

Hog Hilton

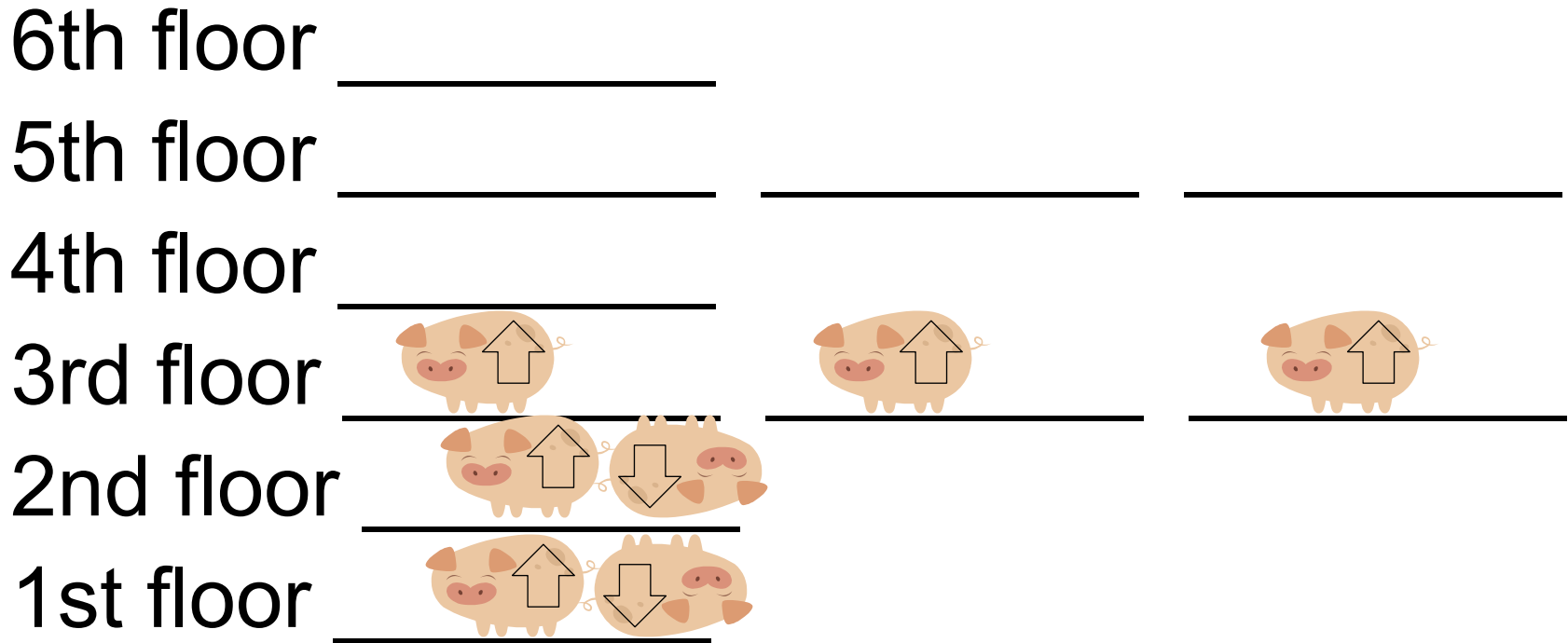
You are the manager of a prestigious new hotel in downtown Midland—the “Hog Hilton”. It’s just the “snort of the town” and you want to keep its reputation a cut above all the other hotels. Your problem is your clientele. They are hogs in the truest sense.

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:

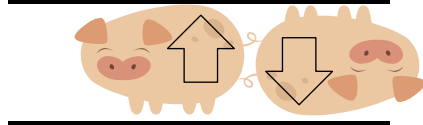
6th floor



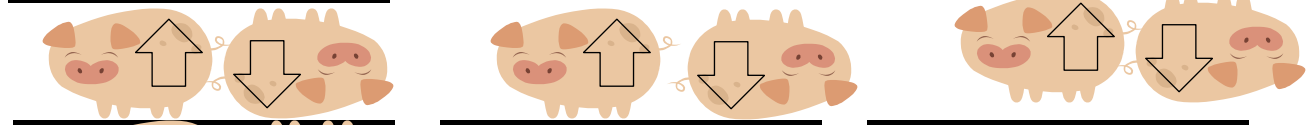
5th floor



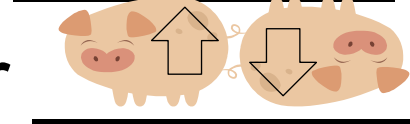
4th floor



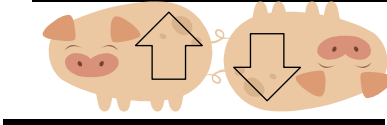
3rd floor



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 _____

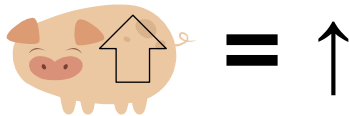
5th floor _____

4th floor _____

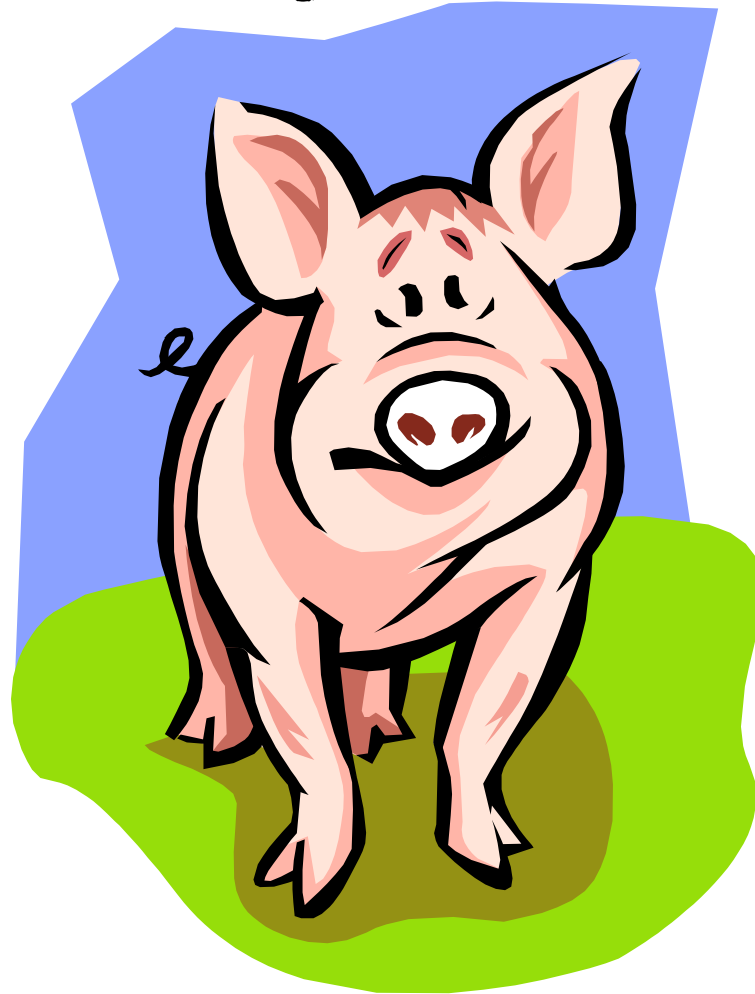
3rd floor _____

2nd floor _____

1st floor _____

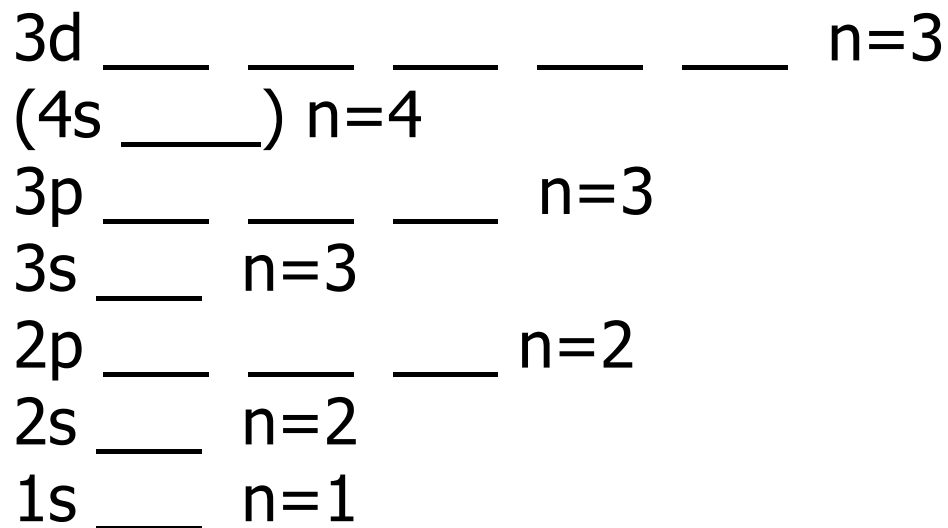


Let's play Hog Hilton!!



