Hog Hilton

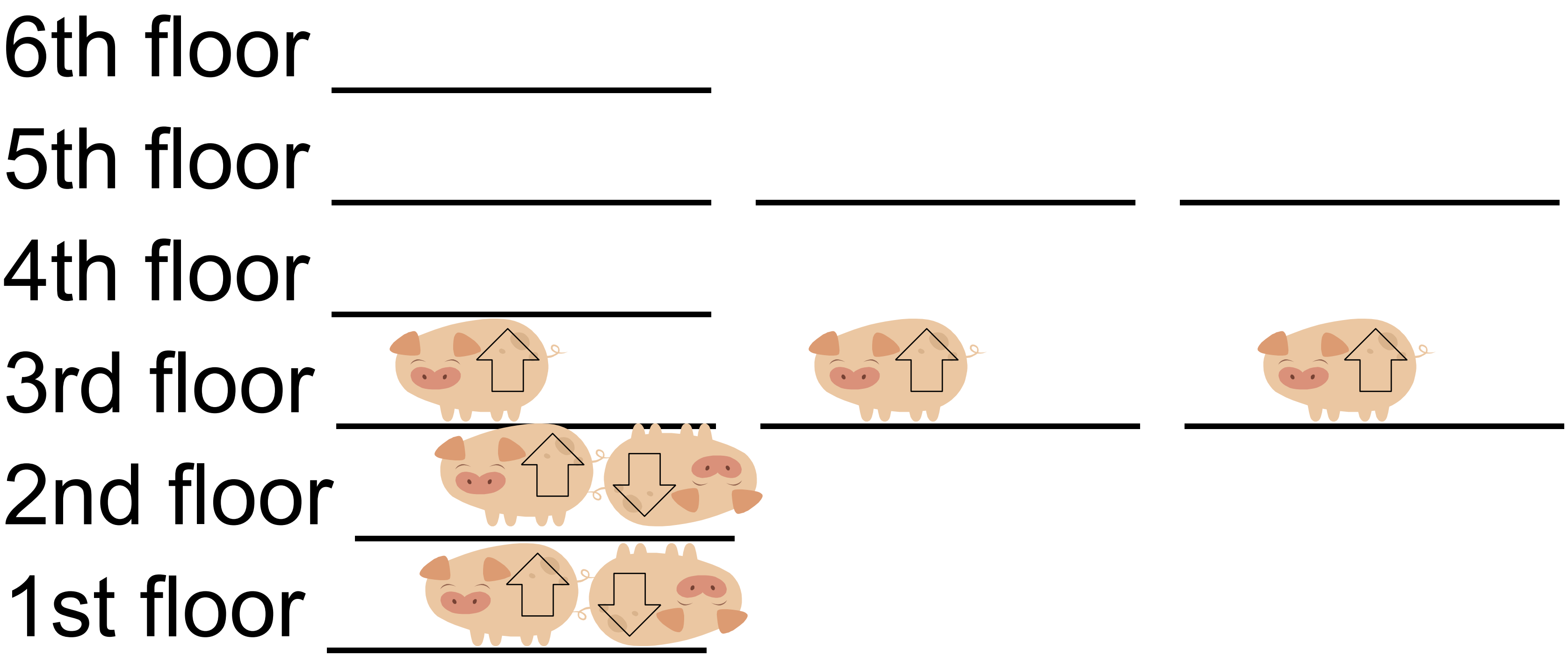
You are the manager of a prestigious new hotel in downtown Midland—the “Hog Hilton”. It’s just the “snort of the town” and you want to keep its reputation a cut above all the other hotels. Your problem is your clientele. They are hogs in the truest sense.

Your major task is to fill rooms in your hotel. The Hog Hilton only has stairs. You must fill up your hotel keeping the following rules in mind:

1) Hogs are lazy, they don’t want to walk up stairs!
2) Hogs want to room by themselves, but they would rather room with another hog than walk up more stairs.
3) If hogs are in the same room they will face in opposite directions.
4) They stink, so you can’t put more than two hogs in each room.

Hog Hilton

- Your hotel looks like the diagram below:



Book 7 hogs into the rooms.

Hog Hilton

Your hotel looks like the diagram below:

6th floor

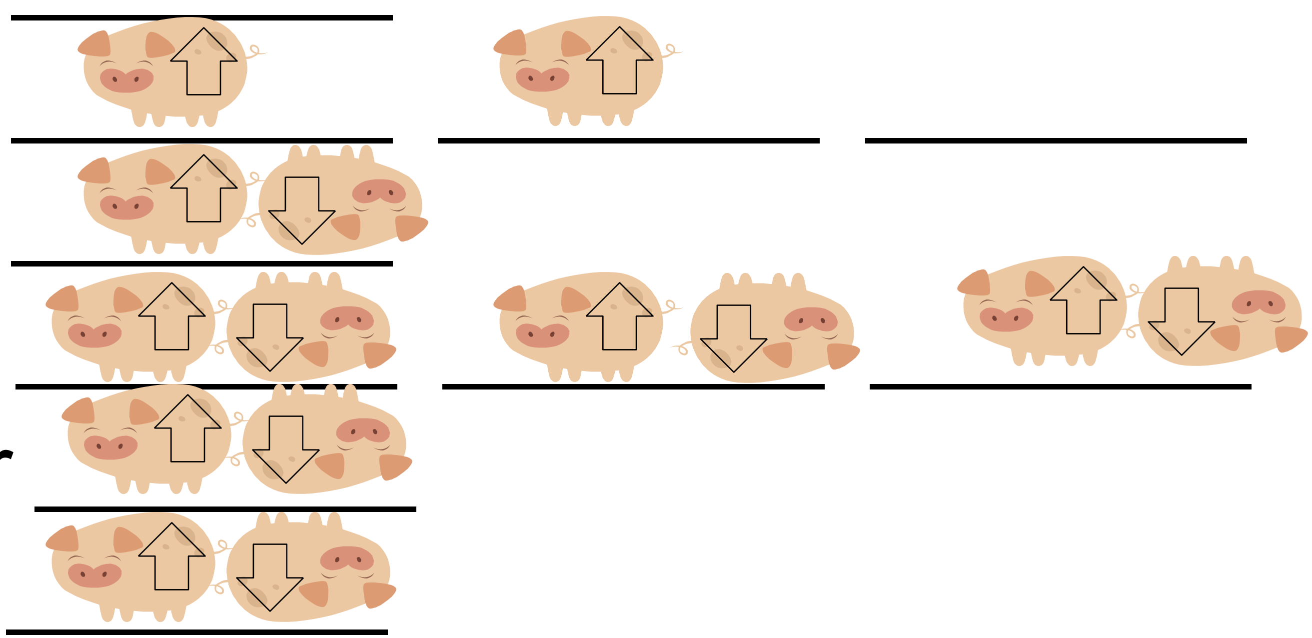
5th floor

4th floor

3rd floor

2nd floor

1st floor



Book 14 hogs into the rooms.

Hog Hilton

Choose 3 **Days** of the week and Draw them in the left side of your spiral.

