CST:
Chem: 1b, 1c, 1g, 1j
2e, 2g, 7d
ES: 1a, 1d, 1j, 1k

Shell Game

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Chem Catalyst:

Q: Name @ least 2 similarities & 2 differences.

Notes:

How are e⁻ arranged in the atom?

- e⁻ are arranged into energy levels / shells
  - designated by a # (n = 1, 2, 3, 4, etc...)
- energy levels / shells are further divided into sublevels / subshells
  - designated by a letter = s, p, d, f
  - each has a specific shape
- Sublevels / subshells contain a certain # of orbitals
  - each orbital can hold a max of 2 e⁻
  - s-subshell has 1 orbital (s holds 2 e⁻ max)
  - p-subshell has 3 orbitals (p holds 6 e⁻ max)
  - d-subshell has 5 orbitals (d holds 10 e⁻ max)
  - f-subshell has 7 orbitals (f holds 14 e⁻ max)

* e⁻ in an atom want to be in the lowest energy state possible (ground state) so they fill up the shells from the nucleus outward
  - ↳ Aufbau principle

What are e⁻ configurations?

- Shorthand way of keeping track of e⁻ placement in an atom
  - ex: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
    - Big # = energy level / shell #
    - letter = sublevel / subshell
    - small # = # of e⁻ in the subshell
  - * ending tells the identity of the atom

Student Worksheet

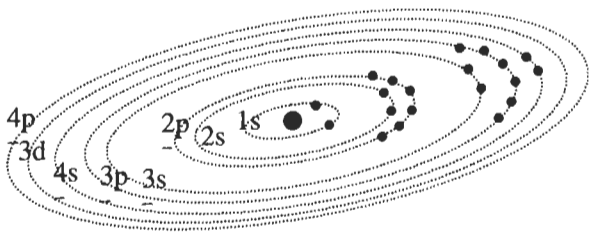
Shell Game

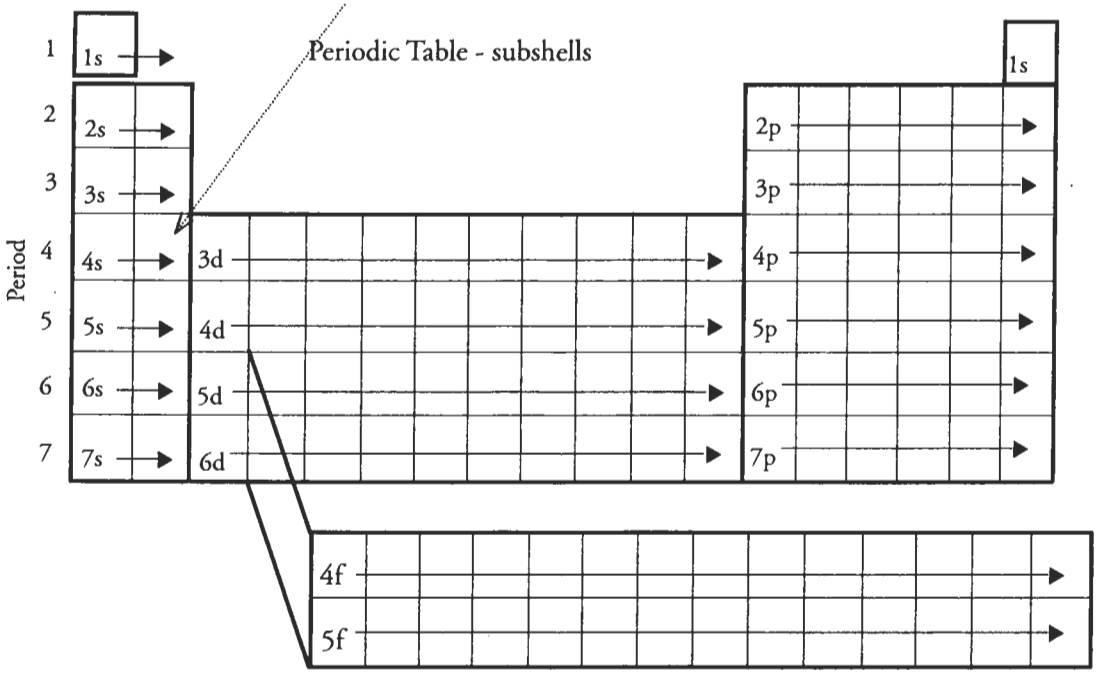
Name: _____

Period:_____ Date:_____

Purpose: This lesson introduces you to electron subshells. You will explore how they are related to the periodic table.

The periodic table shown below indicates the subshell into which the outermost, or last electron(s), are placed for each element. For example, if you relate the drawing of the locations of the electrons for calcium, Ca, with the periodic table, you will find that the last electrons are placed in the 4s subshell.