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?



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

A. Rules for e⁻ configurations

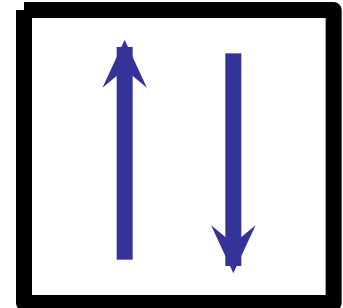
1. Aufbau principle: electrons fill the lowest energy orbitals first.

(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

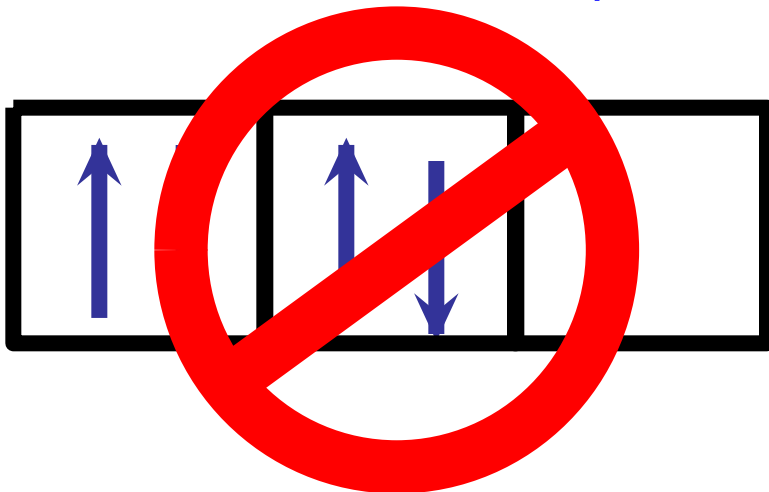
(They stink, so you can't put more than two hogs in each room. & If hogs are in the same room they will face in opposite directions.)