6th floor ________

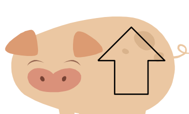
5th floor ________ ________ ________

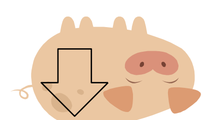
4th floor ________

3rd floor ________ ________ ________

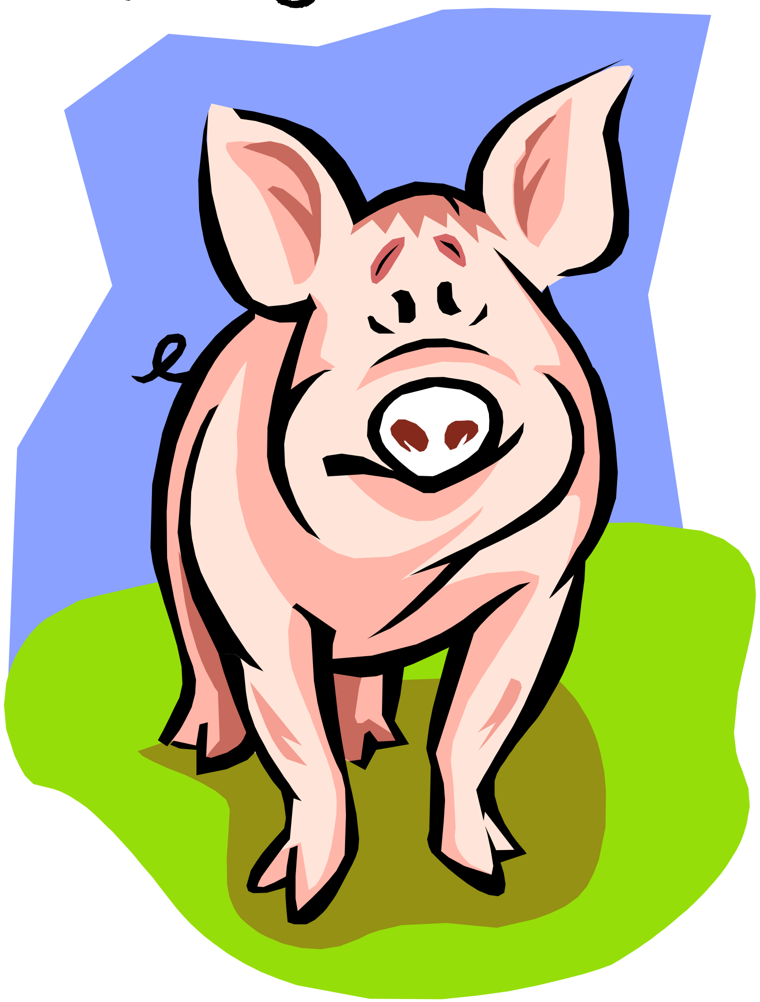
2nd floor ________

1st floor ________

 = ↑

 = ↓

Let's play Hog Hilton!!



Now you will relate the "Hog Hilton" to electron orbitals. Electron orbitals are modeled by the picture on the left and are grouped into principal energy levels.

1. Compare their similarities and differences.
2. To go between floors on the Hog Hilton did the hogs need to use energy? Would electrons need to use the energy to go between orbitals?

3d ___ ___ ___ ___ ___ n=3
(4s ____) n=4
3p ___ ___ ___ n=3
3s ___ n=3
2p ___ ___ ___ n=2
2s ___ n=2
1s ___ n=1

6th floor ____
5th floor ____ ____ ____
4th floor ____
3rd floor ____ ____ ____
2nd floor ____
1st floor ____

A. Rules for e^- configurations

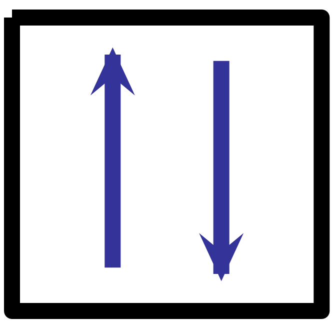
1. Aufbau principle: electrons fill the lowest energy orbitals first.

(Hogs are lazy, they don't want to walk up stairs!)

A. Rules for e^- configurations

2. Pauli Exclusion principle: each orbital can hold **TWO** electrons with opposite spins

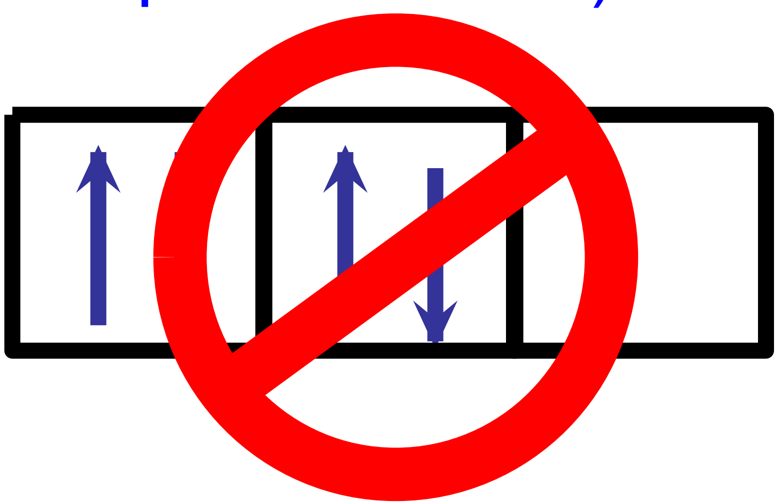
(They stink, so you can't put more than two hogs in each room. & If hogs are in the same room they will face in opposite directions.)



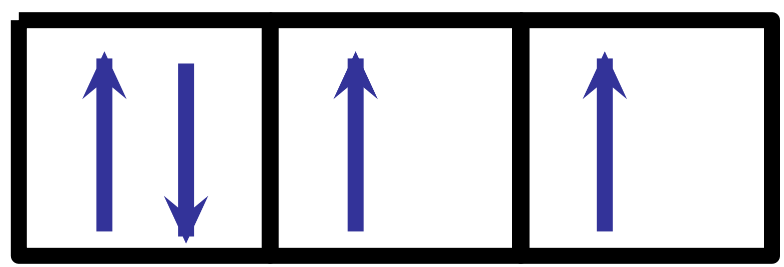
A. Rules for e^- configurations

3. <u>Hund's rule</u>: within a sublevel, place one e^- per orbital before pairing them.

(Hogs want to room by themselves, but they would rather room with another hog than walk up more stairs.)



WRONG



RIGHT

B. Drawing Orbitals

Krypton

4p ↑↓ ↑↓ ↑↓

3d ↑↓ ↑↓ ↑↓ ↑↓ ↑↓

4s ↑↓

3p ↑↓ ↑↓ ↑↓

3s ↑↓

2p ↑↓ ↑↓ ↑↓

2s ↑↓

1s ↑↓

White Board Practice: Drawing Orbitals

Chlorine

4p ___ ___ ___

3d ___ ___ ___ ___ ___

4s ___

3p ↑↓ ↑↓ ↑

3s ↑↓

2p ↑↓ ↑↓ ↑↓

2s ↑↓

1s ↑↓

White Board Practice: Drawing Orbitals

Nickel

4p ____ ____ ____

3d ↑↓ ↑↓ ↑↓ ↑ ↑ ____

4s ↑↓

3p ↑↓ ↑↓ ↑↓

3s ↑↓

2p ↑↓ ↑↓ ↑↓

2s ↑↓

1s ↑↓

C. Writing the Electron Configuration

Krypton: atomic number - 36

4p _ ↑↓ _ _ ↑↓ _ _ ↑↓ _

3d _ ↑↓ _ _ ↑↓ _ _ ↑↓ _ _ ↑↓ _ _ ↑↓ _

4s _ ↑↓ _

3p _ ↑↓ _ _ ↑↓ _ _ ↑↓ _

3s _ ↑↓ _

2p _ ↑↓ _ _ ↑↓ _ _ ↑↓ _

2s _ ↑↓ _

1s _↑↓_

Exponent is number of e-

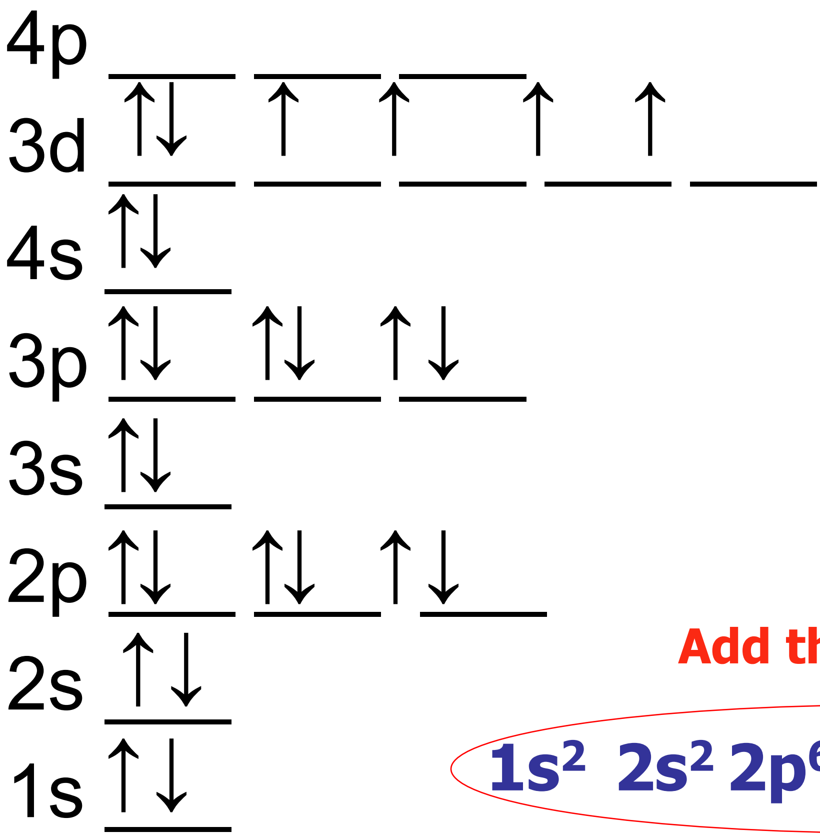
$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6$

