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Ionisation energy

- 31. (a) Ionisation potential increases across the period.
- **32.** (b) Cu < Ag < Au.
- 33. (a) A decrease in the ionisation potential

Reason: Inner electrons reduce effective nuclear charge experienced by outer electron → lower ionization energy.

- 34. (c) Due to stable half-filled orbitals.
- **35.** (c) Greater than the first ionization energy because after removal one e^- , effective nuclear charge increases.
- **36.** (c) Rare gases as the e^- is to removed from stable electron configuration.
- 37. (d) Since it is a noble gas.
- **38.** (b) The first *I.P.* is maximum for hydrogen due to its small size.
- 39. : (d) As < P < S

Explanation:

S is to the right of $P \rightarrow highest IE$ in this set

40. (a) U > K > Cs and (b) B > U > K

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41. (c) Due to his fullfilled configuration.





- **42.** (b) 1st I.P. decreases down the group.
- **43.** (a) 1st I.P. increases from left to right in a period.
- **44.** (b) Ne > Cl > P > S > Mg > Al Highest \rightarrow Ne (2080), Cl (1251) next, S (1000) and P (1012) \rightarrow P slightly < S , Mg = 738, Al = 577
- **45.** (b) First I.P. for C is 11.3, for N is 14.5 and for O is 13.6
- 46. (a) NH₃ < PH₃ < AsH₃ acidic nature

Trend: As we go down group 15, the **basicity decreases** and **acidity increases** in hydrides.

NH₃ is **least acidic**, AsH₃ more acidic → Correct

(b) $Li^+ < Na^+ < K^+ < Cs^+$ – ionic radius

Trend: Ionic radius increases down the group \rightarrow Li⁺ < Na⁺ < K⁺ < Cs⁺ \rightarrow Correct

(c) $Al_2O_3 < MgO < Na_2O < K_2O - basicity$

Trend: Oxides become **more basic down the group for alkali metals**, less basic for amphoteric Al₂O₃.

Al₂O₃ is **amphoteric**, MgO slightly basic, Na₂O, K₂O strongly basic → Correct

(d) Li < Be < B < C - 1st ionization potential 1st IE trend across period 2:

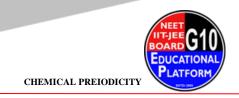
Li (520) < Be (899) < B (801) < C (1086 kJ/mol)

Notice B (801) < Be (899) \rightarrow IE of B is less than Be due to p-orbital vs s-orbital effect \rightarrow sequence is wrong

- (d) Li < Be < B < C 1st ionization potential is wrong
- **47.** (a) *Li* has least I.P about 5.4.
- 48. (b) I.E. increases across the period.
- 49. (a) H



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Reason: Li^{2+} is a **hydrogen-like ion** (1 electron) \rightarrow same type of electronic transitions as H.

- **50.** (a) He has highest ionisation energy due to it full fill 1s-orbital.
- **51.** (a) s-electrons are strongly bonded to the nucleus. So large amount of energy is required to remove an e^- .
- **52.** (d) Mg > Al > Na. This is due to the presence of fully filled s-orbital in Mg.
- 53. (a) $Cs^+ < K^+ < Mg^{2+} < Al^{3+}$

Polarizing power depends on:

Polarizing power ∝ charge/radius Higher charge → more polarizing Smaller size → more polarizing **Given ions:** Cs⁺, K⁺, Mg²⁺, Al³⁺

Cs⁺: +1, large → lowest

K⁺: +1, smaller → higher than Cs⁺

Mg²⁺: +2, small → higher

Al³⁺: +3, very small \rightarrow highest

Increasing order: Cs⁺ < K⁺ < Mg²⁺ < Al³⁺

54. (a) Na < Al < Mg < Si

Approximate IE₁ values (kJ/mol):

Na \rightarrow 496, Mg \rightarrow 738, Al \rightarrow 578, Si \rightarrow 786

Observe: Al < Mg < Si \rightarrow due to p-orbital effect (Al has $3p^1 \rightarrow$ easier to remove than Mg $3s^2$)

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- **55.** (c) The 1st I.P. for hydrogen is 13.6 *volts*
- **56.** (b) Alkali metals are strong reducing agents





57. (d) O²⁻

Reason: Extra electrons in O²⁻ are weakly held due to **electron-electron** repulsion, so it requires **least energy to remove one electron**.

58. (a) Due to the large size of group IA elements, the outermost electron is far from the nucleus and can easily be removed. their ionisation energies or ionisation potentials are relatively low.

Li Na K Rb Cs Ionisation potential (eV) 5.4 5.1 4.3 4.2 3.9

59. (d) II_Na > II_Mg

Reason: After removing Na's first electron, the second electron comes from **core**, which is tightly bound → huge jump in ionization energy.

60. (a) N > 0 > Be > B Ist ionisation energy of (n) because of half filled p -orbital.

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