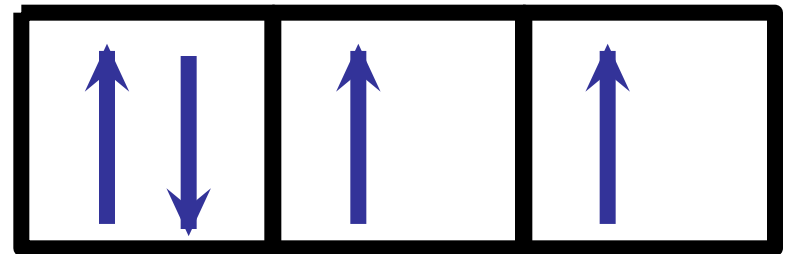
A. Rules for e^- configurations

3. Hund's rule: 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.)



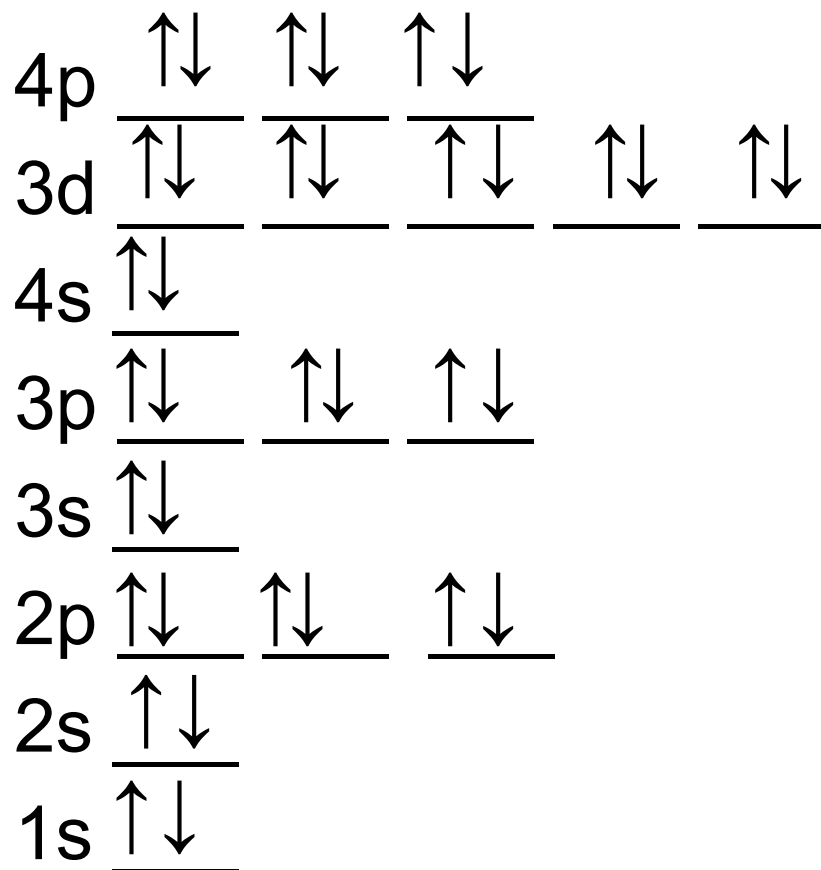
WRONG



RIGHT

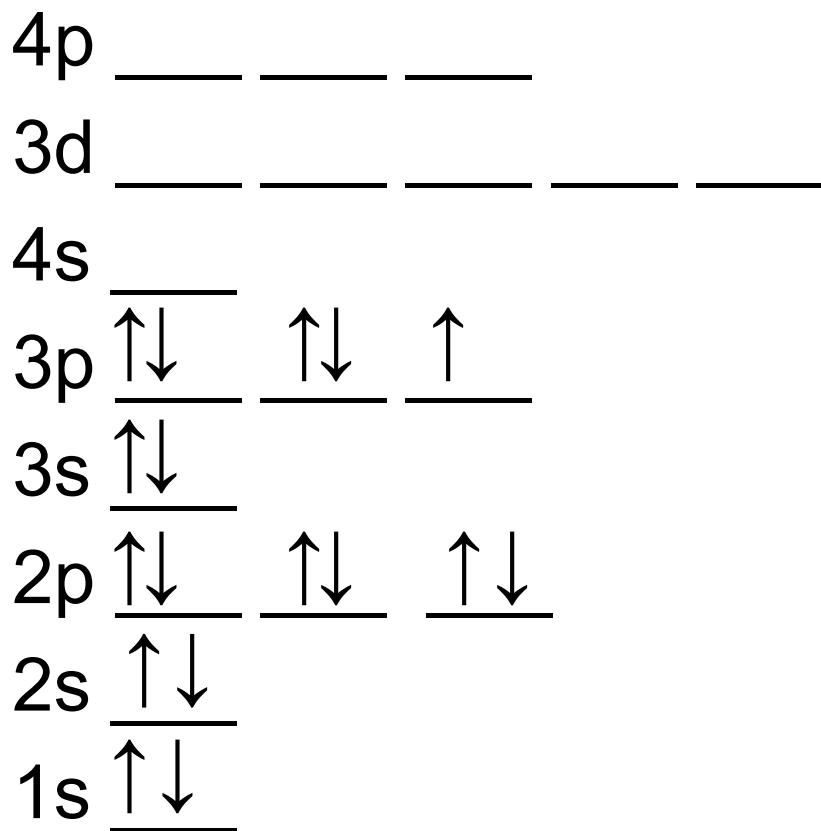
B. Drawing Orbitals

Krypton



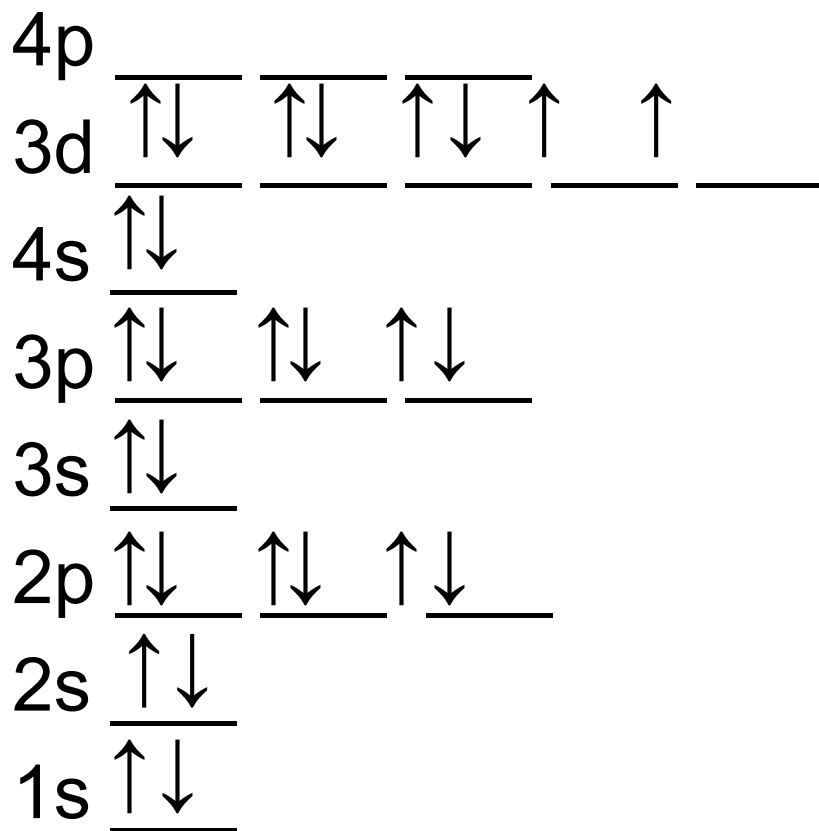
White Board Practice: Drawing Orbitals

Chlorine



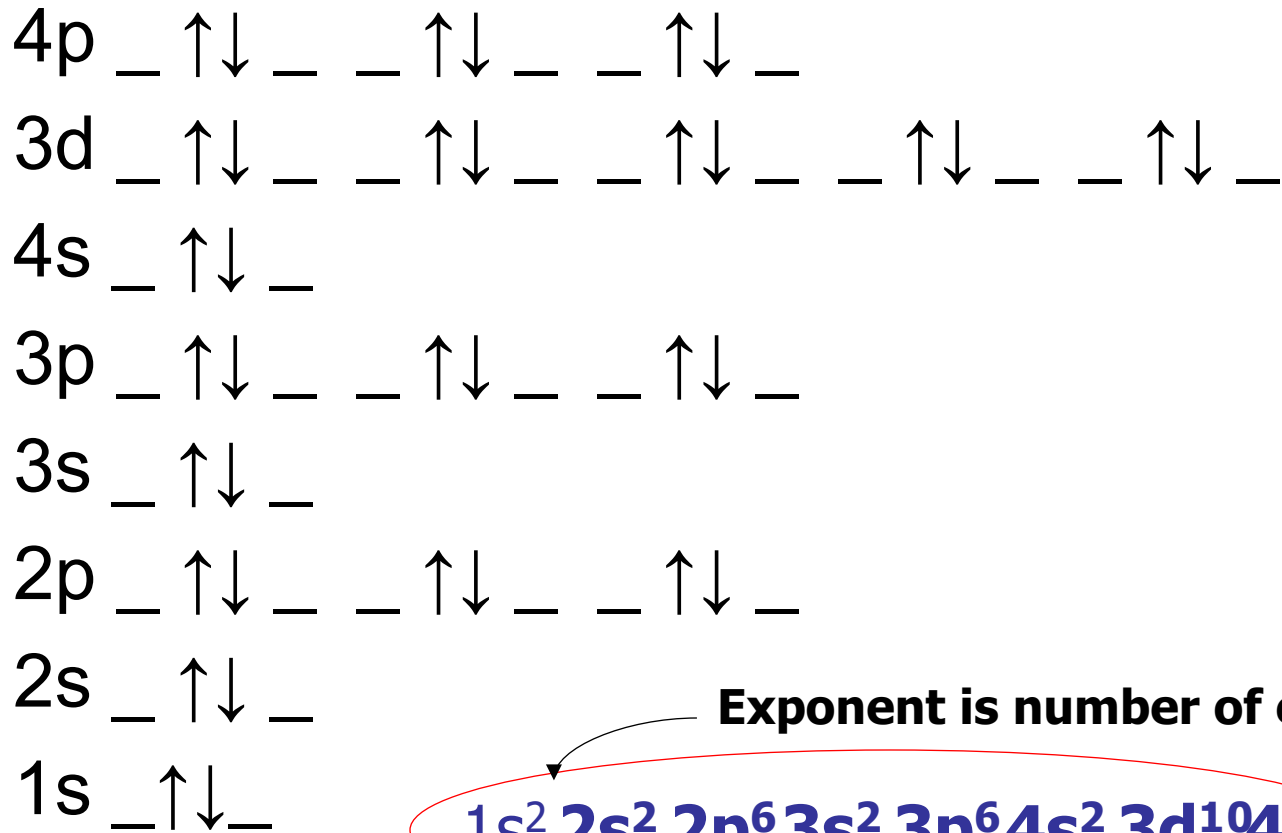
White Board Practice: Drawing Orbitals

Nickel



C. Writing the Electron Configuration

Krypton: atomic number - 36



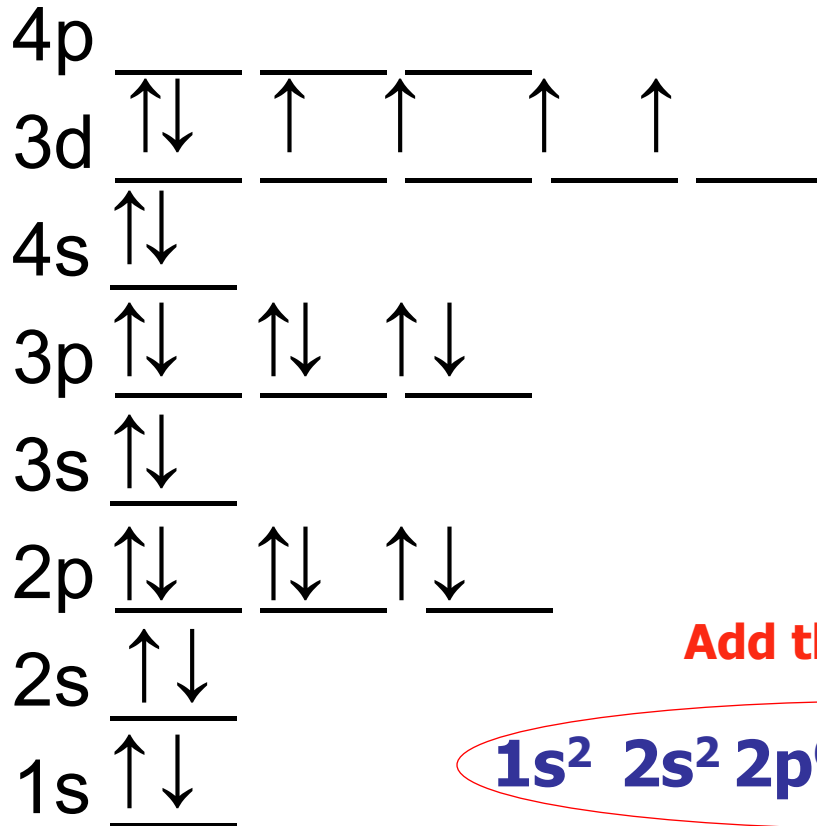
Add the exponents to check your answer

White Board Practice:

