INERT GAS CONFIGURATIONS

What are inert Gases again??

NOBLE GASES!!

MAYBE NOT SO NOBLE??

We are most interested in the outermost(valence) electrons.

We can divide all the electrons in an electron configuration into 2 groups:

CORE and OUTER electrons.

The **CORE** of an atom is the set of electrons with the nearest **Noble Gas** configuration before the element.
The **OUTER** electrons are outside the core.

Eg. Aluminum = **$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$**

Core/Inert Gas Notation: [Ne] **$3s^2\ 3p^1$**

E.g. Sodium = **$1s^2\ 2s^2\ 2p^6\ 3s^1$**

Core/Inert Gas Notation: [Ne] **$3s^1$**

PRACTISE TIME: USING CORE NOTATION…

- Hebden Pg 156 #27 (odds only)

ISOELECTRONIC CONFIGURATIONS

1. **This means "having the same number of electrons / the same electron configuration as a noble gas" but not the same number of protons or the same properties.**
2. Recall …Mg vs. Mg^{2+}

Mg→ $1s^2\ 2s^2\ 2p^6\ 3s^2$

Mg^{2+} → $1s^2\ 2s^2\ 2p^6$ *loses two electrons to be isoelectronic with Neon (Ne)   **Ne→ $1s^2\ 2s^2\ 2p^6$**

The e- in Mg^{2+} are the same as Neon, and the configuration is the same, but they are still different elements – most elements want to do this - be Isoelectronic (look-alikes) with Noble gases.

WHEN WRITING ISOELECTRONIC CONFIGURATIONS…

1) When removing electrons – remove the outermost ones first (so p before s before d)

2) When adding electrons – add to the last unfilled shell (starting where the neutral atom left off)

Question: Which noble gas is S^{2-} isoelectronic to??

Answer: Ar!! $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

TRY ONE...

- Titanium Ion...Ti^{4+}

Ti^{4+} → [Ne] $3s^2 3p^6$

You can't just write [Ar]!!

PRACTICE TIME: USING CORE NOTATION

1) **Br^{1-}** — Br^{1-} :[Ar]$3d^{10}4s^{2}4p^{6}$
2) **Sc^{3+}** — Mn^{2+} : [Ne] $3s^{2}3p^{6}$
3) **N^{3-}** — N^{3-} : [He]$2s^{2}2p^{6}$
4) **Sb^{3+}** — Sb^{3+} : [Kr]$4d^{10}5s^{2}$

GROUND STATE VS. EXCITED STATE

(PP. 152-153)

Eg. Na→ $1s^2\ 2s^2\ 2p^6\ 3s^1$

$1s^2\ 2s^2\ 2p^6\ 5s^1$ ES!!!

Which represents the Ground State, and which is the Excited State??

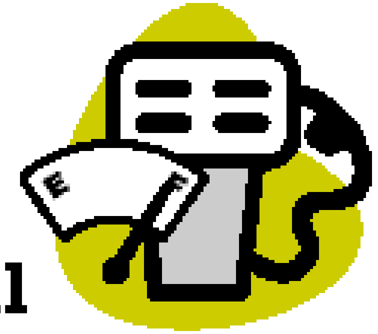
Pretty easy to see that the excited state is any configuration where the electron has an electron that has jumped into a higher orbit than it should have next!!

WHAT ARE EACH OF THESE ELEMENTS… AND WHICH ARE IN AN EXCITED STATE??

1) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$
2) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^1$
3) $1s^2\ 2s^2 2p^4\ 3s^1$
4) $1s^2\ 2s^2\ 2p^6\ 3s^1$

1) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$ (20 e-) = Calcium GS
2) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^1$ (20e-) = Calcium ES!!!
3) $1s^2\ 2s^2 2p^4\ 3s^1$ (9 e-) = Fluorine ES!!!
4) $1s^2\ 2s^2\ 2p^6\ 3s^1$ (11e-) = Sodium GS

ORBITAL STABILITY



1. The most stable orbitals are completely full (all paired electrons) or half full (no paired electrons).
   a. These types of orbitals are lower in energy (more stable) than those which are partially filled.
   b. This is especially important for p, d, and f orbitals
2. Atoms will sometimes rearrange their electrons between orbitals close in energy in order to obtain one of these above conditions.

