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:

As is **largest** → lowest IE
P smaller than As → higher IE
S is to the right of P → highest IE in this set

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

B (Z = 5): 8.30 eV, **K (Z = 19):** 4.34 eV,
Cs (Z = 55): 3.89 eV, **U (Z = 92):** 6.2 eV

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 → Ne (2080), Cl (1251) next, S (1000) and P (1012) → 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) NH_3 < PH_3 < AsH_3 – acidic nature**

Trend: As we go down group 15, the **basicity decreases** and **acidity increases** in hydrides.
NH_3 is **least acidic**, AsH_3 more acidic → Correct
(b) Li^+ < Na^+ < K^+ < Cs^+ – ionic radius
Trend: **Ionic radius increases down the group** → Li^+ < Na^+ < K^+ < Cs^+ → 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 Al_2O_3.
Al_2O_3 is **amphoteric**, MgO slightly basic, Na_2O, K_2O 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)** → IE of B is **less than Be** due to **p-orbital vs s-orbital effect → 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**

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

50. (a) *He* has highest ionisation energy due to it full fill 1*s*-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^+, Mg^{2+}, Al^{3+}
Cs^+: +1, large → lowest
K^+: +1, smaller → higher than Cs^+
Mg^{2+}: +2, small → higher
Al^{3+}: +3, very small → highest
Increasing order: $Cs^+ < K^+ < Mg^{2+} < Al^{3+}$

54. **(a)** Na < Al < Mg < Si
Approximate IE_1 values (kJ/mol):
Na → 496, Mg → 738, Al → 578, Si → 786
Observe: **Al < Mg < Si** → due to p-orbital effect (Al has $3p^1$ → easier to remove than Mg $3s^2$)

55. (c) The 1st I.P. for hydrogen is 13.6 $volts$

56. (b) Alkali metals are strong reducing agents

57. **(d) O^{2-}**

Reason: Extra electrons in O^{2-} 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) $N > O > Be > B$ Ist ionisation energy of (n) because of half filled p -orbital.