Add the exponents to check your answer

White Board Practice: Writing Electron Configurations

Iron

Fe – atomic number 26



Add the exponents to check your answer

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

White Board Practice:
Writing Electron Configurations

Sulfur

S – atomic number- 16

4p ___ ___ ___

3d ___ ___ ___ ___ ___

4s ___

3p ↑↓ ↑ ↑

3s ↑↓

2p ↑↓ ↑↓ ↑↓

2s ↑↓

1s ↑↓

Add the exponents to check your answer

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

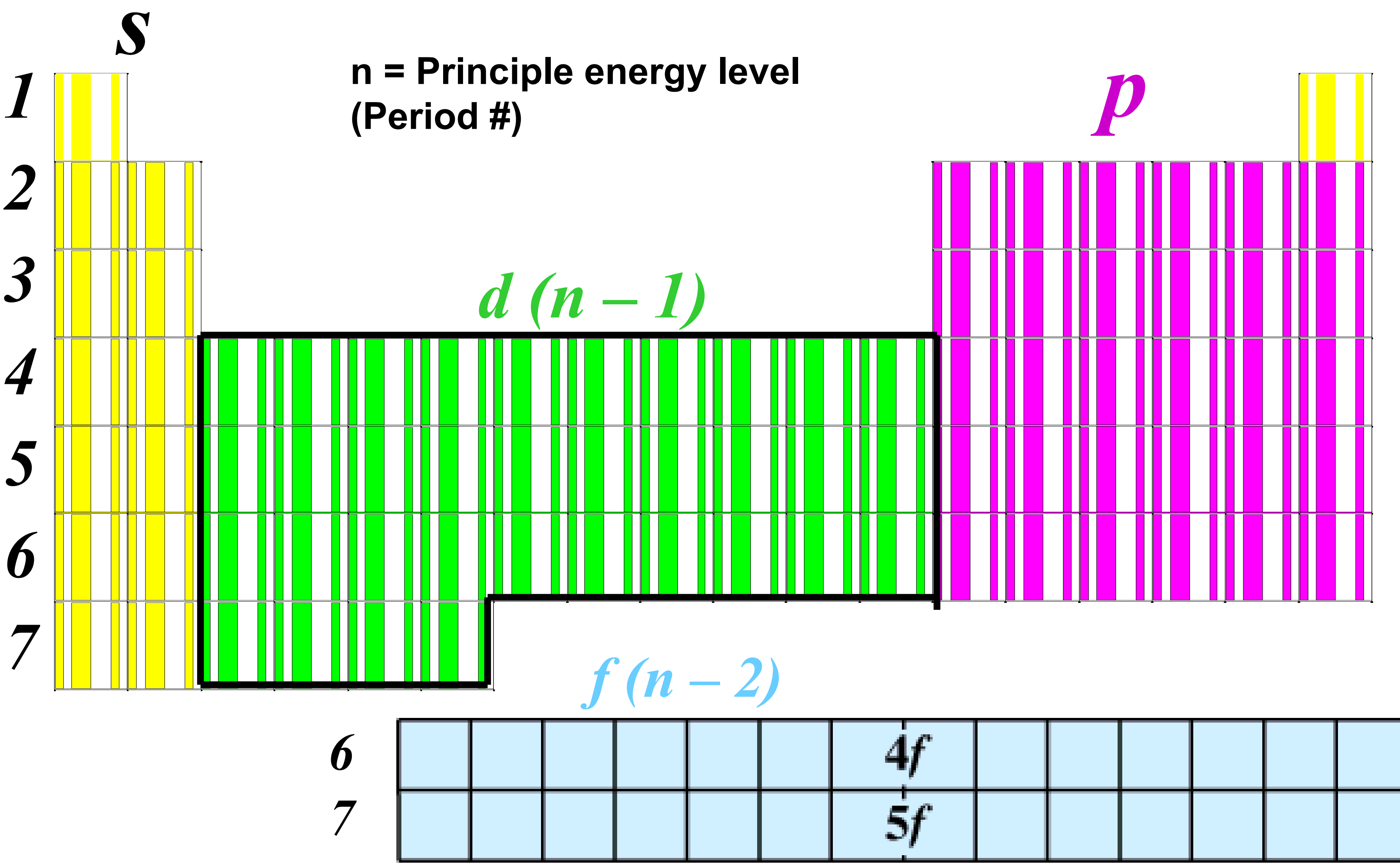
Worksheet: **Electron Configurations**

Aluminum atomic number - 13

Al Electron Configuration: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

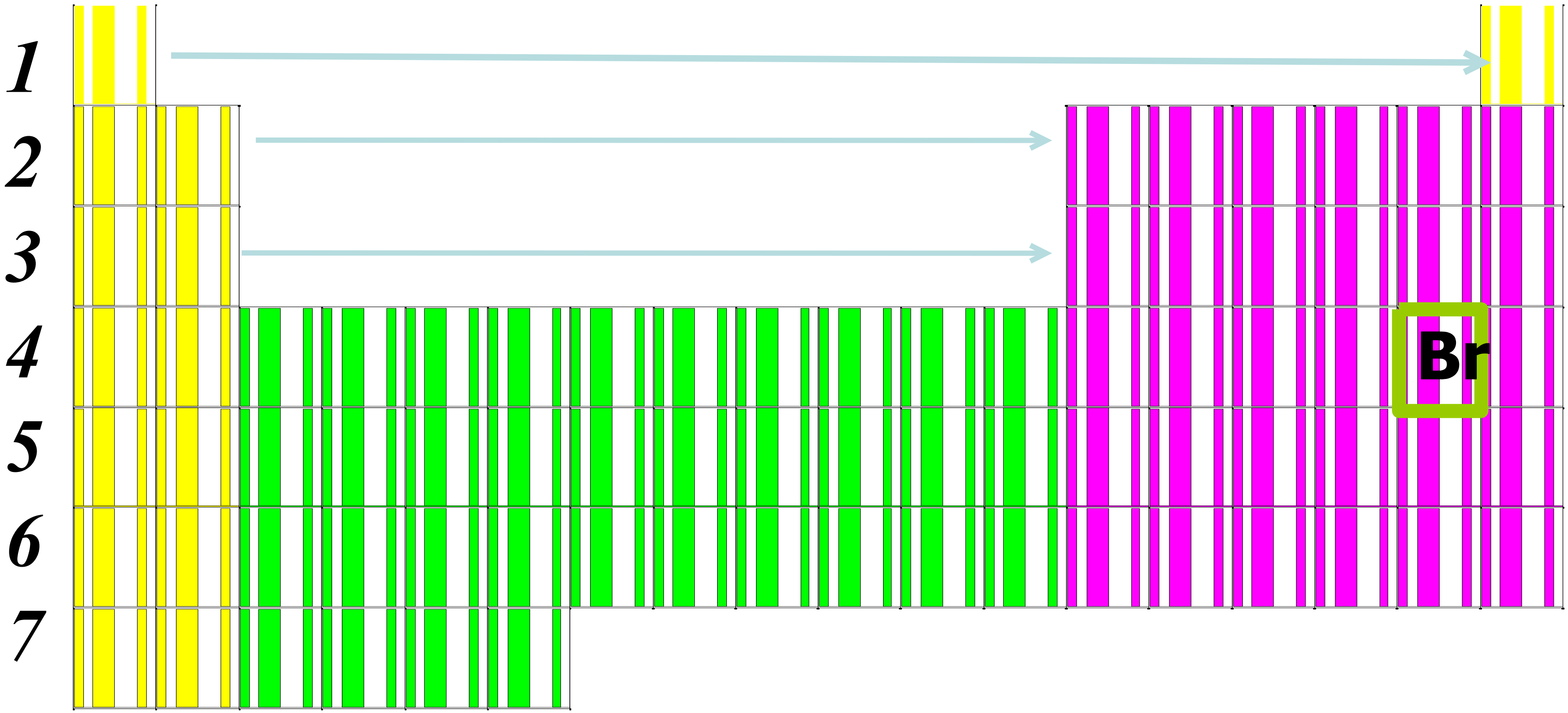
1s	2s	2p			3s	3p		
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓		↑	

