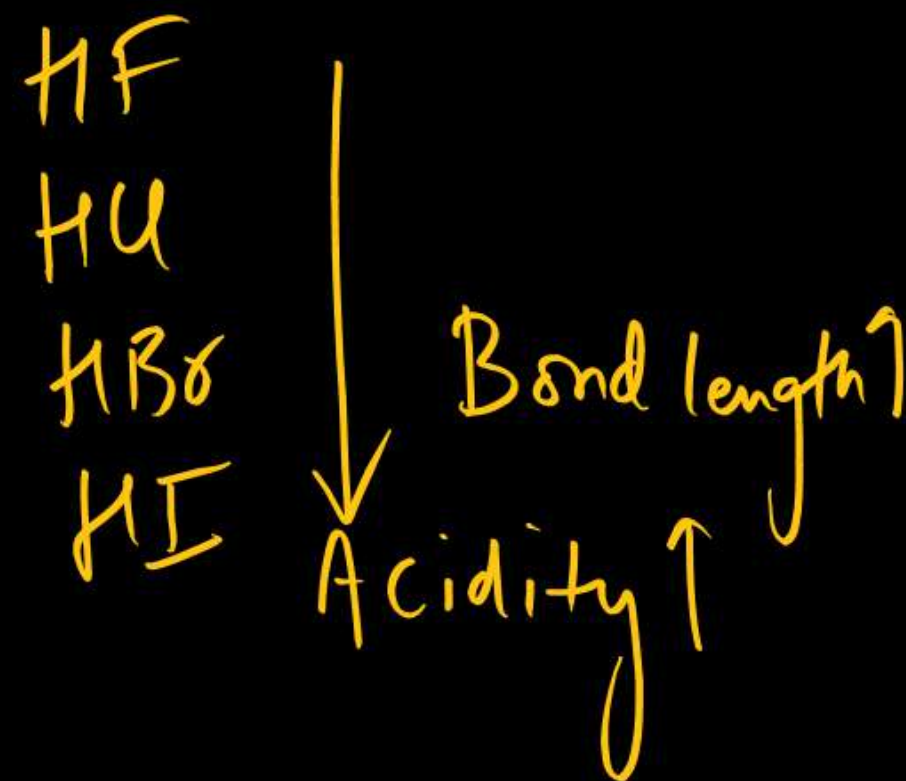
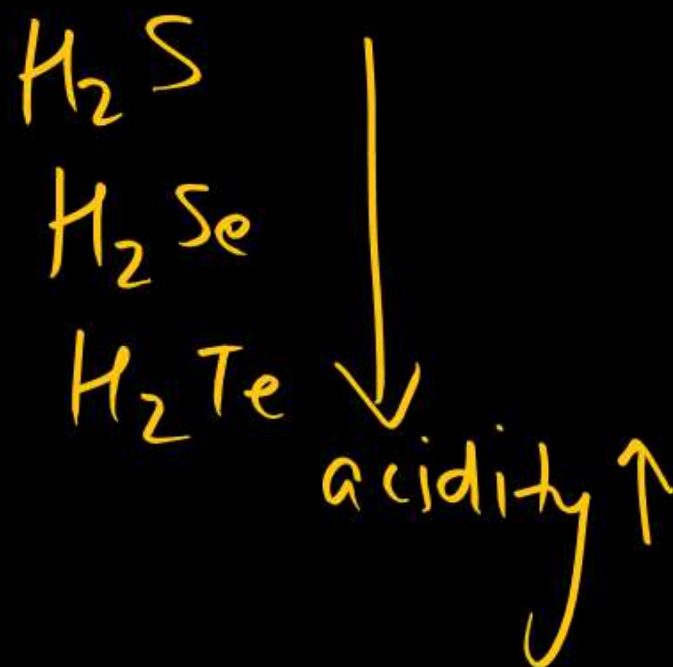
$Rb$   
 $Cs$   
 $\downarrow$   
 $\text{size} \uparrow$