Writing Electron Configurations

Iron

Fe – atomic number 26



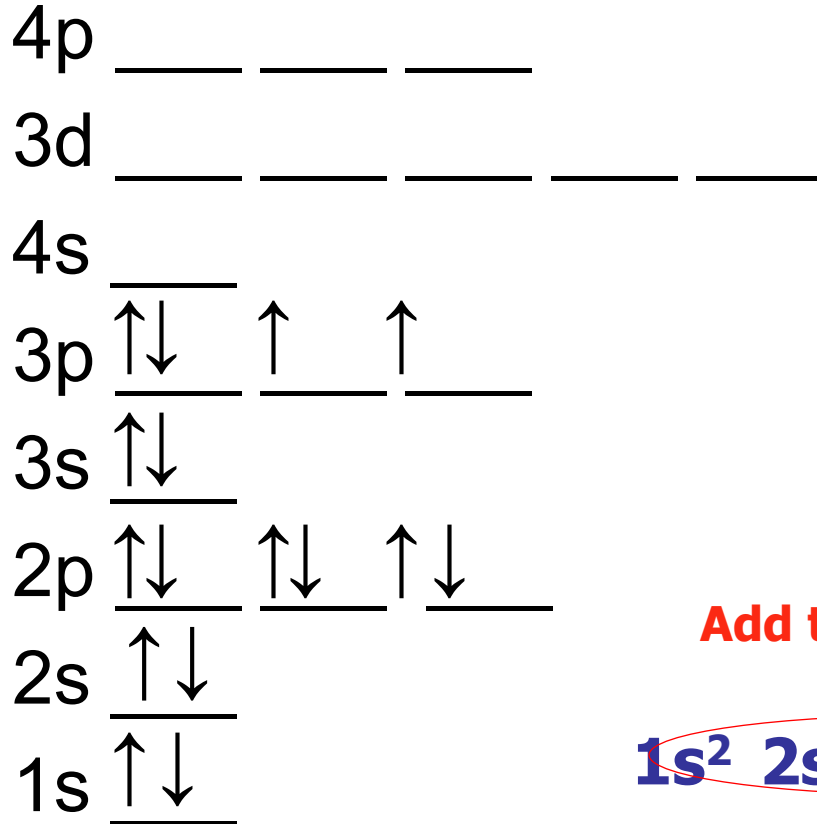
Add the exponents to check your answer



White Board Practice: Writing Electron Configurations

Sulfur

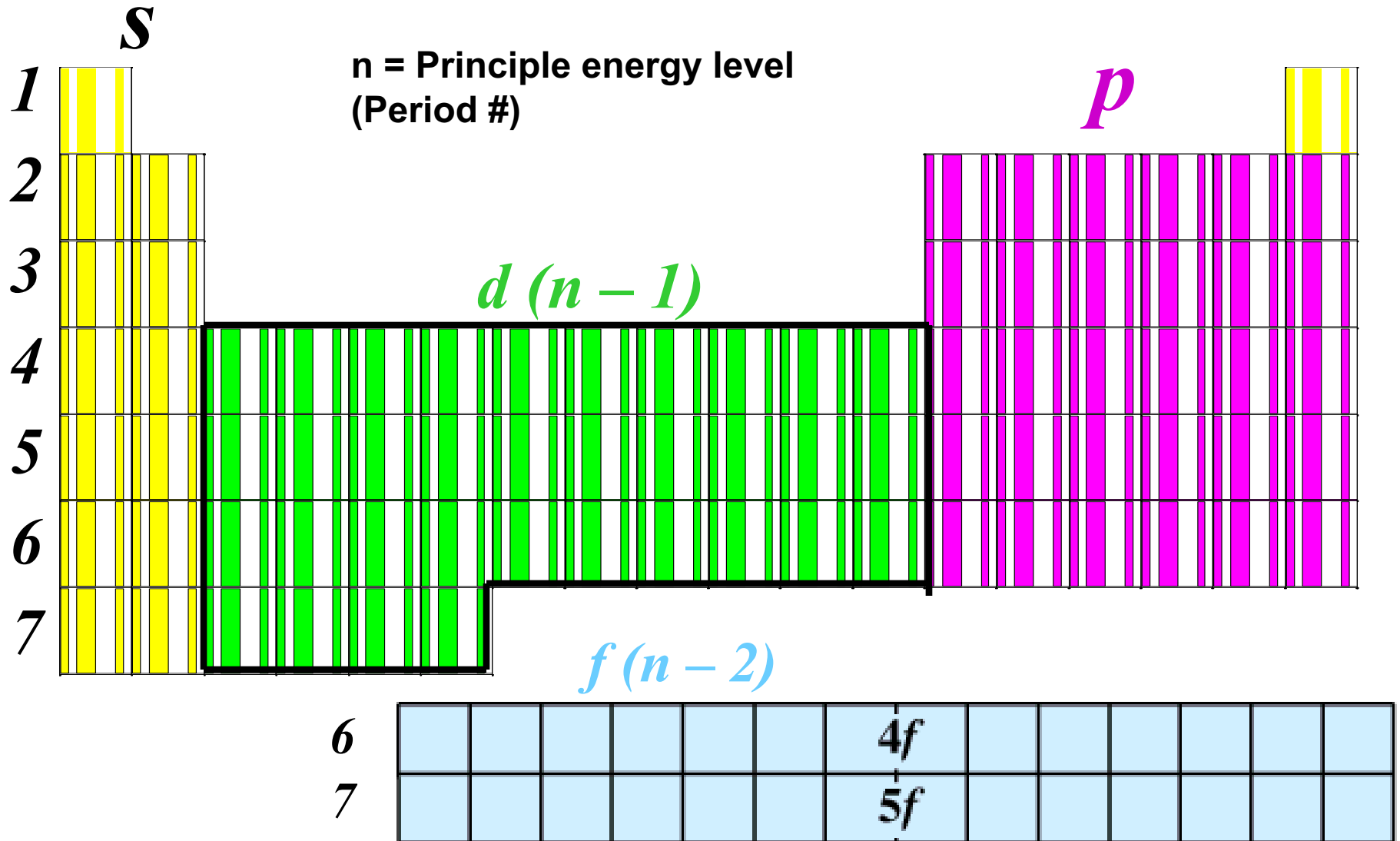
S – atomic number- 16