e- config. Periodic Patterns



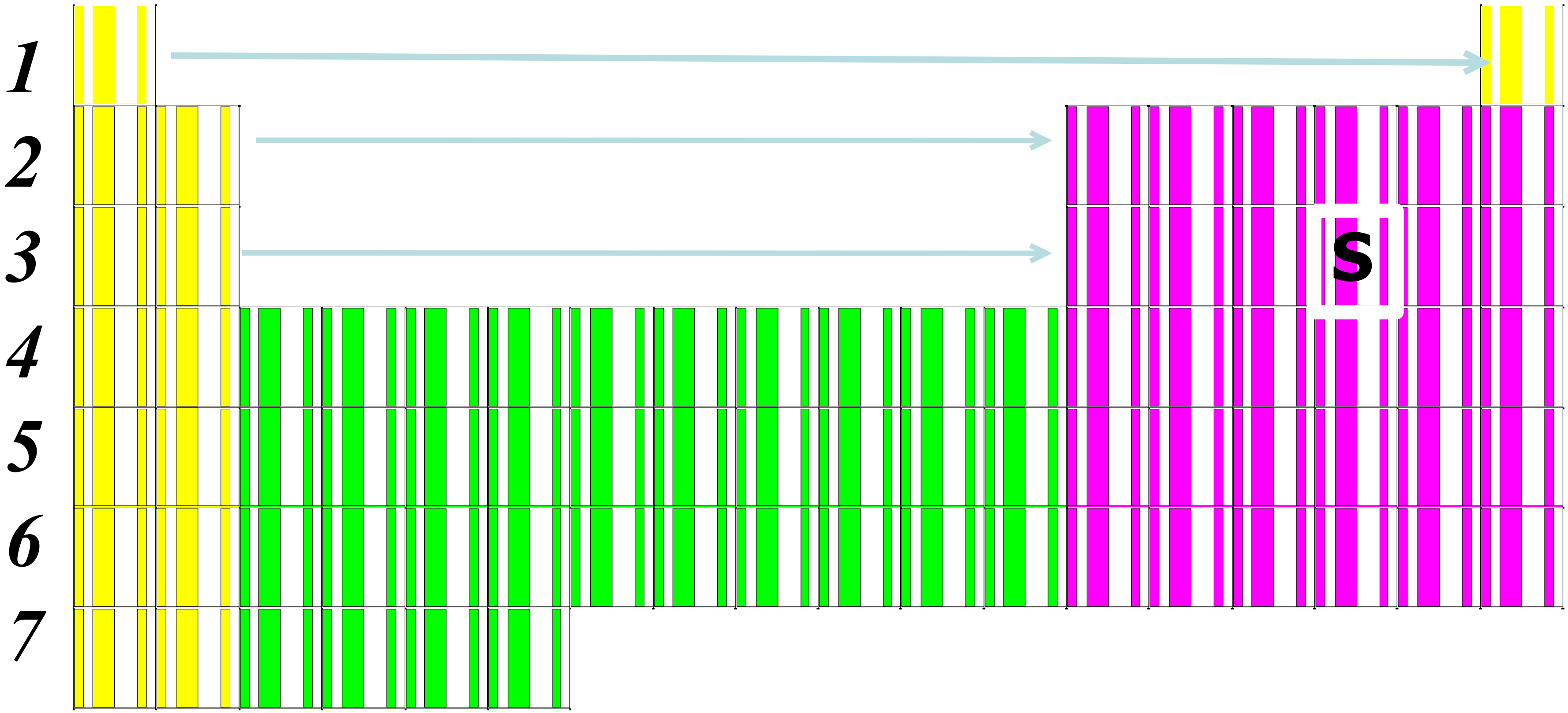
What is the electron configuration for Br?

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^5$



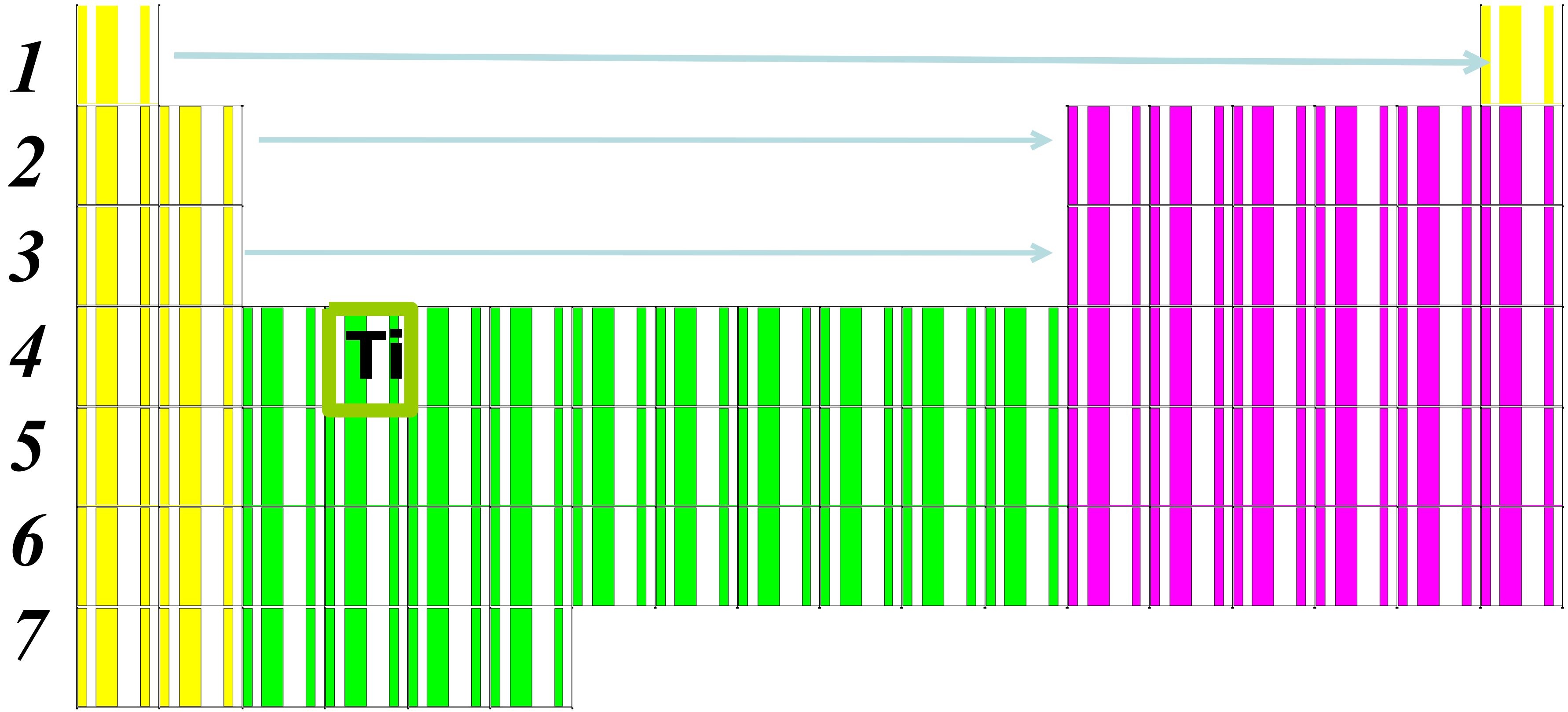
What is the electron configuration for Sulfur?

