Atomic Structure

Atoms

Repres-entation	Proton number: no of proton	Nucleon number: no of proton and neutron
Isotopes	atoms of same element with different no of neutron	i.e. same no of proton, diff no of neutrons
	same no of e^- = same chemical properties	diff no of neutron = diff mass = diff physical properties

Electronic structure of atom

3 levels

Principle quantum shell	Energy band of shells separated by large energy gap	Numbered (1,2,3)	specifies energy of e^-, size of orbital, avg distance from nucleus
	Higher no =	further from nucleus = less strongly attracted	higher energy level of e^-
Subshell	group of orbitals which share same shape and properties	4 types: s, p, d, f	Energy: s<p<d<f
Orbitals	region of space with high possib-ility (>95%) of finding e^-	each orbital can hold max 2 e^-, and must be of opp spin	
	s orbital	spherical	
	p orbital	dumbbell along axis	px, py, pz
	d orbital	2 dumbbells on plain	d(xy), d(yz), d(xz)
		2 dumbbells cutting axis	$d(x^2-y^2)$
		dumbell cutting z-axis, donut at the centre	$d(z^2)$
	f orbital	*NOT IN SYLLABUS*	

Effective nuclear charge

Strength of electrostatic forces of attraction felt by valence e^- after accounting for shielding effect of inner electrons

Z(eff) = Z - S

Z: nuclear charge	size of positive charge (no of protons)	larger = stronger EFoA
S: shielding effect	decrease in EFoA btwn nucleus and e^- due to repelling effect of inner e^-	
	no of inner e^- (no of inner PQN/ subshell)	more = weaker EFoA btwn nucleus and e^-

Ionisation energy

energy required to remove 1mol of e^- from 1mol of gaseous atoms to form 1mol of singly charged gaseous cations (1st IE)

Breaking EFoA = endothermic = always +ve

Subsequent IE always greater than previous	stronger EFoA between more +vely charged nucleus and e	Z incr -> Z(eff) incr -> more E to overcome	
Trend			
Down group	Z incr, but S incr more significantly => Z(eff) decr	valence e^- to be removed are further from nucleus	
	= EFoA decr	= less E req. to remove e^-	
	= decr in IE		
Across period	S almost same as same PQN	Z incr as proton no incr	= Z(eff) incr
	= incr EFoA	= more E req. to remove e^-	
	= incr in IE		
Anomaly: within period	G2 > G13	p-orbital e^- at higher E than s-orbital e–	
		= less E req to be ionised	

Ionisation energy (cont)

	G15>G16	e⁻ from G16 is paired	= inter-e⁻ repulsion in same orbital
		= less E req to ionise completely	
When answering	1. write both electronic config		
	2. change in Z, S, PQN, Z(eff)		
	3. change in EFoA and E req.		
	4. Effect on IE		
Successive IE of an element	singly -> doubly charged	doubly -> triply charged	
	Z remains same (for same element), S decr => Z(eff) incr		
	= more E req to overcome		
		Large incr in IE => change in PQN	

Structure of atoms

Subatomic particles	Symbol	relative mass	relative charge	position in atom	actual mass	mvmt in E-field
Proton	p	1	+1	nucleus	1.67E-27	deflect towards -ve plate
Neutron	n	1	0	nucleus	1.67E-27	no deflection
Electron	e	1/1840	-1	orbitals	9.11E-31	deflect to +ve plate

Electronic configuration

Arrangement of e⁻ in their principal quantum shells, subshells and orbitals

Rules for arrang-ement	Pauli's exclusion principle	each orbital holds max 2 e⁻, in opp spin	
		each e⁻ is a half arrow	opp spin = 1 point up, other point down
	Hund's rule	orbitals must be singly occupied first w/ parallel spin before pairing	to minimise inter-e⁻ repulsion
	Aufbau principle	e⁻ in ground state goes into empty orbital w/ lowest energy, before filling up next orbital of lowest energy	
		as PQN incr, energy ga between sucessive shell decrease	eventually overlaps/con-verges
		3d vs 4s: fill and remove from 4s first	4s lower E when empty, higher E when filled
3 representation			
Written	1s2 2s2 2p6 3s2 3p6 4s2 3d7		
	write 3d before 4s as 4s is higher energy		
	Anomaly for Cr and Cu	Expected: [Ar] 4s2 3d4 *or* 3d9	Actual: Expected: [Ar] 4s1 3d5 *or* 3d10
		symmetrical 3d cloud more energetically favourable	close E levels allow for rearra-ngement

Electronic configuration (cont)		
Drawn config	Draw lines representing orbitals	fill up with e^- accordingly
Energy level diagram	y axis: E level	.
	each subshell occupies the same E level	.
	spaces btwn subshell decrease as E incr	.

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