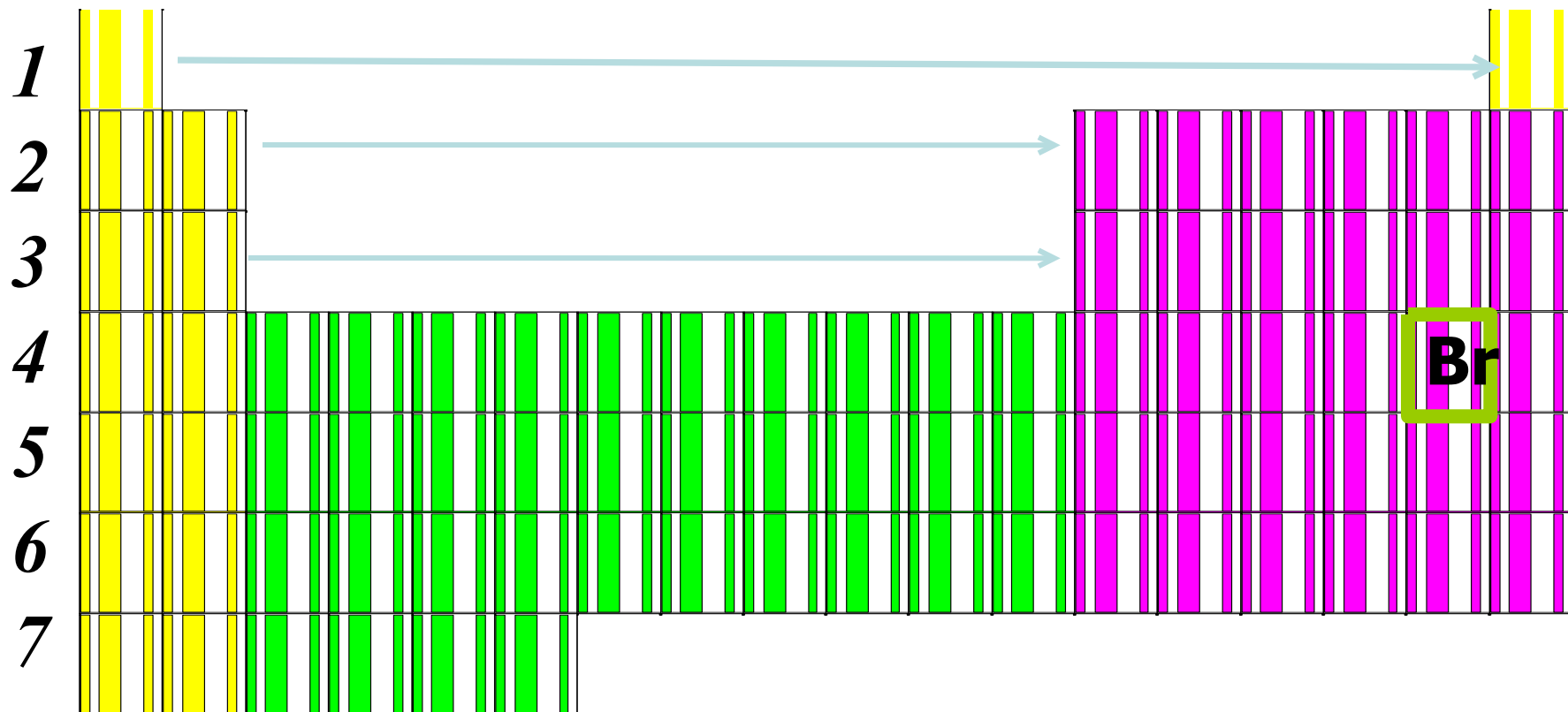
Add the exponents to check your answer



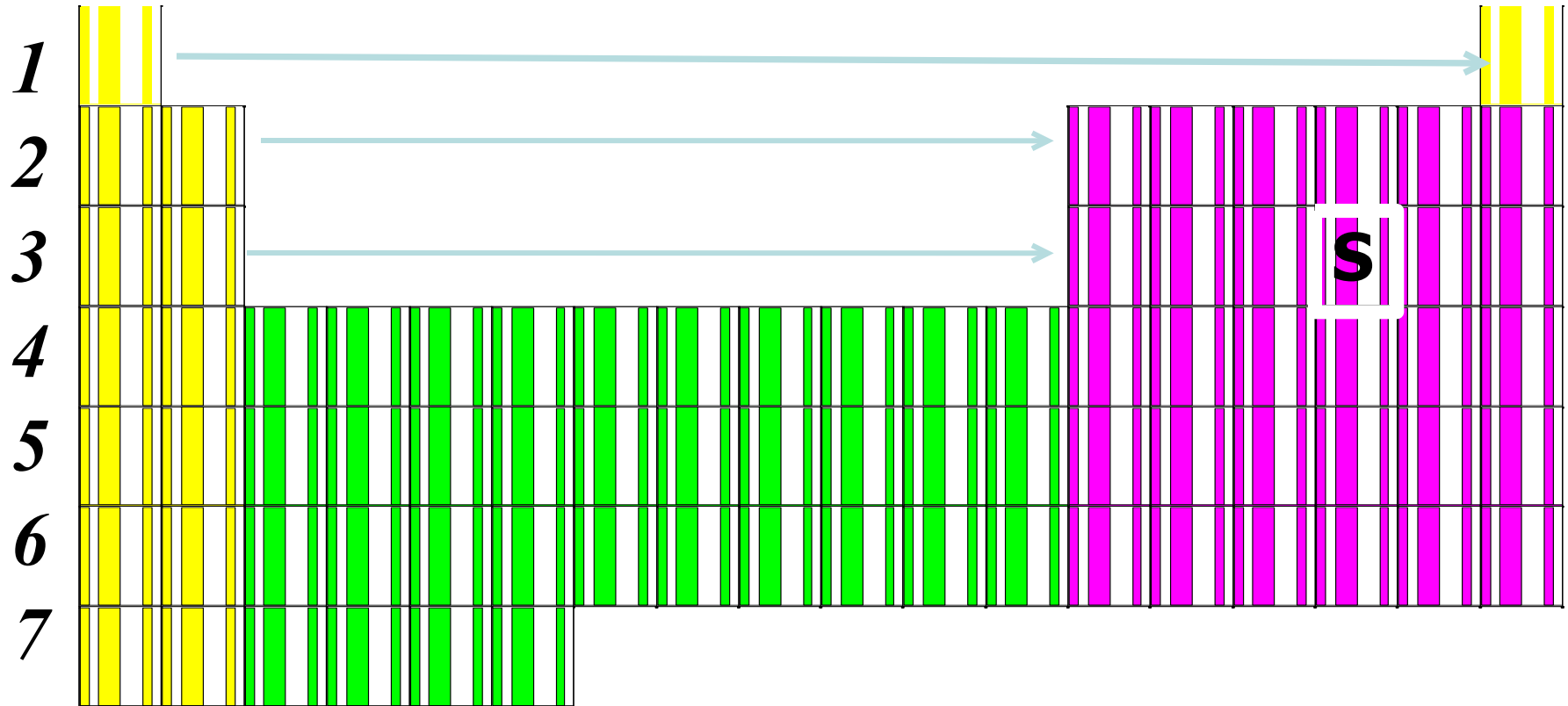
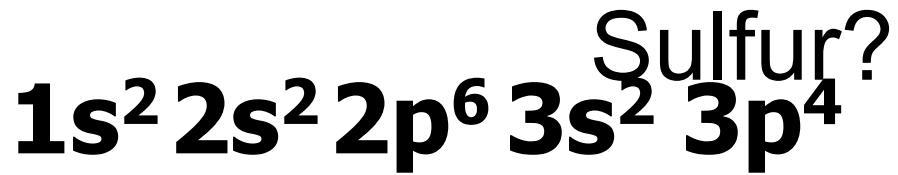
e- config. Periodic Patterns



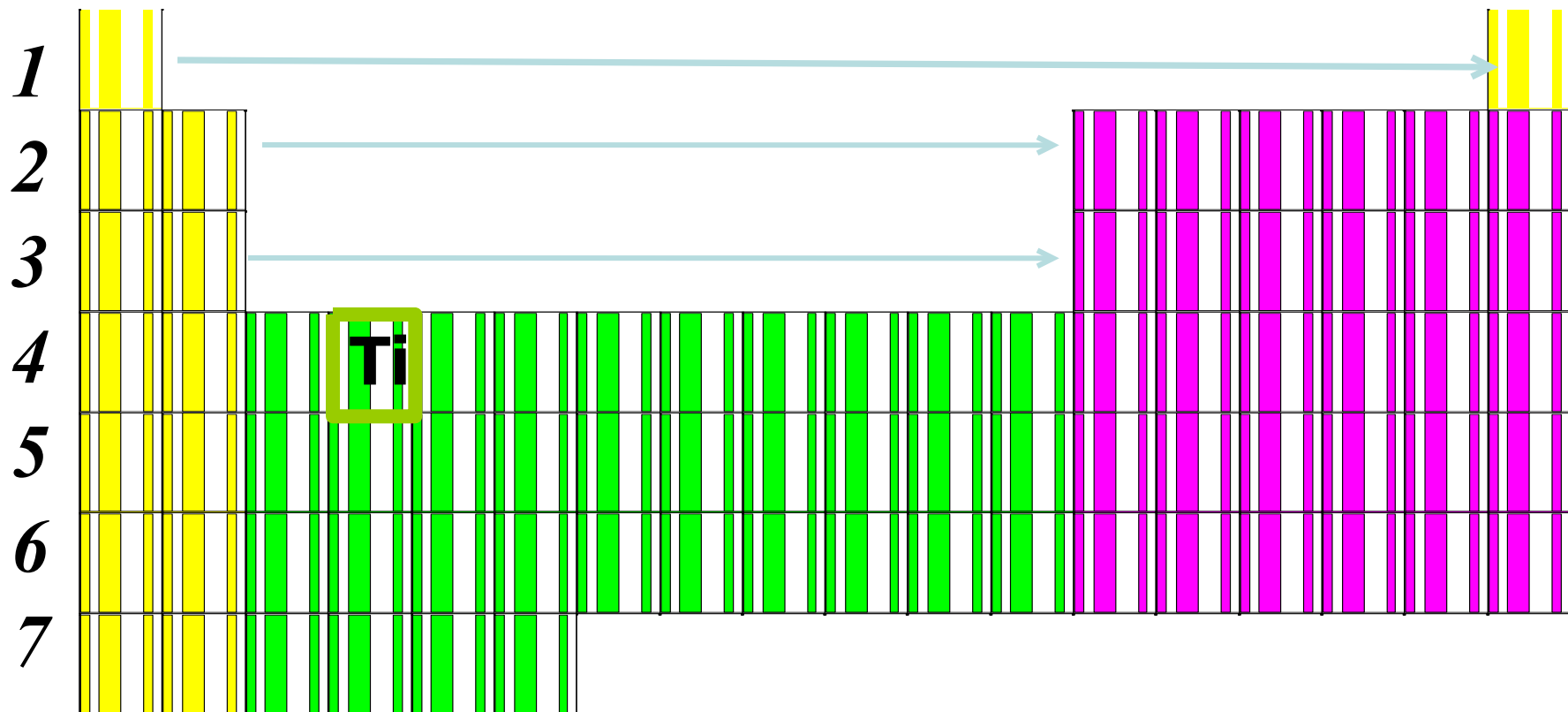
What is the electron configuration for Br?