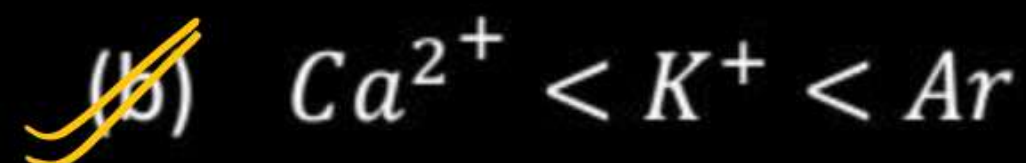
18. Incorrect order of acidic strength is :-



AIIMS 2014



19. The species  $Ar$ ,  $K^+$  and  $Ca^{2+}$  contain the same number of electrons. In which order do their radii increase?



AIPMT 2015





20. The number of d-electrons in  $Fe^{2+}$  ( $Z = 26$ ) is not equal to the number of electrons in which one of the following?



- (a) p electrons in Cl ( $Z=17$ )  $1s^2 2s^2 2p^6 3s^2 3p^5$   
 $p = 11$
- (b) d electrons in Fe ( $Z=26$ ) ✓
- (c) p electrons in Ne ( $Z=10$ )  $1s^2 2s^2 2p^6$
- (d) s electrons in Mg ( $Z=12$ )



$d = 6e^-$



$s = 6$   
 $e^-$

AIPMT 2015



21. Because of lanthanoid contraction, which of the the following pairs of elements have nearly same atomic radii?



(a) Zr(40) and Nb(41)

☒ (b) Zr(40) and Hf(72)

(c) Zr(40) and Ta(73)

(d) Ti(22) and Zr(40)

**AIPMT 2015**





22. The formation of oxide  $O^{2-}$  (g), from oxygen atom requires first an exothermic and then an endothermic step as shown below :



Thus process of formation  $O^{2-}$  in gas phase is unfavourable even though  $O^{2-}$  is isoelectronic with neon. It is due to the fact that,

Re-AIPMT  
2015

- (a) Oxygen is more electronegative .
- (b) Addition of electron in oxygen results in larger size of the ion.
- ☒ (c) Electron repulsion outweighs the stability gained by achieving noble gas configuration.
- (d)  $O^{-}$  ion has comparatively smaller size than Oxygen atom







23. Which is the correct order of increasing energy of the listed orbitals in the atom of titanium ? ( $Z=22$ )

$(n+l)$  rule

(a) 3s 3p 3d 4s

✓ (b) 3s 3p 4s 3d  
 $n+l$ : 3 4 4 5

(c) 3s 4s 3p 3d

(d) 4s 3s 3p 3d

Re-AIPMT  
2015

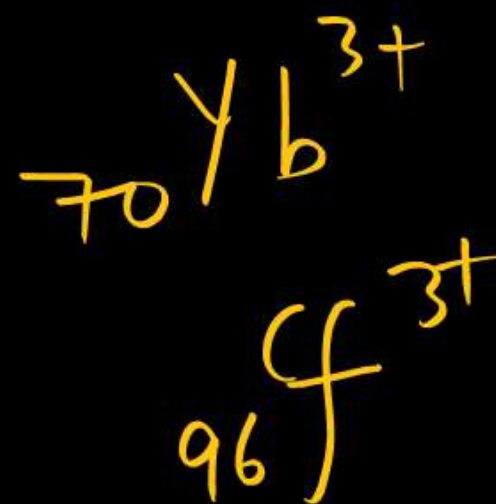


24. Smallest ionic radius is :-



AIIMS 2015

$57 La^{3+}$   
(6<sup>th</sup>) Lanthanoid  
(7<sup>th</sup>) Actinoid





25. Electronic configuration of  $Al^{3+}$  with excluding bonded electron in aluminate ion :-



~~(a)~~ [Ne]

(b) [Ar]

(c) [Ne] $3s^2$

(d) [Ar] $4s^2$

AIIMS 2015





26. In which of the following options the order of arrangement does not agree with variation of property indicated against it?



