35 poss in 2011

Name key

Period _____

EGG CARTON ACTIVITY: *Electron Configurations & Orbital Diagrams*

Materials: egg cartons, beans, periodic table

Procedure:

1. Obtain two egg cartons and bag of beans.

2. Label each trough with the appropriate energy sublevel. Create a chart (with arrows) to help you determine the correct order of the energy sublevels. *Check your order w/ teacher before marking in the egg cartons.*

+½ 1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p, 5s, 4d, 5p, 6s, 4f, 5d, 6p, 7s, 5f, 6d, 7p, 6f, 7d, 7f

1s
2s 2p
3s 3p 3d
4s 4p 4d 4f
5s 5p 5d 5f
6s 6p 6d 6f
7s 7p 7d 7f

No elements fill these orbitals

3. Fill each sublevel according to the three rules for determining electron configurations. (*Let white beans = cc spin and brown = c spin.*) These rules are:

+1½ ***Rule 1:*** Pauli Exclusion: Each orbital can have a max of 2 e⁻ & must be opposite spin.

From wieder aufbauen = rebuilding ***Rule 2:*** Aufbau Principle: lowest energy sublevels filled first

Rule 3: Hund's Rule: e⁻ fill up equal energy orbitals first so max # of unpaired e⁻ results.

4. Indicate the orbital diagrams and electron configurations for the following elements: * Also indicate the abbreviated configuration (where appropriate).

+2½ a. Helium: $1s^2$

He 2

orbital diagram 1↓ (1s) ____ ____ ____ ____ ____ ____ ____ ____

+3 b. Neon: $1s^2\ 2s^2\ 2p^{6\to10}$ → abbrev. $[He]^2 2s^2 2p^{6\to10}$

Ne 10

orbital diagram 1↓ (1s) 1↓ (2s) 1↓ (2p) 1↓ (2p) 1↓ (2p) ____ (3s) ____ (3p) ____ (3p) ____ (3p)

8

c. **Argon:** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ Abbrev: $[Ne]^{10}\ 3s^2 3p^6$

Ar 18

orbital diagram 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿

1s 2s 2p 2p 2p 3s 3p 3p 3p

Ar

d. **Krypton:** $1s^2\ 2s^2 2p^6 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6$ Abbrev: $[Ar]^{18} 4s^2\ 3d^{10} 4p^6$

Kr 36

orbital diagram 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿

1s 2s 2p 2p 2p 3s 3p 3p 3p

1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿

4s 3d 3d 3d 3d 3d 4p 4p 4p

e. **Boron:** $1s^2\ 2s^2\ 2p^{1 \to 5}$ Abbrev: $[He]^2 2s^2\ 2p^1$

B 5

orbital diagram 1↿ 1↿ 1 ___ ___ ___ ___ ___ ___

1s 2s 2p 2p 2p 3s 3p 3p 3p

✗ f. **Sulfur:** $1s^2 2s^2\ 2p^6\ 3s^2\ 3p^{4 \to 16}$ Abbrev: $[Ne]^{10} 3s^2\ 3p^4$

S 16

orbital diagram 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1 1

1s 2s 2p 2p 2p 3s 3p 3p 3p

g. **Scandium:** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{1 \to 21}$ Abbrev: $[Ar]^{18} 4s^2\ 3d^1$

Sc 21

orbital diagram 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿ 1↿

1s 2s 2p 2p 2p 3s 3p 3p 3p

1↿ 1 ___ ___ ___ ___ ___ ___ ___

4s 3d 3d 3d 3d 3d 4p 4p 4p

h. Aluminum: $1s^2 2s^2 2p^6 3s^2 3p^1 \rightarrow 13$ Abbrev: $[Ne]^{10} 3s^2 3p^1$
AL 13

orbital diagram

1s	2s	2p	2p	2p	3s	3p	3p	3p
↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↑		

i. Cadmium: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} \rightarrow 48 \rightarrow [Kr]^{36} 5s^2 4d^{10}$
Cd (48)

orbital diagram

1s	2s	2p	2p	2p	3s	3p	3p	3p
↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂

4s	3d	3d	3d	3d	3d	4p	4p	4p
↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂

5s	4d	4d	4d	4d	4d	5p	5p	5p
↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂			

j. Zirconium: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^2 \rightarrow 40$ Abbrev. $[Kr]^{36} 5s^2 4d^2$
Zr (40)

orbital diagram

1s	2s	2p	2p	2p	3s	3p	3p	3p
↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂

4s	3d	3d	3d	3d	3d	4p	4p	4p
↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂

5s	4d	4d	4d	4d	4d	5p	5p	5p
↿⇂	↑	↑						

k. Germanium: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^2 \rightarrow 32$ Abbrev. $[Ar]^{18} 4s^2 3d^{10} 4p^2$
Ge (32)

orbital diagram

1s	2s	2p	2p	2p	3s	3p	3p	3p
↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂

4s	3d	3d	3d	3d	3d	4p	4p	4p
↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↑	↑	