What is the electron configuration for



What is the electron configuration for Titanium?



What element has the electron configuration $1s^22s^22p^63s^23p^4$?

1	1	New Original										13	14	15	16	17	18		
1	IA											IIIA	IVA	VA	VIA	VIIA	VIIIA		
1	H																2		
	Hydrogen																He		
	1.00794																4.002602		
2	3	4											5	6	7	8	9	10	
	Li	Be											B	C	N	O	F	Ne	
	Lithium	Beryllium											Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon	
	6.941	9.012182											10.811	12.0107	14.00674	15.9994	18.9984032	20.1797	
3	11	12	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
	Na	Mg	IIIB	IVB	VB	VIB	VIIIB				IB	IIB	Al	Si	P	S	Cl	Ar	
	Sodium	Magnesium											Aluminum	Silicon	Phosphorus	Sulfur	Chlorine	Argon	
	22.989770	24.3050											26.981538	28.0855	30.973761	32.066	35.453	39.948	
4	19	20	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	
	Potassium	Calcium	Scandium	Titanium	Vanadium	Chromium	Manganese	Iron	Cobalt	Nickel	Copper	Zinc	Gallium	Germanium	Arsenic	Selenium	Bromine	Krypton	
	39.0983	40.078	44.955910	47.867	50.9415	51.9961	54.938049	55.8457	58.933200	58.6934	63.546	65.409	69.723	72.64	74.92160	78.96	79.904	83.798	
5	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
	Rubidium	Strontium	Yttrium	Zirconium	Niobium	Molybdenum	Technetium	Ruthenium	Rhodium	Palladium	Silver	Cadmium	Indium	Tin	Antimony	Tellurium	Iodine	Xenon	
	85.4678	87.62	88.90585	91.224	92.90638	95.94	98	101.07	102.90550	106.42	107.8682	112.411	114.818	118.710	121.760	127.60	126.90447	131.293	
6	55	56	57 to 71		72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
	Cs	Ba			Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
	Cesium	Barium			Hafnium	Tantalum	Tungsten	Rhenium	Osmium	Iridium	Platinum	Gold	Mercury	Thallium	Lead	Bismuth	Polonium	Astatine	Radon
	132.90545	137.327			178.49	180.9479	183.84	186.207	190.23	192.217	195.078	196.96655	200.59	204.3833	207.2	208.98038	(209)	(210)	(222)
7	87	88	89 to 103		104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
	Fr	Ra			Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Uub	Uut	Uuq	Uup	Uuh	Uus	Uuo
	Francium	Radium			Rutherfordium	Dubnium	Seaborgium	Bohrium	Hassium	Mitlerium	Darmstadtium	Roentgenium	Ununbium	Ununtrium	Ununquadium	Ununpentium	Ununhexium	Ununseptium	Ununoctium
	(223)	(226)			(261)	(262)	(266)	(264)	(269)	(268)	(271)	(272)	(285)	(284)	(289)	(288)	(292)		

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?

The periodic table shows the following elements and their atomic numbers:

1 H Hydrogen 1.00794	2 He Helium 4.002602																
3 Li Lithium 6.941	4 Be Beryllium 9.012182	5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.1797										
11 Na Sodium 22.989770	12 Mg Magnesium 24.3050	13 Al Aluminum 26.981538	14 Si Silicon 28.0855	15 P Phosphorus 30.973761	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948										
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955910	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938049	26 Fe Iron 55.8457	27 Co Cobalt 58.933200	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.409	31 Ga Gallium 69.723	32 Ge Germanium 72.64	33 As Arsenic 74.92160	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.798
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90447	54 Xe Xenon 131.293
55 Cs Cesium 132.90545	56 Ba Barium 137.327	57 to 71 Lanthanides	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.078	79 Au Gold 196.96655	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98038	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium (226)	89 to 103 Actinides	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (269)	109 Mt Meitnerium (268)	110 Ds Darmstadtium (271)	111 Rg Roentgenium (272)	112 Uub Ununbium (285)	113 Uut Ununtrium (284)	114 Uuq Ununquadium (289)	115 Uup Ununpentium (288)	116 Uuh Ununhexium (292)	117 Uus Ununseptium	118 Uuo Ununoctium

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.

