Answer all the questions below as fully as you can then check your answers

1. What is the AUFBAU principle?

2. What is Hund's rule of maximum multiplicity?

3. If a set of orbitals is described as degenerate what does this mean?

4. How many electrons can an orbital hold?

a. When electrons pair up in orbitals what can you say about their spins?

5. Complete the table below.

Principle energy level	Maximum number of electrons it can hold	Number of orbitals
1		
2		
3		
4		

Complete table below:

Sub-level	Maximum number of electrons it can hold	Number of orbitals present in sub-level
s		
p		
d		
f		

6. Which element has the following electronic configuration?

a. $[Ar]4s^2$ b. $[Ar]4s^23d^3$ c. $[Ne]3s^23p^4$

7. Write the electronic configuration for the following elements:

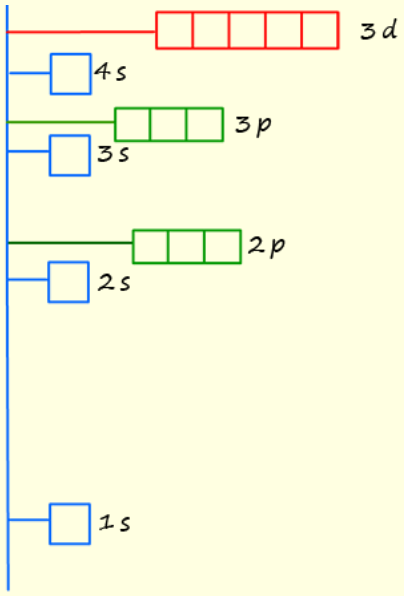
a. Al b. K c. Sc d. F E. Mg

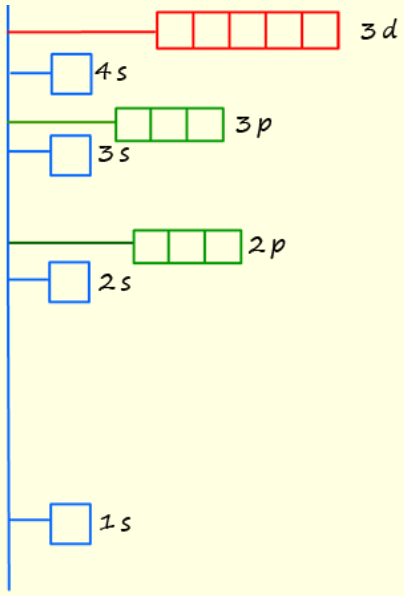
8. Write out the electronic structure for Cr and Cu.

a. What is unusual about the electron arrangements for these two transition metals? Explain why this unusual electron arrangement occurs.

9. Complete the following orbital diagram for the elements shown:

a. $_{15}P$ b. $_{22}Ti$





10. Which block in the periodic table will you find the following elements?

a. Sodium (Na) b. Selenium (Se) c. Gold (Au) d. Chlorine (Cl)

Answers

1. What is the AUFBAU principle?
   A set of rules to enable you to work out the electronic configuration of atoms

2. What is Hund's rule of maximum multiplicity?
   As electrons are added to degenerate orbitals they fill the lowest energy orbitals first. The electrons occupy the orbitals singularly and with parallel spins before pairing up. When they pair up they have opposite spins to reduce repulsion between them.

3. If a set of orbitals is described as degenerate what does this mean?
   They have the same energy. The electrons will occupy the same principal energy level or same sub-level.

4. How many electrons can an orbital hold?
   Maximum of 2 electrons.

a. When electrons pair up in orbitals what can you say about their spins?
   The have opposite spins to reduce repulsion between them.

5. Complete the table below.

Principle energy level	Maximum number of electrons it can hold	Number of orbitals
1	2	1
2	8	4
3	18	9
4	32	16

Use the formula $2n^2$ to calculate the maximum number of electrons in each principal energy level (n) e.g. The third principal energy level will hold $2 \times 3^2 = 18$ electrons.

Complete table below:

Sub-level	Maximum number of electrons it can hold	Number of orbitals present in sub-level
s	2	1
p	6	3
d	10	5
f	14	7

6. Which element has the following electronic configuration?

a. $[Ar]4s^2$ calcium

b. $[Ar]4s^23d^3$ vanadium

c. $[Ne]3s^23p^4$ sulfur

7. Write the electronic configuration for the following elements:

a. Al $[Ne]4s^2\ 3p^1$

b. K $[Ar]4s^1$

c. Sc $[Ar]4s^2\ 3d^1$

d. F $1s^2\ 2s^22p^5$

E. Mg $[Ne]4s^2$

8. Write out the electronic structure for Cr and Cu.

$[Ar]4s^13d^5$ and $[Ar]4s^13d^{10}$

a. What is unusual about the electron arrangements for these two transition metals?

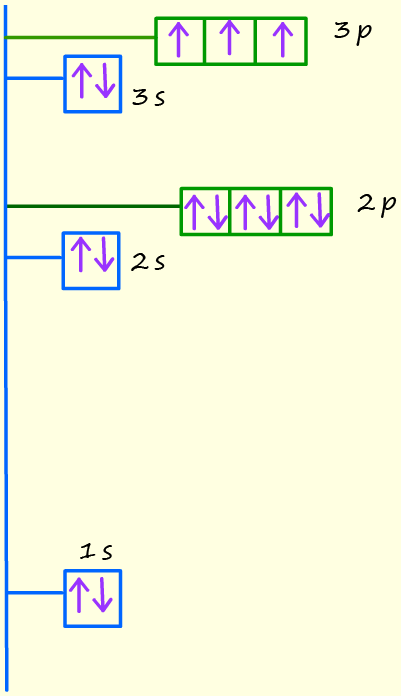
They both have a partly filled 4s orbital but have electrons present in a higher 3d sub-level.

Explain why this unusual electron arrangement occurs.

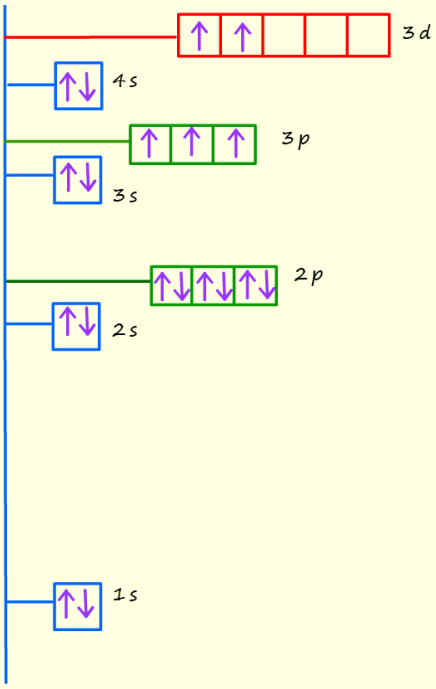
The presence of filled and half-filled 3d sub-levels offer extra stability to the atom.

9. Complete the following orbital diagram for the elements shown:

Phosphorus



Titanium



10. Which block in the periodic table will you find the following elements?

a. Sodium (Na) — s-block

b. Selenium (Se) — p-block

c. Gold (Au) — d-block

d. Chlorine (Cl) — p-block