

Unit 3

Modeling Atomic Structure

Mr. Maxwell

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Atomic Number

The _____ is the number of _____ in the nucleus of an atom.

Atomic Number

The **atomic number** is the number of _____ in the nucleus of an atom.

Atomic Number

The **atomic number** is the number of **protons** in the nucleus of an atom.

Atomic Mass

The _____ the total number of _____ and _____ in the nucleus of an atom.

Atomic Mass

The **mass number** is the total number of protons and neutrons in the nucleus of an atom.

Atomic Mass

The **mass number** is the total number of **protons** and **neutrons** in the nucleus of an atom.

Atomic Mass

The **mass number** is the total number of **protons** and **neutrons** in the nucleus of an atom.

Hydrogen



Hydrogen



What does the 1 mean?

Hydrogen



What does the 1 mean?

1 is the total number of neutrons and protons.

Helium



Helium



What does the 4 mean?

Helium



What does the 4 mean? 4 is the total number of neutrons and protons.

Helium



What does the 4 mean? 4 is the total number of neutrons and protons.
What does the 2 mean?

Helium



What does the 4 mean? 4 is the total number of neutrons and protons.

What does the 2 mean? 2 is the number of protons.

Lithium



Lithium



How many protons does Lithium have?

Lithium



How many protons does Lithium have? 3

Lithium



How many protons does Lithium have? 3 How many neutrons?

Lithium



How many protons does Lithium have? 3 How many neutrons? $7 - 3 =$

Lithium



How many protons does Lithium have? 3 How many neutrons? $7 - 3 = 4$

The Great Dane



The Bohr Model - Bohr proposed that an atom was a nucleus with electrons "orbiting" in different

The Great Dane



The Bohr Model - Bohr proposed that an atom was a nucleus with electrons "orbiting" in different energy levels.

Energy Levels

Electrons can only have certain energy values known as

Energy Levels

Electrons can only have certain energy values known as **energy levels**

Energy Levels

The electrons closest to the nucleus have the
further from away have energy.

energy, while those

Energy Levels

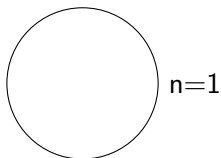
The electrons closest to the nucleus have the **lowest** energy, while those further from away have _____ energy.

Energy Levels

The electrons closest to the nucleus have the **lowest** energy, while those further from away have **higher** energy.

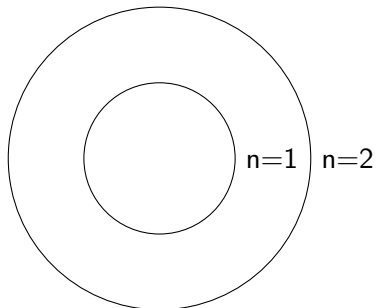
Energy Levels

The electrons closest to the nucleus have the **lowest** energy, while those further from away have **higher** energy.



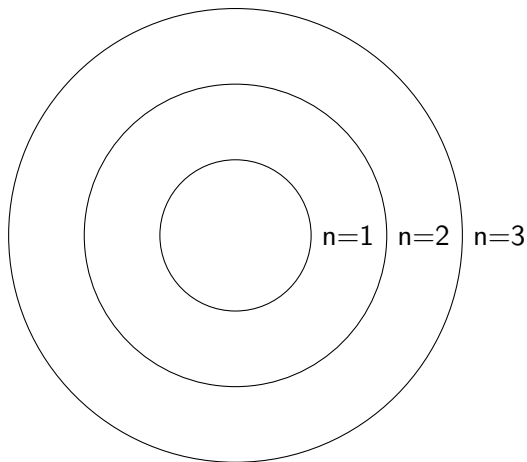
Energy Levels

The electrons closest to the nucleus have the **lowest** energy, while those further from away have **higher** energy.



Energy Levels

The electrons closest to the nucleus have the **lowest** energy, while those further from away have **higher** energy.