z Longhand Configuration



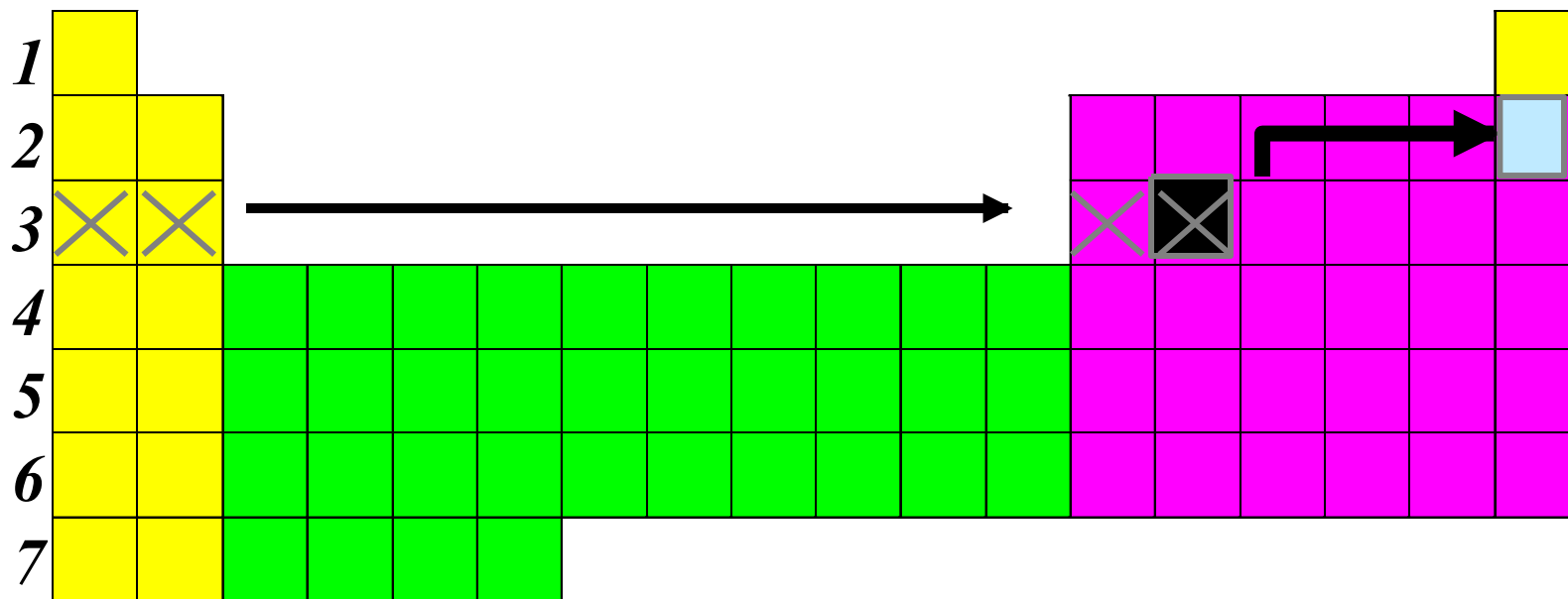
z Shorthand Configuration



1 IA		New Original																18 VIIIA	
1	H Hydrogen 1.00794											13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	2 He Helium 4.002602		
2	Li Lithium 6.941	Be Beryllium 9.012182											B Boron 10.811	C Carbon 12.0107	N Nitrogen 14.00674	O Oxygen 15.9994	F Fluorine 18.9984032	Ne Neon 20.1797	
3	Na Sodium 22.989770	Mg Magnesium 24.3050	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB	Al Aluminum 26.981538	Si Silicon 28.0855	P Phosphorus 30.973761	S Sulfur 32.066	Cl Chlorine 35.453	Ar Argon 39.948	
4	K Potassium 39.0983	Ca Calcium 40.078	Sc Scandium 44.955910	Ti Titanium 47.867	V Vanadium 50.9415	Cr Chromium 51.9961	Mn Manganese 54.938049	Fe Iron 55.8457	Co Cobalt 58.933200	Ni Nickel 58.6934	Cu Copper 63.546	Zn Zinc 65.409	Ga Gallium 69.723	Ge Germanium 72.64	As Arsenic 74.92160	Se Selenium 78.96	Br Bromine 79.904	Kr Krypton 83.798	
5	Rb Rubidium 85.4678	Sr Strontium 87.62	Y Yttrium 88.90585	Zr Zirconium 91.224	Nb Niobium 92.90638	Mo Molybdenum 95.94	Tc Technetium (98)	Ru Ruthenium 101.07	Rh Rhodium 102.90550	Pd Palladium 106.42	Ag Silver 107.8682	Cd Cadmium 112.411	In Indium 114.818	Sn Tin 118.710	Sb Antimony 121.760	Te Tellurium 127.60	I Iodine 126.90447	Xe Xenon 131.293	
6	Cs Cesium 132.90545	Ba Barium 137.327	57 to 71		Hf Hafnium 178.49	Ta Tantalum 180.9479	W Tungsten 183.84	Re Rhenium 186.207	Os Osmium 190.23	Ir Iridium 192.217	Pt Platinum 195.078	Au Gold 196.96655	Hg Mercury 200.59	Tl Thallium 204.3833	Pb Lead 207.2	Bi Bismuth 208.98038	Po Polonium (209)	At Astatine (210)	Rn Radon (222)
7	Fr Francium (223)	Ra Radium (226)	89 to 103		Rf Rutherfordium (261)	Db Dubnium (262)	Sg Seaborgium (266)	Bh Bohrium (264)	Hs Hassium (269)	Mt Meitnerium (268)	Ds Darmstadtium (271)	Rg Roentgenium (272)	Uub Ununbium (285)	Uut Ununtrium (284)	Uuq Ununquadium (289)	Uup Ununpentium (288)	Uuh Ununhexium (292)	Uus Ununseptium	Uuo Ununoctium

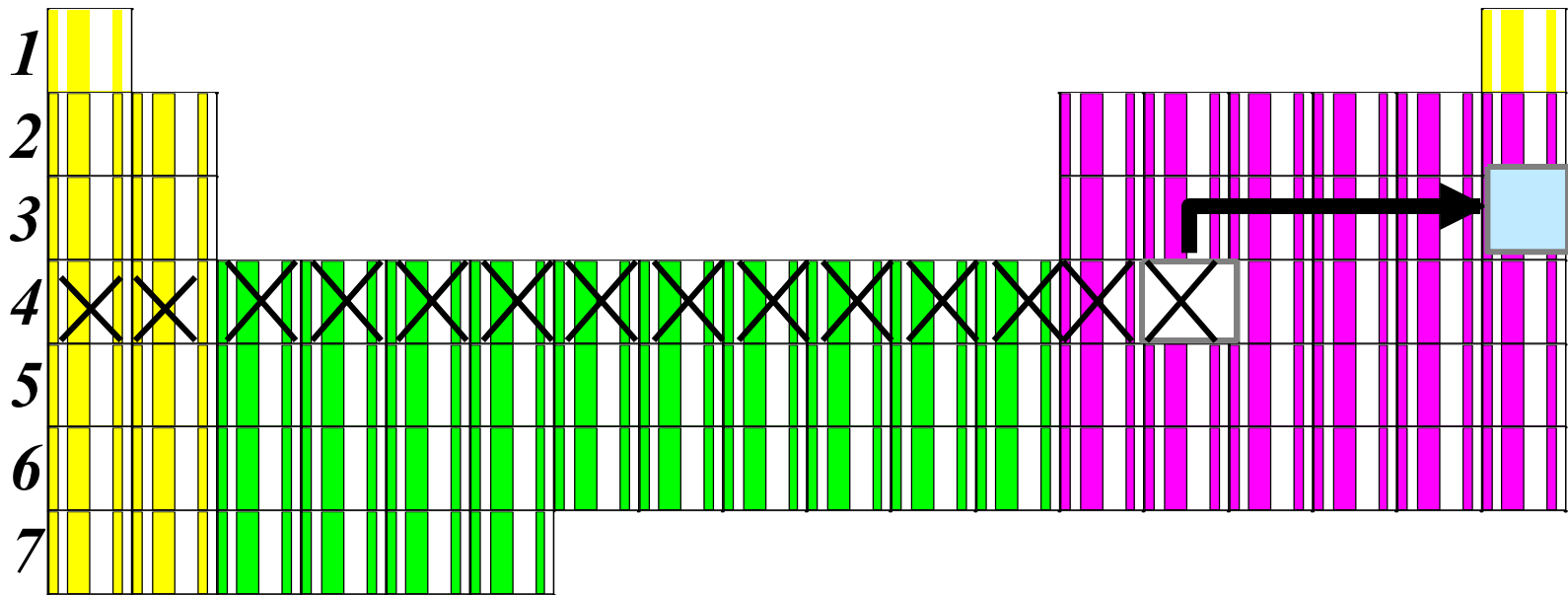
Noble Gas Shorthand

Ex – Silicon



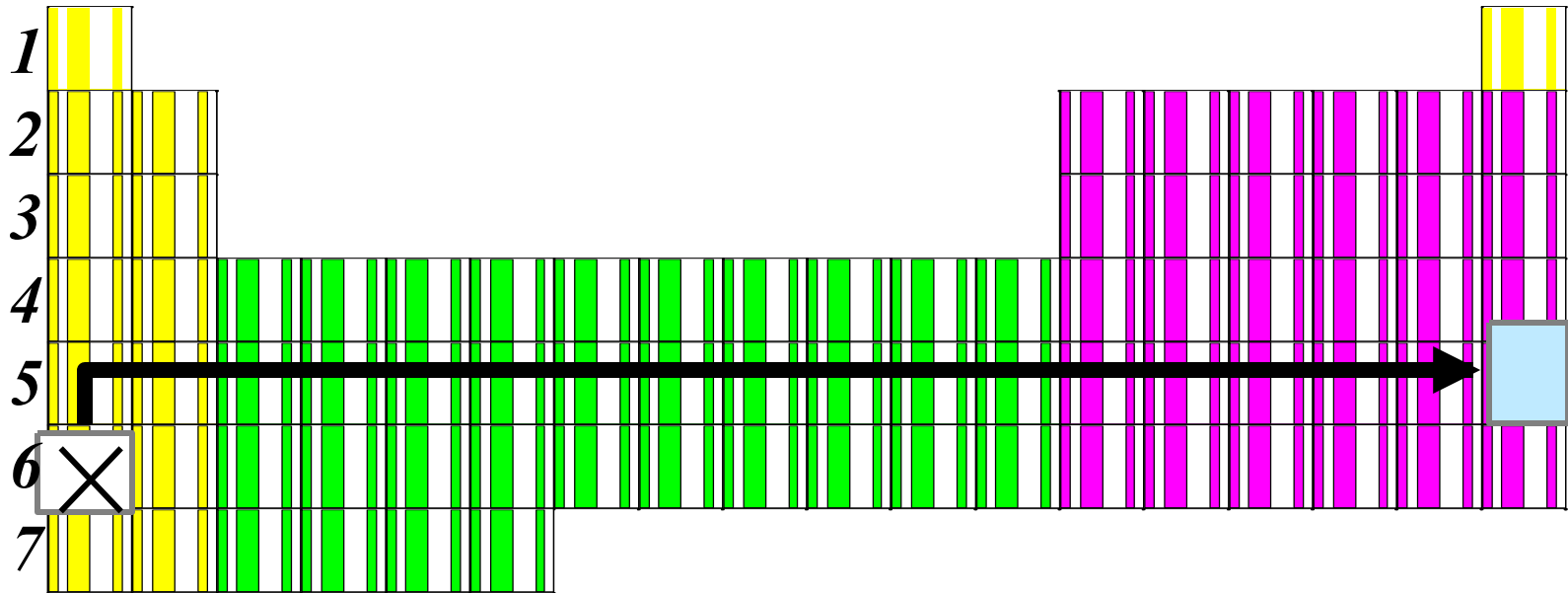
Noble Gas Shorthand

- **Ex - Germanium**



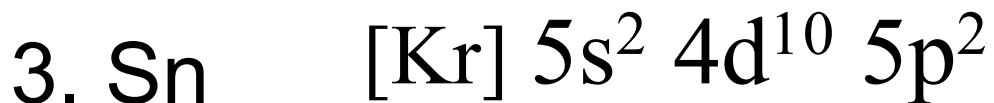
Noble Gas Shorthand

- **Ex** - Cesium



Learning Check

Use Noble Gas Shorthand write the e⁻ config.