Predict what the most stable electron configuration will be!

Cr= $[Ar]^{18}\ 3d^4\ 4s^2$ →

$[Ar]^{18}\ 3d^5\ 4s^1$ = both orbitals half full now!
… most stable!

Cu= $[Ar]^{18}\ 3d^9\ 4s^2$ →

$[Ar]^{18}\ 3d^{10}\ 4s^1$ = 1 full and other half full now!
… most stable!

3. **The transition metals (d-orbitals) will lose electrons from their outer orbitals (highest n value) first, and then the d-orbitals to form stable ions.** ***(p before s before d)***

e.g. Sn

$[Kr]^{36}\ 4d^{10}\ 5s^{2}5p^{2}$

Sn^{2+}

$[Kr]^{36}\ 4d^{10}\ 5s^{2}5p^{0}$

Sn^{4+}

$[Kr]^{36}\ 4d^{10}\ 5s^{0}5p^{0}$

VALENCE ELECTRONS…

"Those electrons in an atom, that are not in an inert Gas formation core, or are not in a full d or f subshell" ….

Al → [Ne] $3s^2\ 3p^1$ = 3 valence e-

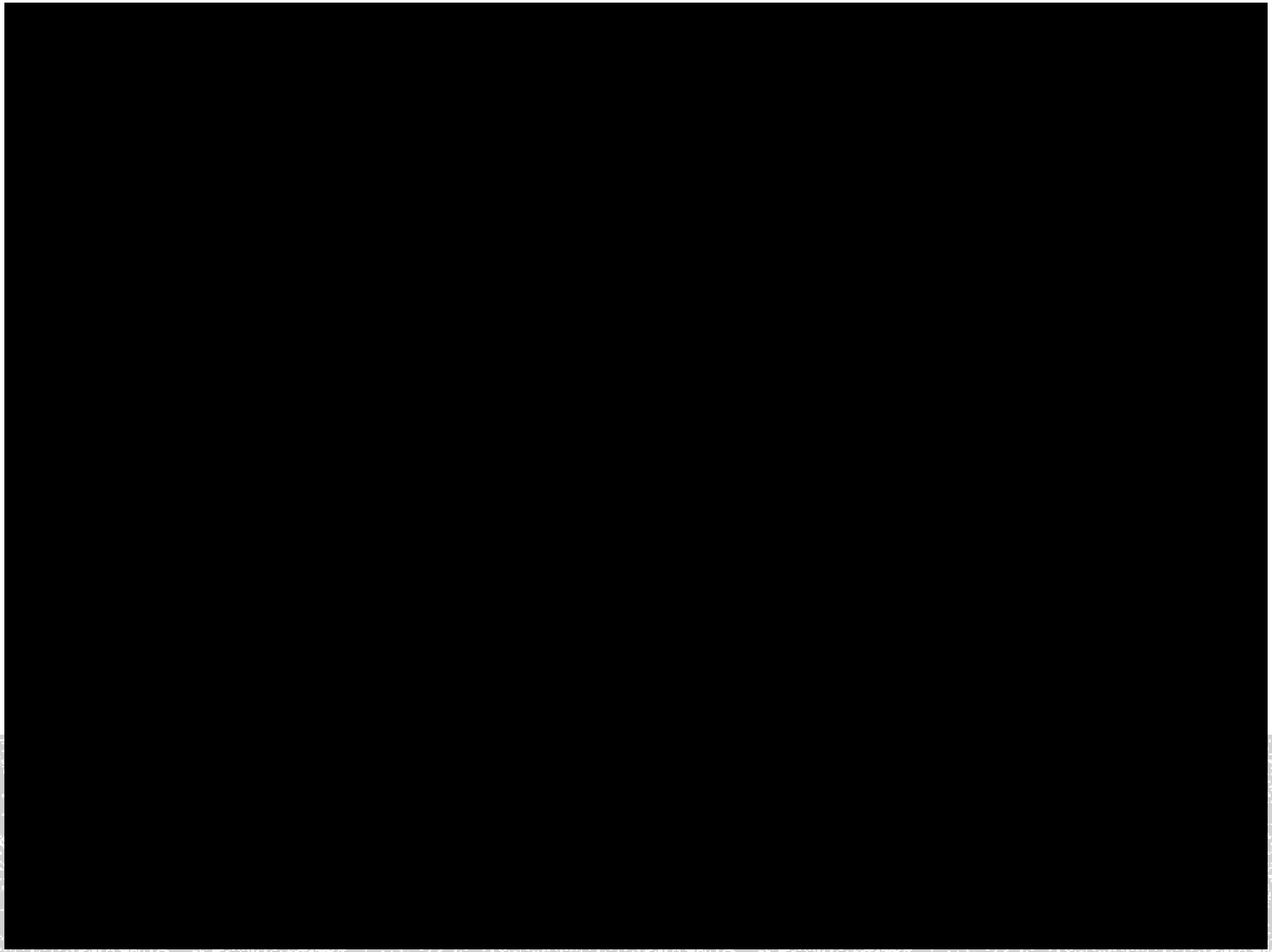
Ga → [Ar] $3d^{10}4s^2\ 4p^1$ = 3 valence e-