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

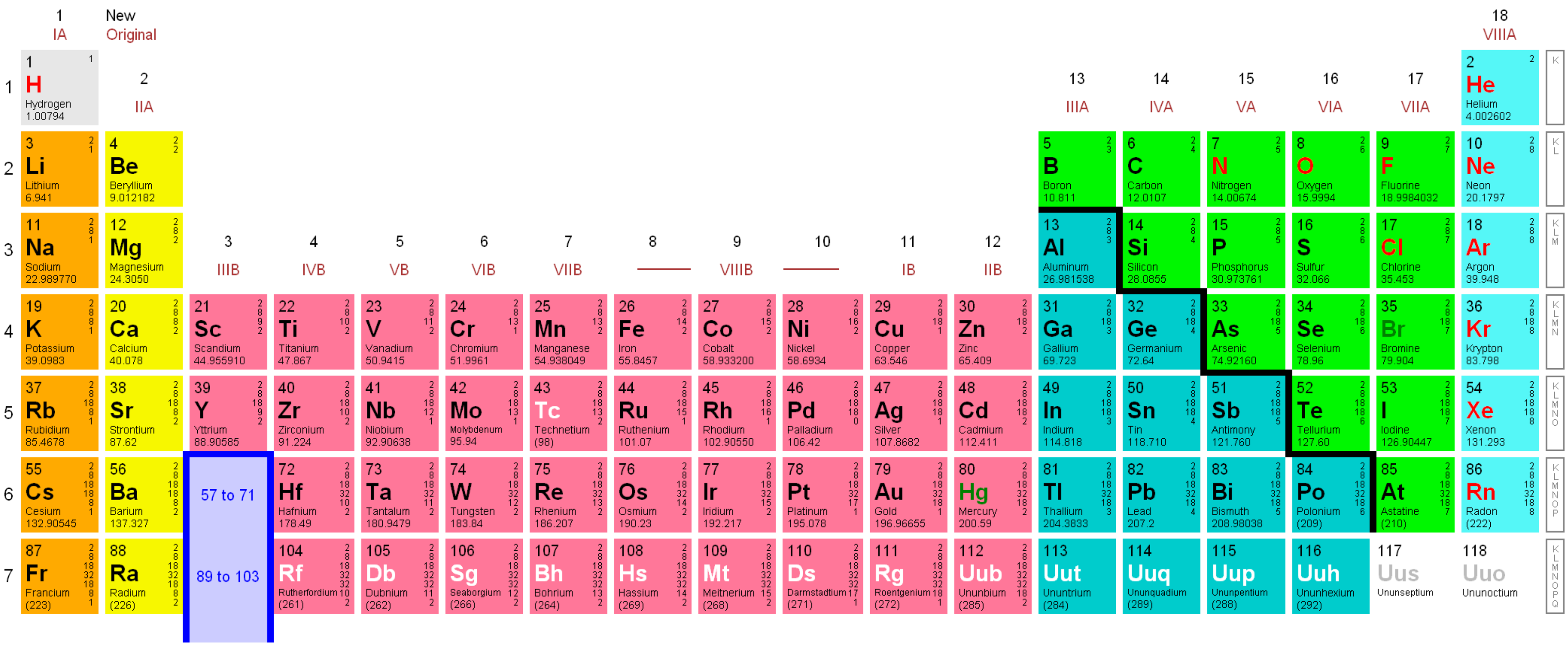


What is the electron configuration for Titanium?

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



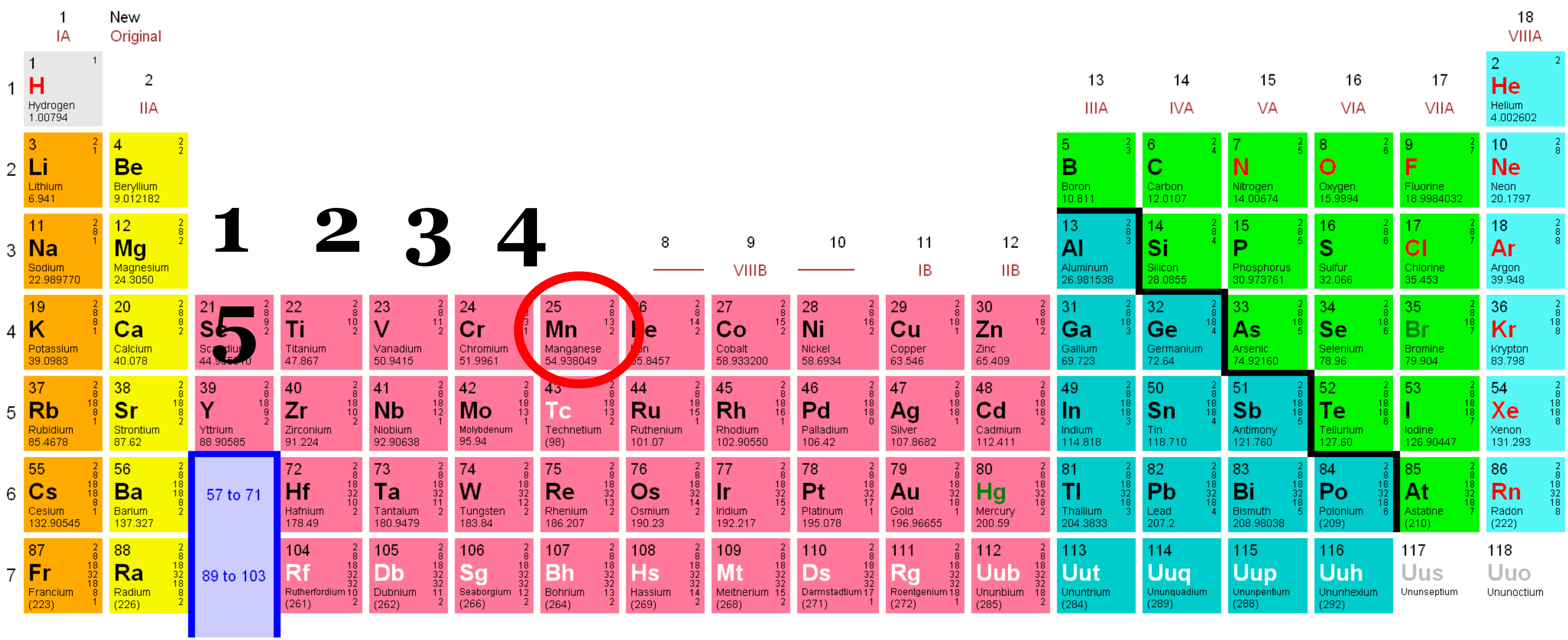
What element has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^4$?



Add together all the exponents, then find that atomic number. = Sulfur 16

Learning Check

How many electrons are present in the d sublevel of a neutral atom of Manganese?



5 electrons

D. Noble Gases Shorthand

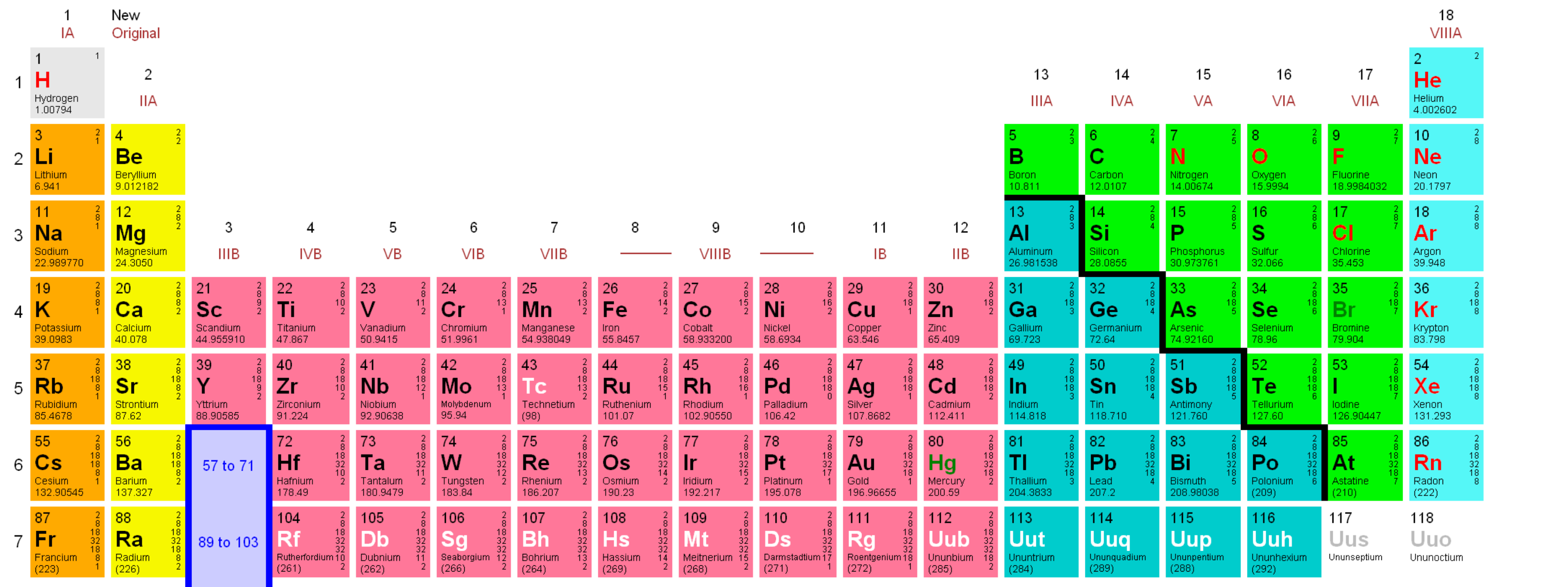
- Use the noble gas in the previous row.
- Write noble gas symbol in brackets then rest of the e-configuration.