Learning Check

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

A. 2

B. 4

C. 8

D. 10

The periodic table shows the following energy levels highlighted in blue:

- Period 1: Hydrogen (1), Helium (2)
- Period 2: Lithium (3), Beryllium (4), Boron (5), Carbon (6), Nitrogen (7), Oxygen (8), Fluorine (9), Neon (10)
- Period 3: Sodium (11), Magnesium (12), Aluminum (13), Silicon (14), Phosphorus (15), Sulfur (16), Chlorine (17), Argon (18)
- Period 4: Potassium (19), Calcium (20), Scandium (21), Titanium (22), Vanadium (23), Chromium (24), Manganese (25), Iron (26), Cobalt (27), Nickel (28), Copper (29), Zinc (30), Gallium (31), Germanium (32), Arsenic (33), Selenium (34), Bromine (35), Krypton (36)
- Period 5: Rubidium (37), Strontium (38), Yttrium (39), Zirconium (40), Niobium (41), Molybdenum (42), Technetium (43), Ruthenium (44), Rhodium (45), Palladium (46), Silver (47), Cadmium (48), Indium (49), Tin (50), Antimony (51), Tellurium (52), Iodine (53), Xenon (54)
- Period 6: Cesium (55), Barium (56), Lanthanum (57-71), Hafnium (72), Tantalum (73), Tungsten (74), Rhenium (75), Osmium (76), Iridium (77), Platinum (78), Gold (79), Mercury (80), Thallium (81), Lead (82), Bismuth (83), Polonium (84), Astatine (85), Radon (86)
- Period 7: Francium (87), Radium (88), Actinides (89-103), Rutherfordium (104), Dubnium (105), Seaborgium (106), Bohrium (107), Hassium (108), Meitnerium (109), Darmstadtium (110), Roentgenium (111), Ununbium (112), Ununtrium (113), Ununquadium (114), Ununpentium (115), Ununhexium (116), Ununseptium (117), Ununoctium (118)

Learning Check

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

A. 4

B. 8

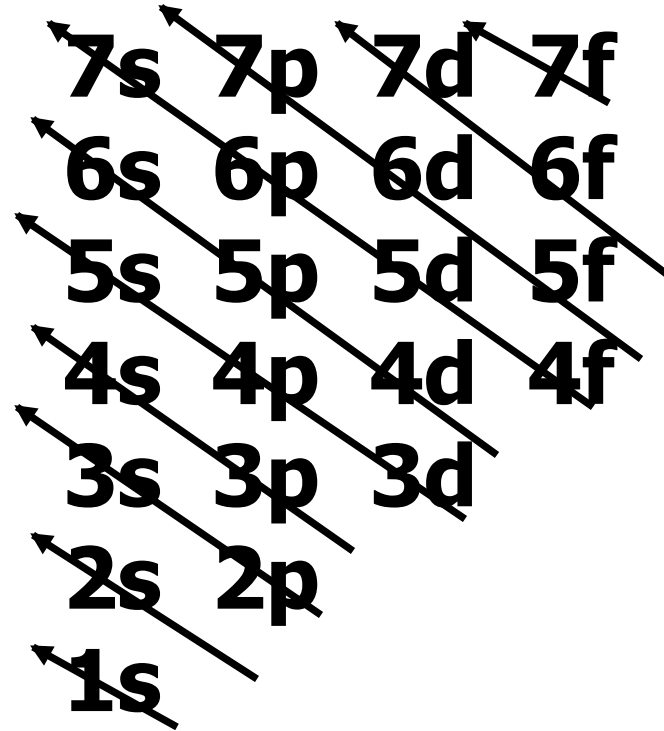
C. 10

D. 18

The periodic table shows the 3rd energy level highlighted in blue. This level includes the following elements: Scandium (Sc, 21), Titanium (Ti, 22), Vanadium (V, 23), Chromium (Cr, 24), Manganese (Mn, 25), Iron (Fe, 26), Cobalt (Co, 27), Nickel (Ni, 28), Copper (Cu, 29), Zinc (Zn, 30), Gallium (Ga, 31), Germanium (Ge, 32), Arsenic (As, 33), Selenium (Se, 34), Bromine (Br, 35), Krypton (Kr, 36), Rubidium (Rb, 37), Strontium (Sr, 38), Yttrium (Y, 39), Zirconium (Zr, 40), Niobium (Nb, 41), Molybdenum (Mo, 42), Technetium (Tc, 43), Ruthenium (Ru, 44), Rhodium (Rh, 45), Palladium (Pd, 46), Silver (Ag, 47), Cadmium (Cd, 48), Indium (In, 49), Tin (Sn, 50), Antimony (Sb, 51), Tellurium (Te, 52), Iodine (I, 53), Xenon (Xe, 54), Barium (Ba, 56), Lanthanum (La, 57-71), Radium (Ra, 88), Actinides (Ac, 89-103), and Francium (Fr, 87).

1	2											13	14	15	16	17	18
1 IA	New Original											IIIA	IVA	VA	VIA	VIIA	VIIIA
1 H Hydrogen 1.00794	2 He Helium 4.002602											13 B Boron 10.811	14 C Carbon 12.0107	15 N Nitrogen 14.00674	16 O Oxygen 15.9994	17 F Fluorine 18.9984032	18 Ar Argon 39.948
2 Li Lithium 6.941	3 Be Beryllium 9.012182											13 Al Aluminum 26.981538	14 Si Silicon 28.0855	15 P Phosphorus 30.973761	16 S Sulfur 32.06	17 Cl Chlorine 35.453	18 Kr Krypton 83.798
3 Na Sodium 22.989770	4 Mg Magnesium 24.3050	3	4	5	6	7	8	9	10	11	12	13 Al Aluminum 26.981538	14 Si Silicon 28.0855	15 P Phosphorus 30.973761	16 S Sulfur 32.06	17 Cl Chlorine 35.453	18 Ar Argon 39.948
4 K Potassium 39.0983	5 Ca Calcium 40.078	21 Sc Scandium 44.955910	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938049	26 Fe Iron 55.8457	27 Co Cobalt 58.933200	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.409	31 Ga Gallium 69.723	32 Ge Germanium 72.64	33 As Arsenic 74.92160	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.798
5 Rb Rubidium 85.4678	6 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90447	54 Xe Xenon 131.293
6 Cs Cesium 132.90545	7 Ba Barium 137.327	57 to 71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.078	79 Au Gold 196.96655	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98038	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
7 Fr Francium (223)	88 Ra Radium (226)	89 to 103	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (269)	109 Mt Meitnerium (268)	110 Ds Darmstadtium (271)	111 Rg Roentgenium (272)	112 Uub Ununbium (285)	113 Uut Ununtrium (284)	114 Uuq Ununquadium (289)	115 Uup Ununpentium (288)	116 Uuh Ununhexium (292)	117 Uus Ununseptium (294)	118 Uuo Ununoctium (294)

Correct orbital filling order



The trick to f orbitals!

Examples:

Erbium- Er 68 **[Xe] 6s²4f¹¹5d¹**

Hassium- Hs **[Rn] 7s²5f¹⁴6d⁶**

Learning Check

Use Noble Gas Shorthand write the e⁻ config.

