CHEM 120 · Test 2 — Last Look

Modules 2–4 · formulas only

17 Q · 45 min · bubble sheet (fill version #) · assigned seat. Module 2 → 6 Q (§2.4 Bohr→end) · Module 3 → 6 Q (all) · Module 4 → 5 Q (p1–14: Lewis + resonance only). **NOT tested:** Mod 1 stoich · Mod 4 VSEPR/polarity/lattice · all Mod 5.

GIVEN on data sheet

Periodic table (molar masses + Z)

$R_H = 2.179\times10^{-18}$ · $h = 6.626\times10^{-34}$ · $c = 2.998\times10^{8}$

N_A · m_e · e · π

$c=\lambda\nu$ · $E=h\nu$ · $\lambda=h/p$ · $p=mv$ · $KE=\frac{1}{2}mv^2$

$E_n=-R_H/n^2$ · $\Delta E=-R_H(1/n_f^2-1/n_i^2)$

MEMORIZE (not given)

$a_0 = 52.9$ pm (1s r_mp)

Heisenberg: $\Delta x\cdot\Delta p \geq h/4\pi$

node rules · RDF=$4\pi r^2R^2$ · Aufbau order · trends · octet/FC/resonance rules

QUANTUM — M2 · 6 Q

$\lambda = hc/|\Delta E|$ $\lambda_{dB} = h/(mv)$

Bohr: n=1 ground; E<0; levels converge as n↑. drop=emit(ΔE<0), jump=absorb. QN: n size · ℓ shape(0s1p2d3f) · m_l(−ℓ..+ℓ) · m_s ±½. ℓ≤n−1, $|m_l|\leq\ell$. For H, energy on n only (3s=3p=3d).

NODES / ORBITALS — M2

# orb level n	**n^2**
angular nodes	**ℓ**
radial nodes	**n−ℓ−1**
total nodes	**n−1**
maxima R^2/RDF	**n−ℓ**

R-vs-r: max@0 → s; 0@0 → p/d/f. crossings = radial nodes. +/− = phase (not charge).

CONFIGS / TRENDS — M3 · 6 Q

Fill (n+ℓ):

1s 2s 2p 3s 3p 4s 3d 4p 5s 4d 5p 6s…

Cr=[Ar]$4s^1 3d^5$ Cu=[Ar]$4s^1 3d^{10}$

Cations: strip highest-n first (ns before d) → Mn^{2+}=[Ar]$3d^5$

Pauli · Aufbau · Hund · shell max=$2n^2$ · s<p<d<f

	→period	↓group
radius	↓	↑
IE / EA / EN	↑	↓

IE dips: Be→B, N→O · F EN=4.0 · diamag=all paired

LEWIS + RESONANCE — M4 · 5 Q

valence e^- = Σval − charge (add for anion)

FC = val − (lp + ½bond)

ΣFC = charge · −FC on more-EN atom · smallest FC wins H terminal · C/N/O/F ≤ octet · period 3+ expand (S,P,Cl,Br,I,Xe) · central = least-EN Resonance: move π & lone pairs only (never σ); needs ≥1 double/triple bond; real = hybrid avg Nitrate N FC=+1 · term. −O FC=−1

FOUNDATION (assumed)

Light: c=λν, E=hν=hc/λ. EM: radio→micro→IR→vis 400–750nm→UV→X→γ (λ↓,E↑). 3 experiments: Blackbody (E=n·hν) · Photoelectric (photons, threshold ν; hν=w+½mv²) · Line spectra (quantized). Valence e^- = group# (1–2) or group#−10 (13–18). Lewis symbol = dots. EN rises top-right: F>O>N≈Cl. Ionic = metal+nonmetal · molecular = 2 nonmetals. Know polyatomic ions (NO_3^-,SO_4^{2-},CO_3^{2-},NH_4^+,OH^-,PO_4^{3-}…).

DON'T-FORGET TRAPS

• angular=ℓ, radial=n−ℓ−1 (not swapped) • a_0 & Heisenberg NOT on data sheet — memorize • cations: 4s off before 3d (Mn^{2+}=[Ar]$3d^5$) • IE dips Be→B & N→O (explain by config) • resonance major: more-EN atom holds −charge (not "smaller FC") • ℓ ≤ n−1 for a valid quantum-number set