- **Longhand Configuration**

S 16e⁻ $1s^2 2s^2 2p^6 3s^2 3p^4$

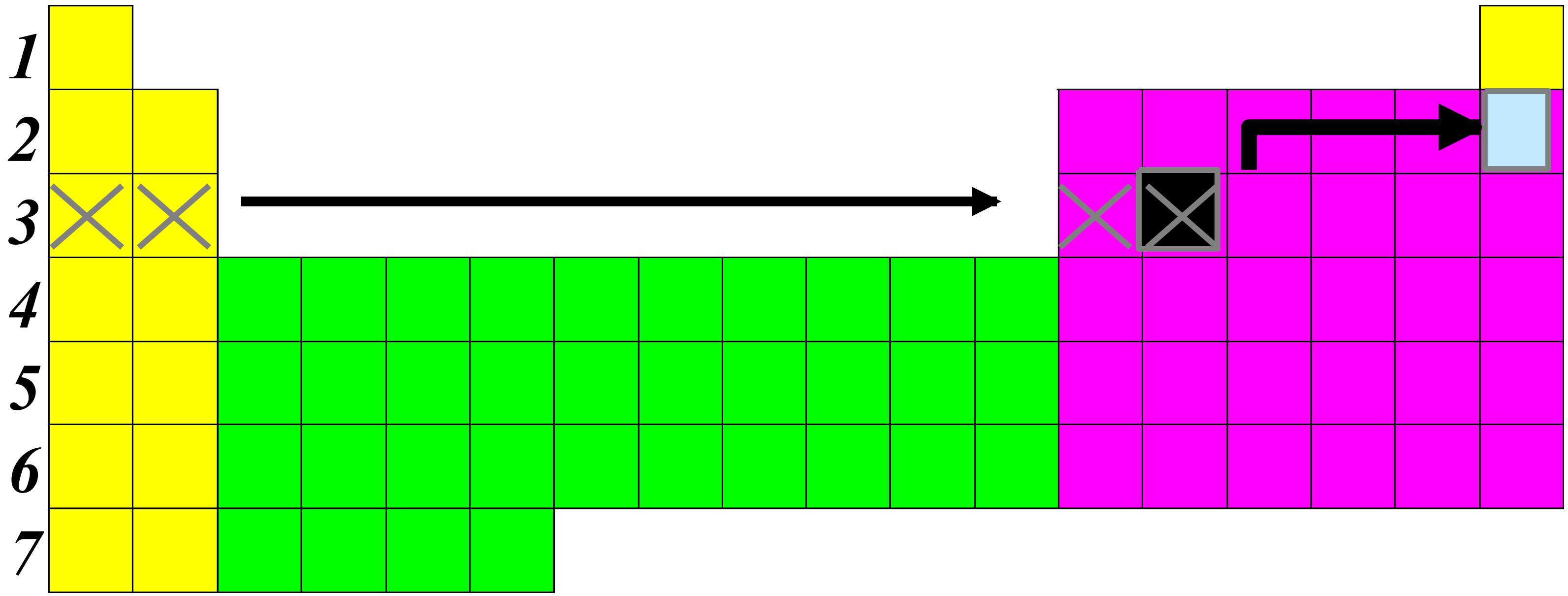
- **Shorthand Configuration**

S16e⁻ $[Ne]\ 3s^2 3p^4$



Noble Gas Shorthand

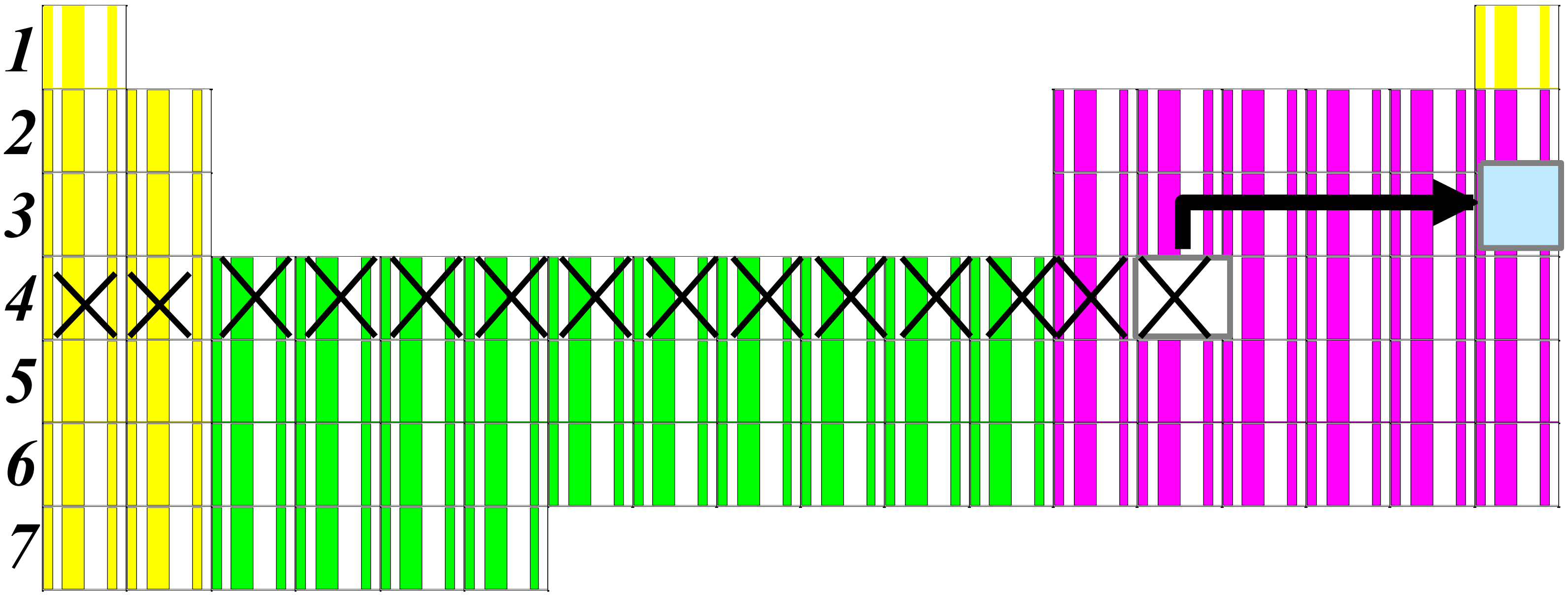
Ex – Silicon



[Ne]3s^2 3p^2

Noble Gas Shorthand

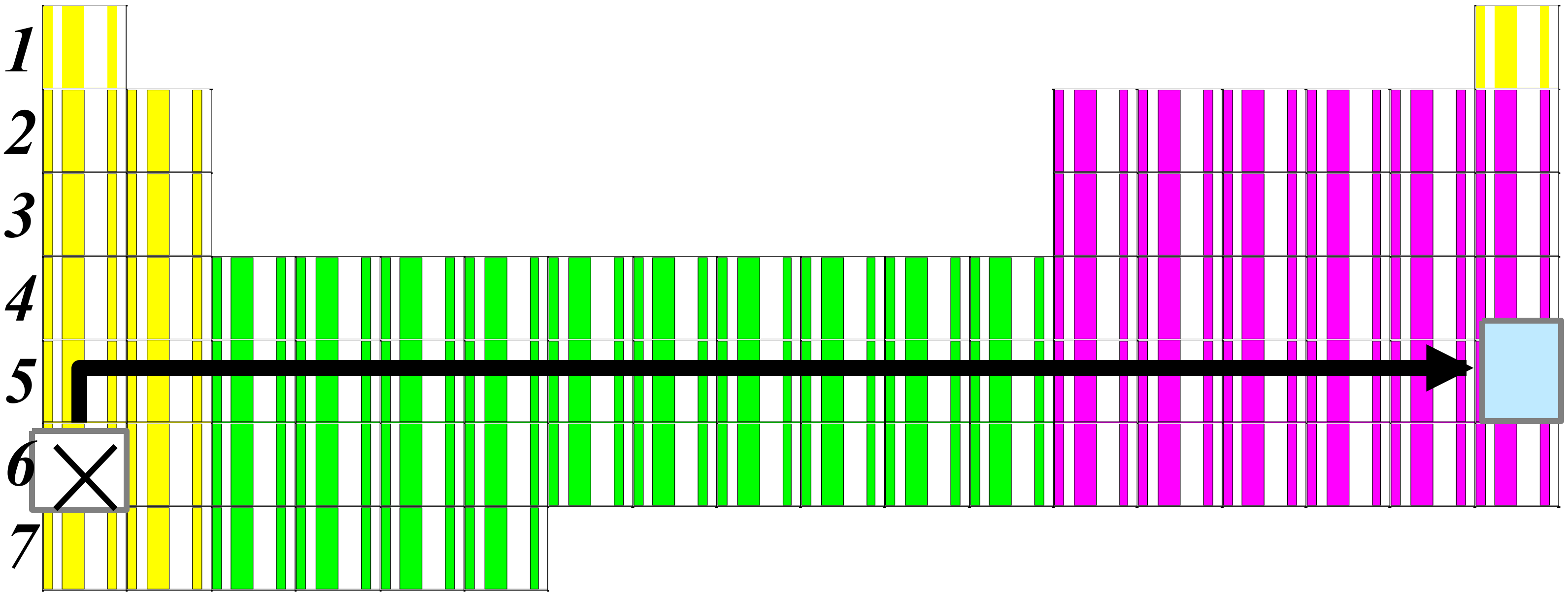
- **Ex -** Germanium



[Ar]4s^{2}3d^{10}4p^{2}

Noble Gas Shorthand

- **Ex -** Cesium



$[Xe]6s^1$

Learning Check