Energy Levels and the Periodic Table

Group ▶	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
Period ▼																				
Nonmetals	1 H																		2 He	
Metals	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne		
	11 Na	12 Mg	<i>Transition metals</i> (sometimes excluding group 12)										13 Al	14 Si	15 P	16 S	17 Cl	18 Ar		
	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr		
	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe		
	55 Cs	56 Ba	La to Yb		71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
	87 Fr	88 Ra	Ac to No		103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
	s-block (plus He)		f-block		d-block								p-block (excluding He)							
Lanthanides			57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb				
Actinides			89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No				

Some elements near the dashed staircase are sometimes called *metalloids*

Energy Level of Hydrogen

Group ▾ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Period ▼

Nonmetals 1

Metals

Transition metals
(sometimes excluding group 12)

Some elements near the dashed staircase are sometimes called metalloids

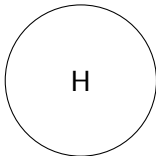
Noble gases

1																	2
H																	He
3	4											5	6	7	8	9	10
Li	Be											B	C	N	O	F	Ne
11	12											13	14	15	16	17	18
Na	Mg											Al	Si	P	S	Cl	Ar
37	38	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
		Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
55	56	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	Ba	La to Yb	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
87	88	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
Fr	Ra	Ac to No	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og
s-block (plus He)		f-block		d-block								p-block (excluding He)					
Lanthanides		57	58	59	60	61	62	63	64	65	66	67	68	69	70		
Actinides		89	90	91	92	93	94	95	96	97	98	99	100	101	102		
		La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb		
		Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No		

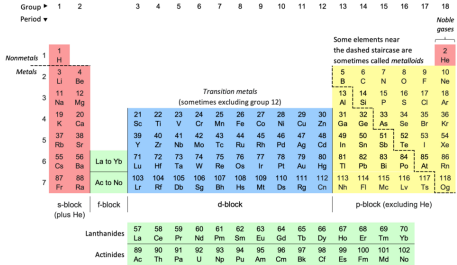
Energy Level of Hydrogen

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
Period																		1		
																		2		
Nonmetals	1																		2	
	H																		He	
Metals	3	4											5	6	7	8	9	10		
	Li	Be											B	C	N	O	F	Ne		
	11	12											13	14	15	16	17	18		
	Na	Mg											Al	Si	P	S	Cl	Ar		
	19	20											31	32	33	34	35	36		
	K	Ca											Ga	Ge	As	Se	Br	Kr		
	37	38											49	50	51	52	53	54		
	Rb	Sr											In	Sn	Sb	Te	I	Xe		
	55	56											81	82	83	84	85	86		
	Cs	Ba											Tl	Pb	Bi	Po	At	Rn		
	87	88											113	114	115	116	117	118		
	Fr	Ra											Nh	Fl	Mc	Lv	Ts	Og		
	s-block (plus He)		f-block		d-block										p-block (excluding He)					
Lanthanides			57	58	59	60	61	62	63	64	65	66	67	68	69	70				
			La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb				
Actinides			89	90	91	92	93	94	95	96	97	98	99	100	101	102				
			Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No				

Some elements near the dashed staircase are sometimes called metalloids



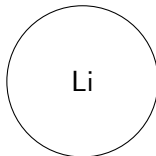
Energy Level of Lithium



Energy Level of Lithium

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18			
Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18			
Nonmetals	1	H																2	He		
Metals	2	Li	Be										5	B	C	N	O	F	Ne		
	3	Na	Mg										13	Al	Si	P	S	Cl	Ar		
	4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	31	Ga	Ge	As	Se	Br	Kr	
	5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	49	In	Sn	Sb	Te	I	Xe	
	6	Cs	Ba	La to Yb		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	81	Tl	Pb	Bi	Po	At	Rn
	7	Fr	Ra	Ac to No		Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	113	Nh	Fl	Mc	Lv	Ts	Og
		s-block (plus He)	f-block	d-block									p-block (excluding He)								
Lanthanides			57	58	59	60	61	62	63	64	65	66	67	68	69	70					
			La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb					
Actinides			89	90	91	92	93	94	95	96	97	98	99	100	101	102					
			Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No					

