Name: _____

Quantum Mechanics Period: ___

(1) What does the principle quantum number describe about an orbital?

(2) Distinguish between the angular momentum quantum number and the magnetic quantum number.

(3) What numbers are allowed by the spin quantum number? How many electrons does this allow per orbital?

(4) Complete the following table.

Element	Symbol	Orbital Notation	Electron Configuration Notation
Hydrogen			
Helium			
Lithium			
Beryllium			
Boron			
Carbon			
Nitrogen			
Oxygen			
Fluorine			
Neon			
Sodium			
Magnesium			
Aluminum			
Silicon			
Phosphorus			
Sulphur			
Chlorine			
Argon			

(5) Write the orbital notation for the following elements.

(a) potassium

(b) nickel

(c) selenium

(d) krypton

(e) tin

(f) yttrium

(g) cerium

(h) actinium

(6) Write the electron configuration notation for the following elements.

(a) calcium
(b) iron
(c) germanium
(d) rubidium
(e) tellurium
(f) indium
(g) lanthanum
(h) thorium

(7) Write two possible excited states for each of the following elements.

(a) hydrogen
(b) aluminum

(8) Write the noble gas notation for the following elements.

(a) beryllium
(b) scandium
(c) silicon
(d) arsenic
(e) cobalt
(f) tellurium
(g) tantalum
(h) samarium
(i) uranium
(j) roentgenium

(9) Write the electron configuration for the following ions.

(a) Cl^{-}
(b) Mg^{2+}
(c) Mn^{2+}
(d) As^{3-}
(e) Ti^{4+}
(f) Ag^{+}

(10) Write the noble gas notation for the following ions.

(a) Na^{+}
(b) S^{2-}
(c) Sr^{2+}
(d) I^{-}
(e) Mo^{2+}
(f) Cm^{3+}

Answers:

(1) The principle quantum number describes the main energy level of an orbital.

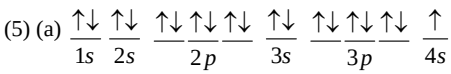
(2) Then angular momentum defines the shape of an orbital (s, p, d, or f)

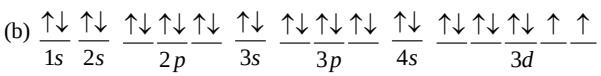
the magnetic quantum number defines the orientation of an orbital.

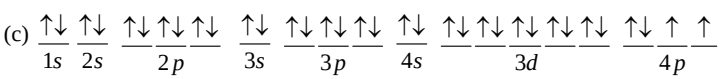
(3) The spin quantum number = $\frac{1}{2}$ or $-\frac{1}{2}$ which allows two electrons (of opposite spin) per orbital.

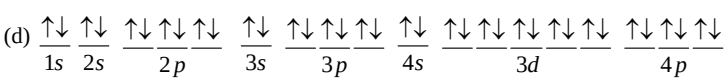
(4)