Use Noble Gas Shorthand write the e^- config.

1. Cr **[Ar] $4s^2$ $3d^4$**

2. Br **[Ar] $4s^2$ $3d^{10}$ $4p^5$**

3. Sn [Kr] $5s^2$ $4d^{10}$ $5p^2$

4. Ba **[Xe] $6s^2$**

Learning Check

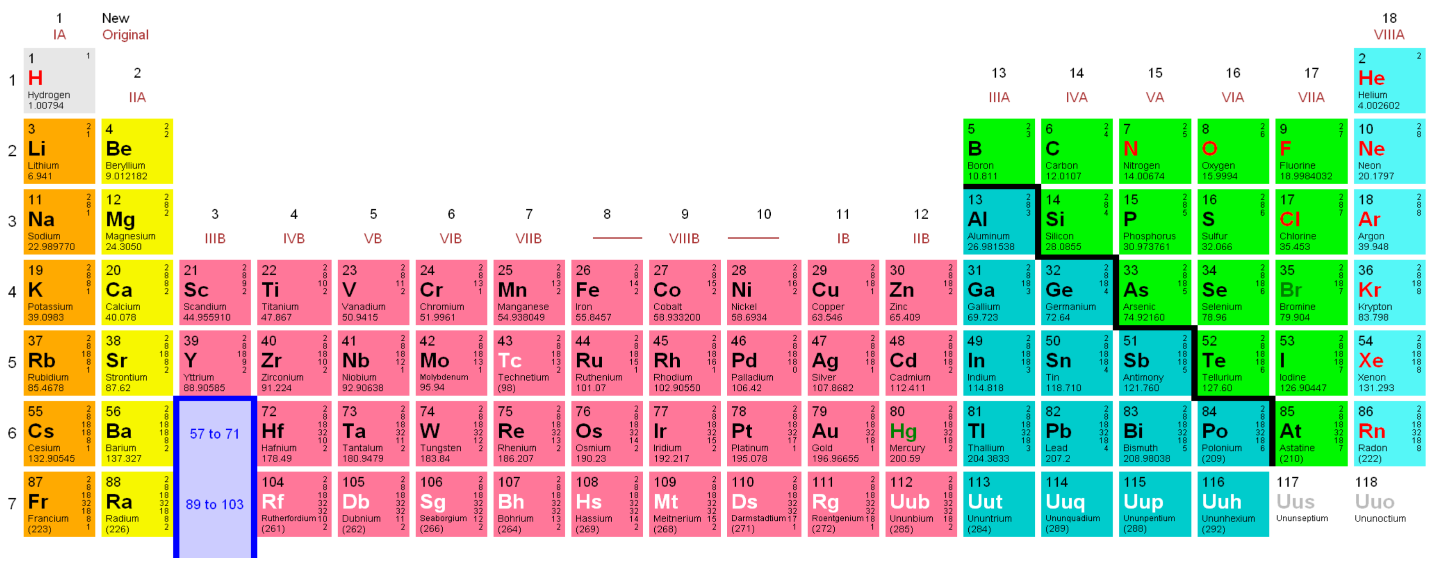
1. Which orbital quantum number combination is **not** possible?

A. 2s

B. 2d

C. 4d

D. 3p



Learning Check

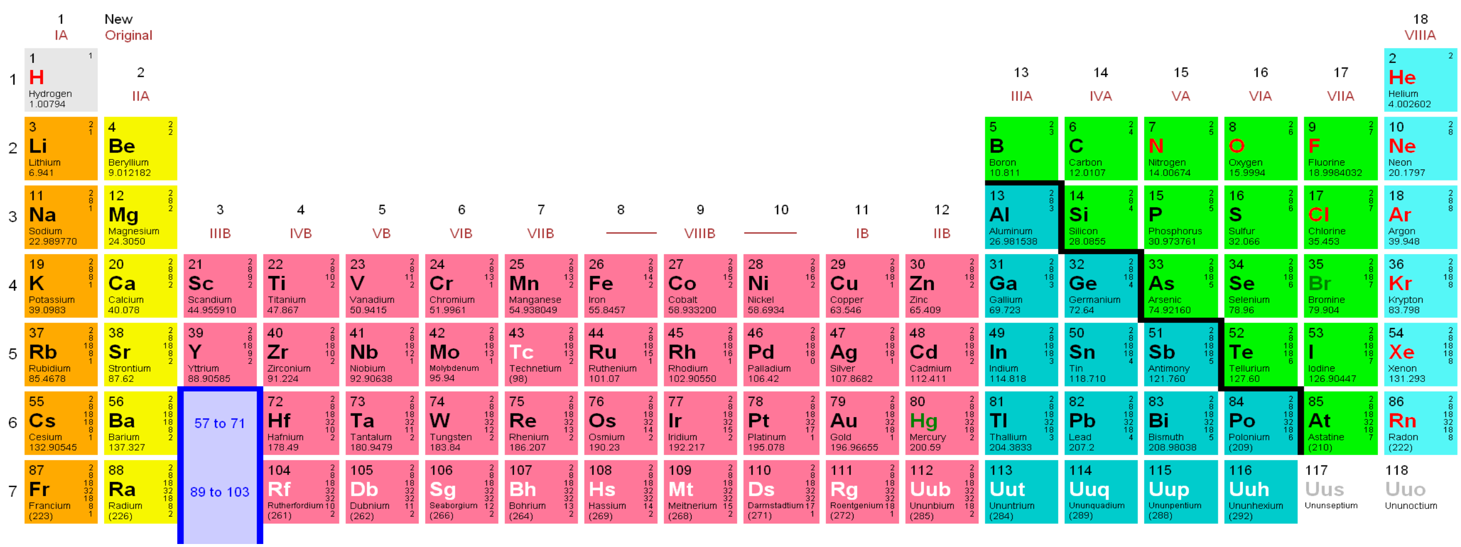
2. How many electrons are required to fill the 1st energy level?