1. Name two elements in which the last electron(s) to be added are placed into s subshells.

2. How many electrons can be placed into the 2s subshell?

3. Name two elements for which the last electron(s) to be added are placed into p subshells.

4. List the elements with 6 electrons in the outermost p subshell.

5. Name two elements for which the last electron(s) to be added are placed into the 3d subshell.

6. How many electrons can be placed into the 3d subshell?

7. Color the four regions of the periodic table were the last electrons are placed in the s, p, d, and f subshells with different colors.

8. A total of eighteen electrons can be placed in the 3rd shell. Explain why.

9. How many subshells are in the 4th shell?

10. An **electron configuration** is a list of all the subshells that have electrons for a given element. Determine which element is associated with each electron configuration in the following table.

Electron configuration	Element
$1s^2 2s^1$	
$1s^2 2s^2 2p^3$	nitrogen, N
$1s^2 2s^2 2p^6 3s^2 3p^5$	
$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$	
$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^2$	
$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^4$	tellurium,Te

11. Refer to the following electron configuration and answer the questions below:

$$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$$

a) How many total electrons does this element have?

b) What element is this?

c) How many shells are represented?

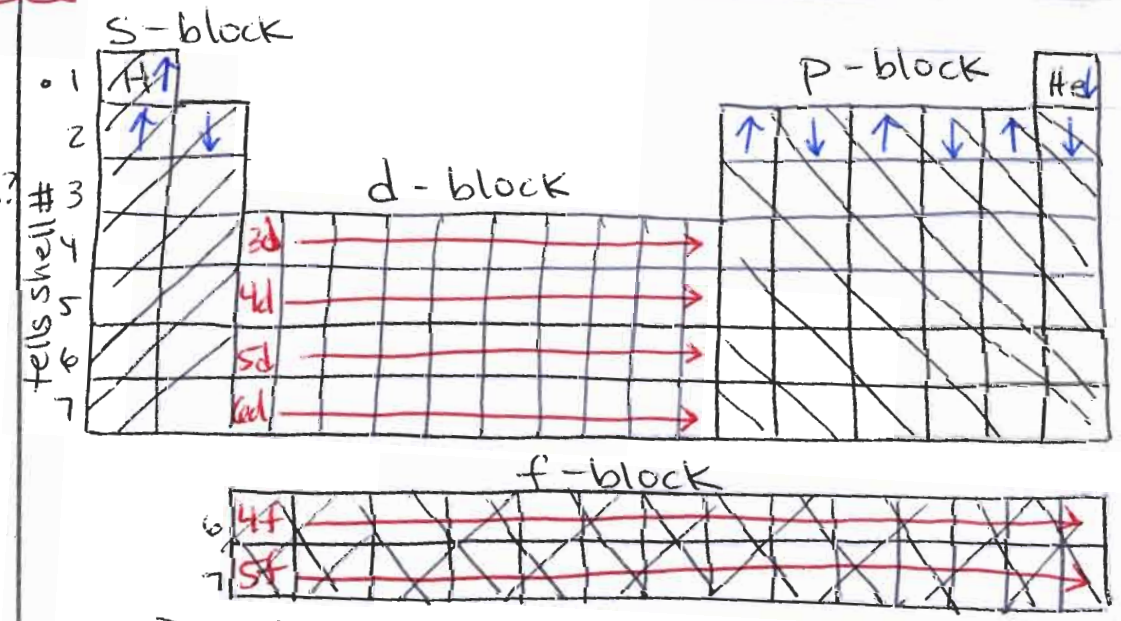
d) How many subshells are represented?

Making Sense:
How is the organization and structure of the periodic table related to electron subshells?

If you finish early….
Predict the electron configuration of cesium, Cs.

Making Sense Notes:

- How can the P.T. help w/ e⁻ configurations?



- P.T. tells us the # of e⁻ in each sublevel:
  - s-block = 2 columns wide = 2 e⁻ max
  - p-block = 6 columns wide = 6 e⁻ max (2 in each of 3 orbitals)
  - d-block = 10 columns wide = 10 e⁻ max (2 in 5 orbitals)
  - f-block = 14 columns wide = 14 e⁻ max (2 in 7 orbitals)

- Atom Analogy
  - "Atom Stadium"
    - "e⁻ fans" sitting around the nucleus "stage"
    - fans are "seated"/organized into:
      - Rows = Energy level / shell
      - Sections = sublevels / subshells
      - Seats

  * Pauli exclusion principle = e⁻ within orbitals of subshells must spin in opposite directions
    - "e⁻ fans" in the stadium "cheer" in opposite directions ↑↓

- How to write e⁻ configurations
  - always start @ the top left hand corner = 1s
  - read shells & subshells from left to right, top to bottom until you get to your element
  - ex: Sr = $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2$

Check-In: Q: Write the config for As

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$