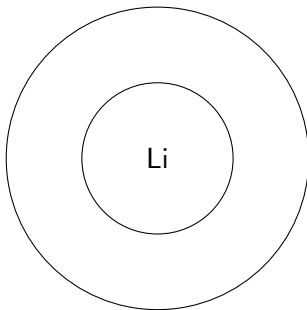
Some elements near the dashed staircase are sometimes called metalloids



Energy Level of Lithium

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18										
Period 1																		1	He									
Period 2	1	2											3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period 3	1	2											3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period 4	1	2											3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period 5	1	2											3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period 6	1	2											3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period 7	1	2											3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Some elements near the dashed staircase are sometimes called metalloids.
 s-block (plus He) | f-block | d-block | p-block (excluding He)

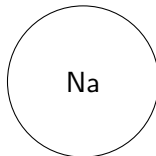


Energy Level of Sodium

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Nonmetals	1 H																	2 He	
Metals	3 Li	4 Be																	
	11 Na	12 Mg	Transition metals (sometimes excluding group 12)										13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	
	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	
	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	
	55 Cs	56 Ba	La to Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
	87 Fr	88 Ra	Ac to No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
	s-block (plus He)		f-block	d-block									p-block (excluding He)						
Lanthanides	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb					
Actinides	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No					

Energy Level of Sodium

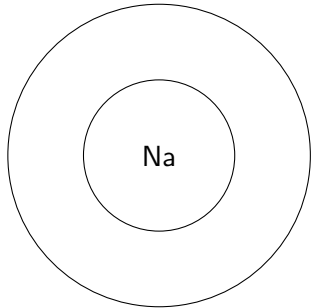
Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Period	1	2																	
Nonmetals	1 H																		
Metals	3 Li	4 Be																2 He	
	11 Na	12 Mg	Transition metals (sometimes excluding group 12)										Some elements near the dashed staircase are sometimes called metalloids						
	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	
	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	
	55 Cs	56 Ba	La to Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
	87 Fr	88 Ra	Ac to No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
	s-block (plus He)	f-block		d-block									p-block (excluding He)						
Lanthanides	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb					
Actinides	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No					



Energy Level of Sodium

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Period																		Noble gases	
1	H																		He
2	Li	Be											B	C	N	O	F	Ne	
3	Na	Mg											Al	Si	P	S	Cl	Ar	
4	K	Ca											Ga	Ge	As	Se	Br	Kr	
5	Rb	Sr											In	Sn	Sb	Te	I	Xe	
6	Cs	Ba											Tl	Pb	Bi	Po	At	Rn	
7	Ra											Nh	Fl	Mc	Lv	Ts	Og		
	s-block (plus He)		f-block		d-block								p-block (excluding He)						
Lanthanides	57	58	59	60	61	62	63	64	65	66	67	68	69	70					
	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb					
Actinides	89	90	91	92	93	94	95	96	97	98	99	100	101	102					
	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No					

Some elements near the dashed staircase are sometimes called metalloids



Energy Level of Sodium

	Group	1	2	3										4	5	6	7	8	9	10	11	12	13	14	15	16	17	18										
	Period	1	2																		Noble gases																	
Nonmetals	1	1																							2													
	2	H	He																																			
Metals	3	Li	Be																																			
	4	Na	Mg											Transition metals (sometimes excluding group 12)					Some elements near the dashed staircase are sometimes called metalloids					Ar	Kr													
	5	K	Ca																					Br														
	6	Rb	Sr	La to Yb																																		
	7	Cs	Ba	Ac to No																																		
	8	Fr	Ra																																			
			s-block (plus He)		f-block		d-block										p-block (excluding He)																					
Lanthanides	57	58	59	60	61	62	63	64	65	66	67	68	69	70																								
	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb																								
Actinides	89	90	91	92	93	94	95	96	97	98	99	100	101	102																								
	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No																								

