1 a i $2.91, \quad 2.59$

ii $\text{mol} = \dfrac{2.91}{24.3 + 32.1 + 16\times4} = \cancel{0.0325}\ 0.024$

$\text{mol} = \dfrac{2.59}{1\times2 + 16} = \cancel{0.086}\ 0.144$

$x = \dfrac{0.144}{0.024} = 6$

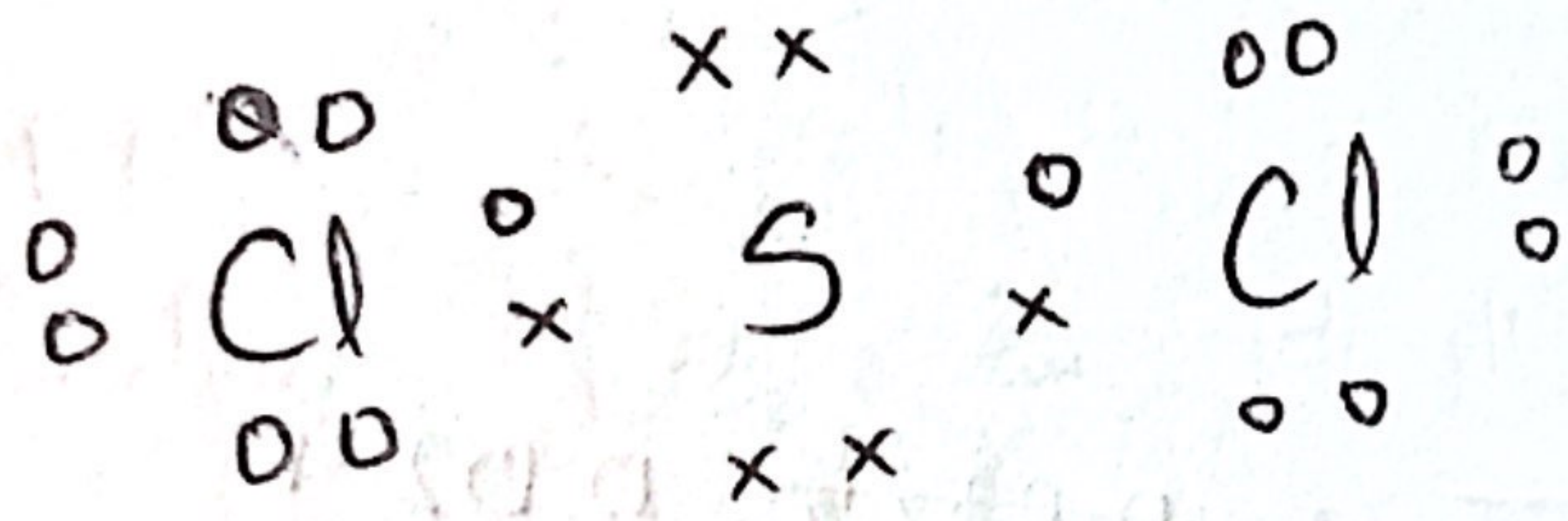
b Heat magnesium sulfate in crucible and then reweigh. Repeat until no change in mass and mass is constant. All the water of crystallisation is evaporated, so we can find exact value of x.

c $\dfrac{3\times16\times2}{2(39.1+35.5)+3\times16\times2} \times 100$

$= 39.2\%$

2 a i A lattice of positively charged metal cations are embedded in and held together by a sea of delocalised electrons, by electrostatic force of attraction between cations and electrons.