(a)  $Al^{3+} < Mg^{2+} < Na^+ < F^-$  (increasing ionic <sup>radii</sup> ~~size~~)

✓ (b)  $B < C < N < O$  (increasing first ionisation enthalpy)

✓ (c)  $I < Br < Cl < F$  (increasing electron gain enthalpy)  
 $F < Cl$

(d)  $Li < Na < K < Rb$  (increasing metallic radii)

NEET-I 2016



27. The biggest gap in electronegativity is :-



☒ (a)  $B \rightarrow Al$

(b)  $Ga \rightarrow In$

(c)  $Al \rightarrow Ga$

(d)  $In \rightarrow Tl$

$B$   
 $\curvearrowright$   
 $Al$   
 $Ga$   
 $In$   
 $Tl$

AIIMS 2016



28. The element  $Z=114$  has been discovered recently. It will belong to which of the following family/group and electronic configuration?



gp. No. = 14

- (a) ~~Carbon family~~,  $[Rn]5f^{14}6d^{10}7s^27p^2$
- (b) Oxygen family,  $[Rn]5f^{14}6d^{10}7s^27p^4$
- (c) Nitrogen family,  $[Rn]5f^{14}6d^{10}7s^27p^6$
- (d) Halogen family,  $[Rn]5f^{14}6d^{10}7s^27p^5$

NEET(UG)  
2017





29. If the I.P of  $Na$ ,  $Mg$ , &  $Si$  are 496, 737 & 786 kJ/mol respectively then I.P of  $Al$  is :



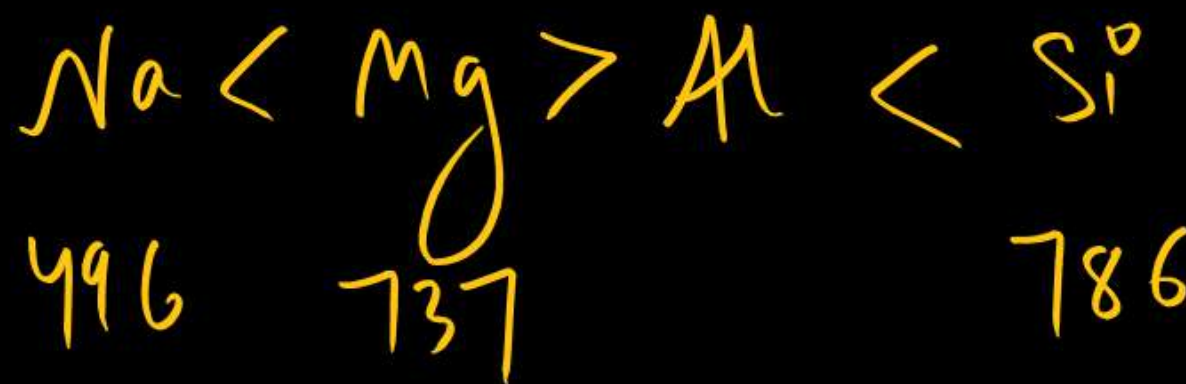
AIIMS 2017

(a) 760kJ/mol

(b) 756kJ/mol

☒ (c) 577kJ/mol

(d) 986kJ/mol



30. Which of the following not reacts with NaOH?



(a)  $As_2O_3$

~~(b)~~  $Bi_2O_3$   
(basic)

AIIMS 2017

(c)  $Sb_2O_3$

(d)  $SeO_2$

N  
P  
As  
Sb  
Bi<sup>o</sup>



31. Which of the following oxides is most acidic in nature ?



(a)  $MgO$

(c)  $BaO$

~~(b)~~  $BeO$   
(amphoteric)

(d)  $CaO$

NEET(UG)  
2018





32. The correct order of atomic radii in group 13 elements is :-



(a)  $B < Al < In < Tl$

(b)  $B < Ga < Al < Tl < In$

(c)  $B < Al < Ga < In < Tl$

~~(d)~~  $B < Ga < Al < In < Tl$

NEET(UG)  
2018

$B < Ga < Al < In < Tl$





33. In which of the following elements d-orbitals do not have any electrons in their outer electronic configuration :-



(b)  $Lr$

(c)  $Th$

(d)  $Lu$

AIIMS 2018





Thank You