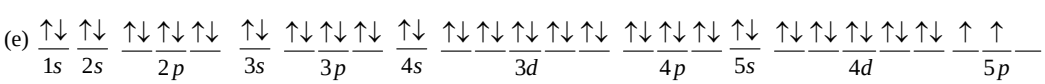
Element	Symbol	Orbital Notation	Electron Configuration Notation
Hydrogen	H	$\frac{\uparrow}{1s}$	$1s^1$
Helium	He	$\frac{\uparrow\downarrow}{1s}$	$1s^2$
Lithium	Li	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow}{2s}$	$1s^2\ 2s^1$
Beryllium	Be	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}$	$1s^2\ 2s^2$
Boron	B	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow}\ \underline{\ }\ \underline{\ }$	$1s^2\ 2s^2\ 2p^1$
Carbon	C	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow}\ \underline{\uparrow}\ \underline{\ }$	$1s^2\ 2s^2\ 2p^2$
Nitrogen	N	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow}\ \underline{\uparrow}\ \underline{\uparrow}$	$1s^2\ 2s^2\ 2p^3$
Oxygen	O	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow}\ \underline{\uparrow}$	$1s^2\ 2s^2\ 2p^4$
Fluorine	F	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \underline{\uparrow}$	$1s^2\ 2s^2\ 2p^5$
Neon	Ne	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}$	$1s^2\ 2s^2\ 2p^6$
Sodium	Na	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \frac{\uparrow}{3s}$	$1s^2\ 2s^2\ 2p\ ^6 3s^1$
Magnesium	Mg	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \frac{\uparrow\downarrow}{3s}$	$1s^2\ 2s^2\ 2p^6\ 3s^2$
Aluminum	Al	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \frac{\uparrow\downarrow}{3s}\ \underline{\uparrow}\ \underline{\ }\ \underline{\ }$	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$
Silicon	Si	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \frac{\uparrow\downarrow}{3s}\ \underline{\uparrow}\ \underline{\uparrow}\ \underline{\ }$	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$
Phosphorus	P	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \frac{\uparrow\downarrow}{3s}\ \underline{\uparrow}\ \underline{\uparrow}\ \underline{\uparrow}$	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$
Sulphur	S	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \frac{\uparrow\downarrow}{3s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow}\ \underline{\uparrow}$	$1s^2\ 2s^2\ 2p\ ^6\ 3s^2\ 3p^4$
Chlorine	Cl	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \frac{\uparrow\downarrow}{3s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \underline{\uparrow}$	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
Argon	Ar	$\frac{\uparrow\downarrow}{1s}\ \frac{\uparrow\downarrow}{2s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \frac{\uparrow\downarrow}{3s}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}\ \underline{\uparrow\downarrow}$	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

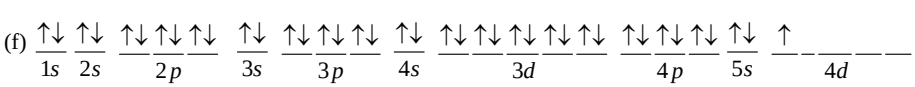
(5) (a) 

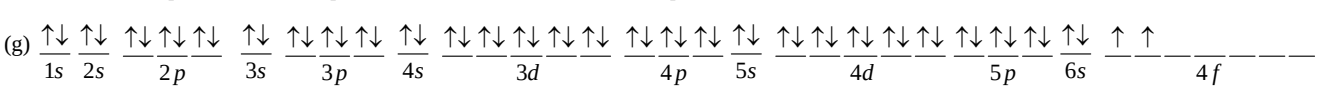
(b) 

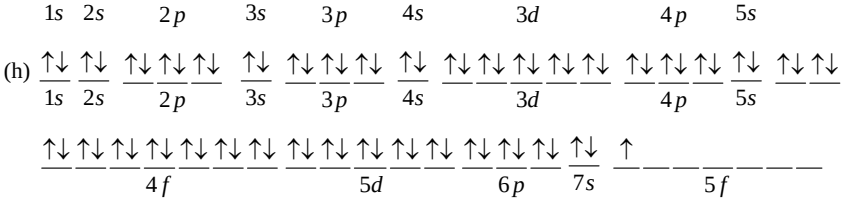
(c) 

(d) 

(e) 

(f) 

(g) 

(h) 

(6)

(a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$

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

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

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

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

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

(g) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^1$

(h) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^6\ 7s^2\ 5f^2$

(7) Answers will vary (a) $2s^1$ or $2p^1$ (b) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 4s^1$ or $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3d^1$

(8)

(a) [He] $2s^2$

(b) [Ar] $4s^2\ 3d^1$

(c) [Ne] $3s^2\ 3p^2$

(d) [Ar] $4s^2\ 3d^{10}\ 3p^3$

(e) [Ar] $4s^2\ 3d^7$

(f) [Kr] $5s^2\ 4d^{10}\ 5p^4$

(g) [Xe] $6s^2\ 4f^{14}\ 5d^3$

(h) [Xe] $6s^2\ 4f^6$

(i) [Rn] $7s^2\ 5f^4$

(j) [Rn] $7s^2\ 5f^{14}\ 6d^9$

(9)

(a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

(b) $1s^2\ 2s^2\ 2p^6$

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

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

(e) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

(f) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^8$

(10)

(a) [Ne]

(b) [Ar]

(c) [Kr]

(d) [Xe]

(e) [Kr] $5s^2\ 4d^2$

(f) [Rn] $7s^2\ 5f^5$