c i

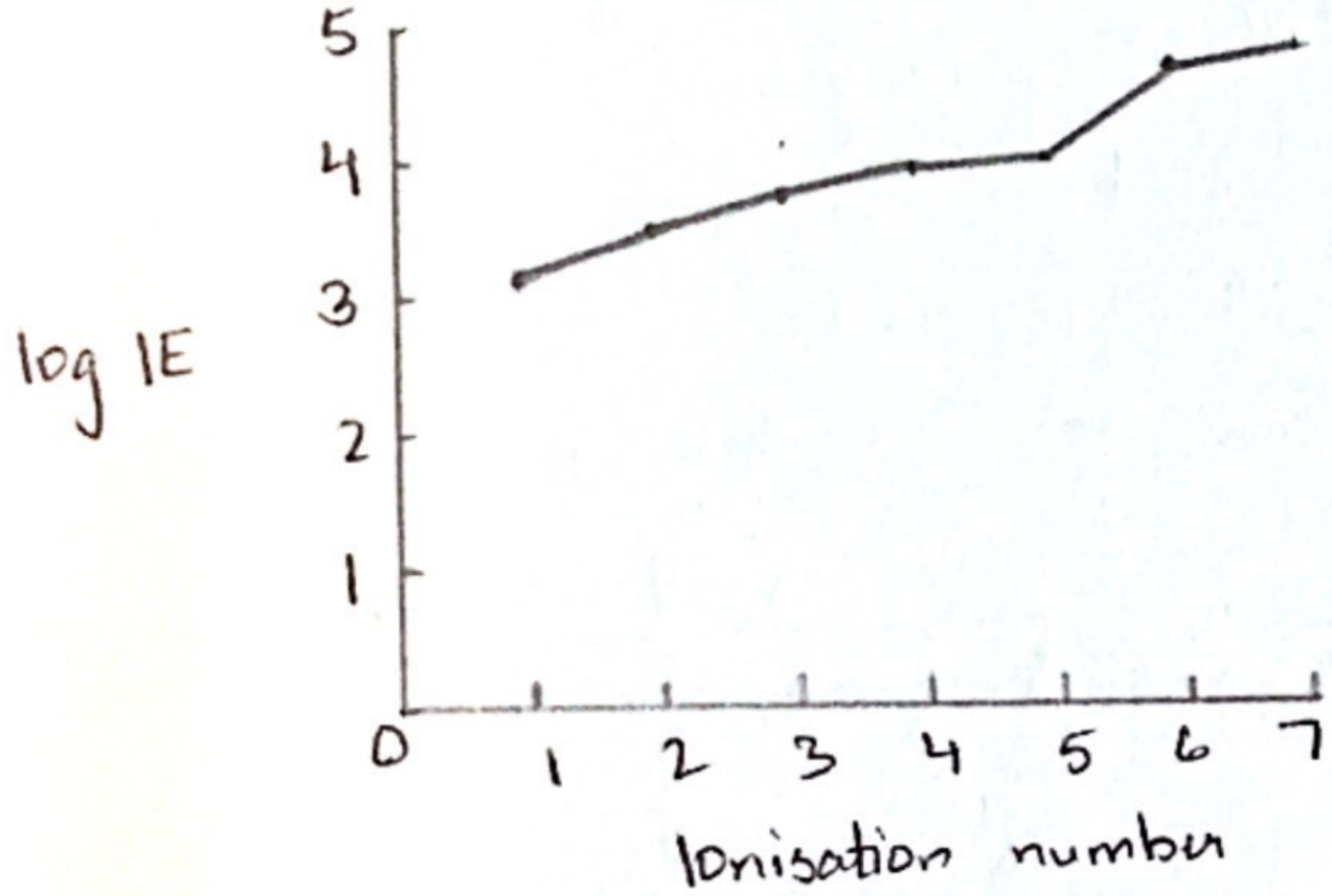


d mol $= \frac{44}{12+16} = 1.57$

$n = 6.02 \times 10^{23} \times 1.57 = 9.45 \times 10^{23}$

3 i $Li(g) \longrightarrow Li^{+}(g) + e^{-}$

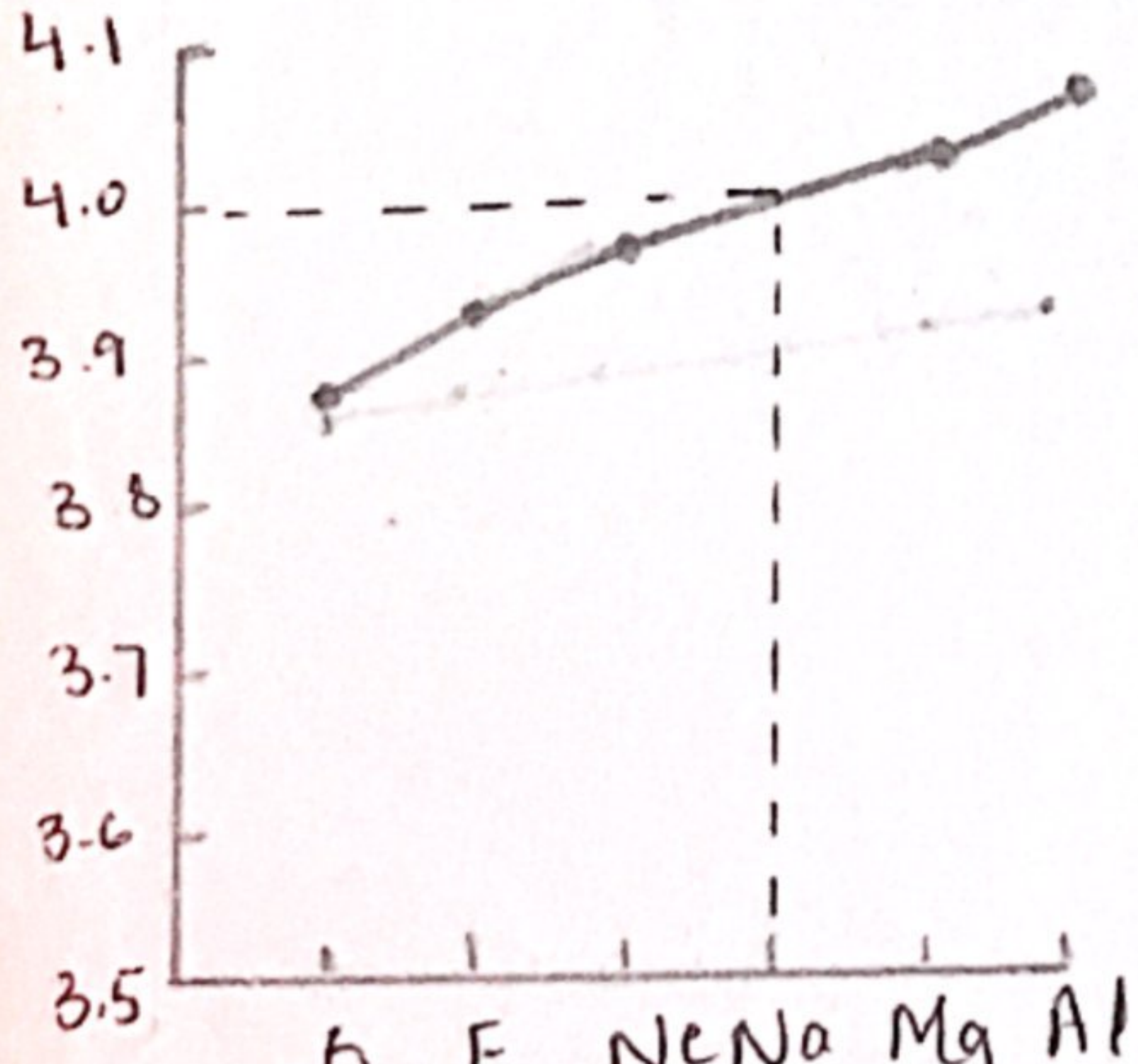
ii Across the period, atomic number increases, and there are more protons in the nucleus. This increases the attraction between ~~protons~~ nucleus and electrons. So more energy is required to overcome the higher force of attraction b The first 3 electrons have a steady increase in ionisation energies, as they are in the same shell and orbital. As an electron is removed, the shielding effect decreases, so ionisation energy increases. After that there is a small jump, as the 4th and 5th electrons are in a different subshell. Then there is a big jump since the 6th and 7th electrons are in a different shell.



4 a The region within an atom that can hold up to two electrons with opposite spins.

b s - spherical p- dumbbell

di



ii 4.0