Pb → [Xe] $4f^{14}5d^{10}6s^2\ 6p^2$ = 4 valence e-

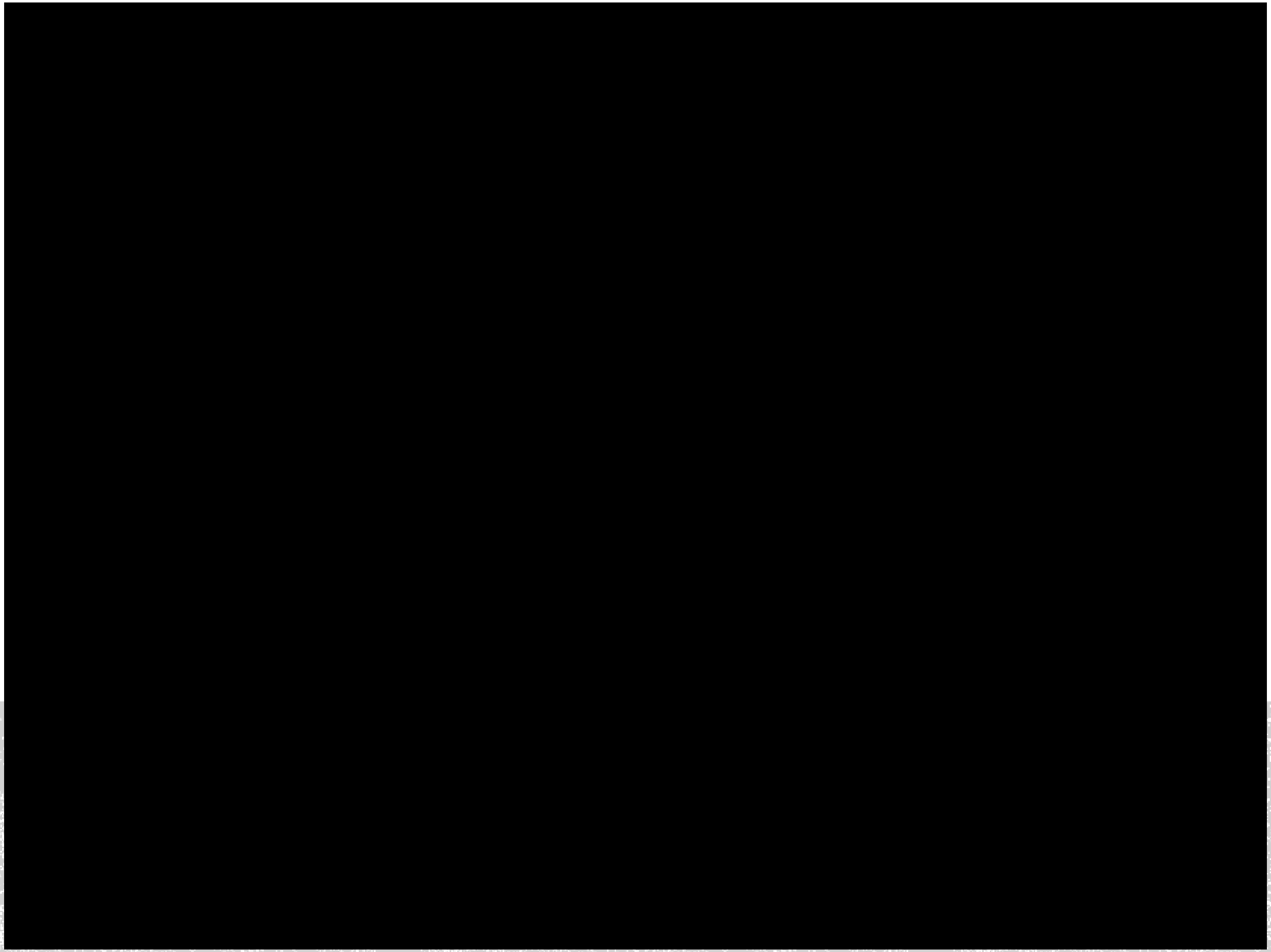
Xe → [Kr] $4d^{10}5s^2\ 5p^6$ = 0 valence e-