A. 2

B. 4

C. 8

D. 10



Learning Check

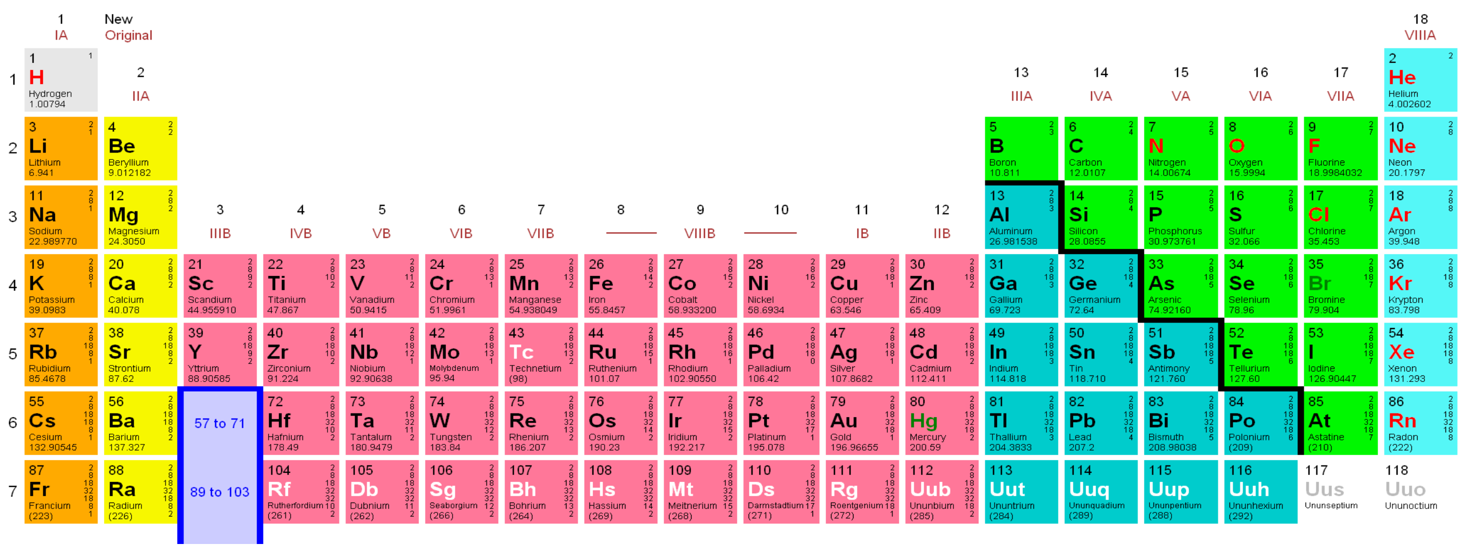
3. How many electrons are required to fill the 2^{nd} energy level?

A. 2

B. 4

C. 8

D. 10



Learning Check

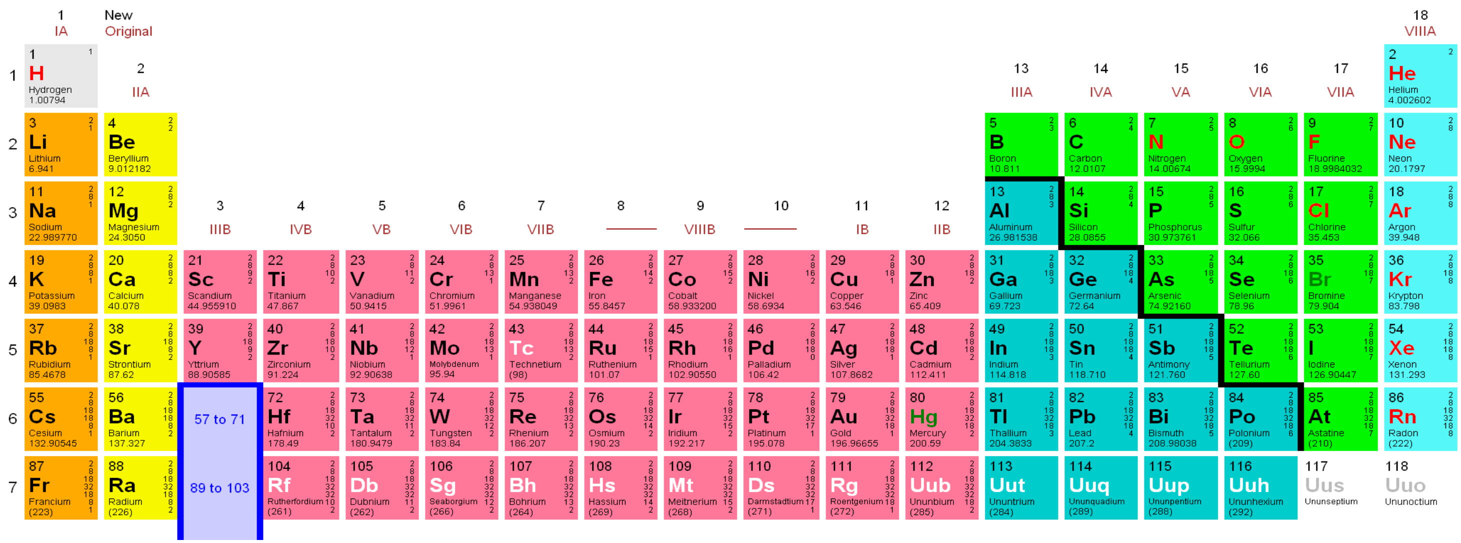
4. How many electrons are required to fill the 3rd energy level?

A. 4

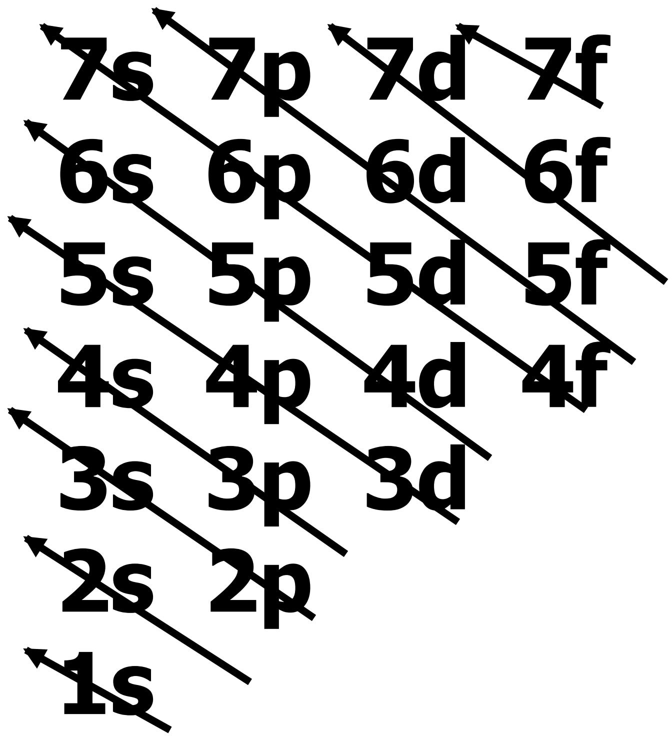
B. 8

C. 10

D. 18



Correct orbital filling order



The trick to f orbitals!

Examples:

Erbium- Er 68**[Xe] $6s^2 4f^{11} 5d^1$**

Hassium- Hs **[Rn] $7s^2 5f^{14} 6d^6$**

Learning Check

Use Noble Gas Shorthand write the e^- config.

1. Sm **[Xe] $6s^2\ 4f^5\ 5d^1$**

2. Db **[Rn] $7s^2\ 5f^{14}\ 6d^3$**