(noble gas)

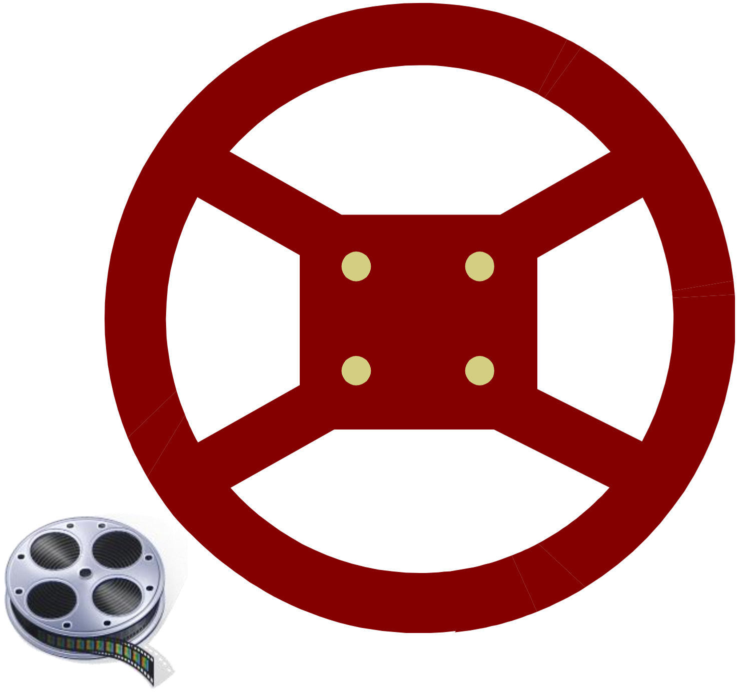
ANOTHER LOOK AT BEING NOBLE??



ONE MORE BILL DANCE!!



MY FAVORITE CLIP...



PRACTISE TIME!!!

Hebden: Pg 157 #28 b,d,f,h,j

Pg 158 #29 odds

Then start the Ch.4 Review!!