

Crack the Electron Code

Simulation: edtechsims.com/crack-the-electron-code

Name: _____ Class: _____ Date: _____



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By the end of this activity, you should be able to:

- identify the s, p, d and f blocks of the Periodic Table
- relate the number of columns in each block to the number of electrons its sublevel can hold
- describe how electrons fill orbitals, with a maximum of 2 electrons per orbital
- use an element's position to write its electron code, and use a code to find the element
- recognise chromium and copper as exceptions to the filling pattern

Part A: Build the Table

On the sim: Open the Build the Table tab. Drag each coloured piece into its correct place on the blank periodic table.

A1 Complete Table 1 with the colour used for each block in the sim.

[2]

s block	p block	d block	f block

Table 1

A2 On Fig. 1, draw the boundaries of the four blocks and label each block s, p, d or f. You may shade each block in its colour.

[4]

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

Fig. 1

Part B: Count the Blocks

On the sim: Open the Count the Blocks tab. Use the spotlight to count the columns in each block.

B1 Complete Table 2.

[4]

Block	Number of columns	Maximum number of electrons in the sublevel
s		
p		
d		
f		

Table 2

B2 What do you notice about the number of columns in each block and the number of electrons its sublevel can hold?

[1]

Part C: Follow the Electrons

On the sim: Open the Follow the Electrons tab. Step through the elements of Period 3.

C1 Complete Table 3.

[4]

Element	Electrons	Shell arrangement	Electron code of last electron
Na	11	2.8.1	3s ¹
Mg			
Al			
Si			
S			
Ar			

Table 3

C2 Why does the last electron of Al go into a p sublevel, but the last electron of Mg goes into an s sublevel?

[2]

Part D: The Orbital Clue

On the sim: Open The Orbital Clue tab. Read the Scientist Information Card, then fill the orbitals.

D1 State the maximum number of electrons that one orbital can hold. [1]

D2 Complete Table 4. [4]

Sublevel	Number of orbitals	Maximum number of electrons
s		
p		
d		
f		

Table 4

Part E: Crack the Code

On the sim: Open the Crack the Code tab and read the Rules.

E1 Complete the rules for writing an electron code, e.g. $3p^4$. [4]

The letter (p) tells you the _____ that the element is in.

The big number (3) tells you the _____. For the d block, it is the period minus _____. For the f block, it is the period minus _____.

The small number (4) tells you the element's _____ counting from the left of that block.

E2 Find the element that matches each code. [5]

$2p^4$	$3s^1$	$4p^5$	$3d^6$	$4s^2$

E3 Write the electron code of the last electron for each element. [5]

Al	K	Cl	Ti	Zn

E4 Chromium and copper are exceptions. Complete Table 5. [4]

Element	Predicted ending	Actual ending
Cr		
Cu		

Table 5

E5 Suggest why chromium and copper do not follow the expected pattern.

[1]

.....

.....

E6 Play all three modes of Crack the Code. Record your best score.

My score: _____ / _____

Part F: Check Your Understanding

On the sim: Open Summary tab. Answer all the questions, then click Submit.

F1 Record your score.

My score: _____ / _____

F2 Choose one question you got wrong or found difficult. Explain the correct answer in your own words.

[2]

.....

.....

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Answer Key: Crack the Electron Code

Note: the password for revealing answers for this activity is ets.

Part A

A1 s: green. p: orange. d: yellow. f: blue.

A2 s block: Groups 1–2 (plus helium). p block: Groups 13–18 (except helium). d block: Groups 3–12, Periods 4–7. f block: the two separate rows below the main table.

Part B

Block	Columns	Max electrons
s	2	2
p	6	6
d	10	10
f	14	14

B2 The number of columns equals the maximum number of electrons the sublevel can hold.

Part C

Element	Electrons	Shell arrangement	Code
Na	11	2.8.1	3s ¹
Mg	12	2.8.2	3s ²
Al	13	2.8.3	3p ¹
Si	14	2.8.4	3p ²
S	16	2.8.6	3p ⁴
Ar	18	2.8.8	3p ⁶

C2 The 3s sublevel holds only 2 electrons. Mg's 12th electron fills 3s, so Al's 13th electron must go into the next sublevel, 3p (Al is the first element in the p block).

Part D

D1 2

Sublevel	Orbitals	Max electrons
s	1	2
p	3	6
d	5	10
f	7	14

Part E

E1 block; period; 1; 2; position (column).

E2 $2p^4$: O. $3s^1$: Na. $4p^5$: Br. $3d^6$: Fe. $4s^2$: Ca.

E3 Al: $3p^1$. K: $4s^1$. Cl: $3p^5$. Ti: $3d^2$. Zn: $3d^{10}$.

Element	Predicted	Actual
Cr	$4s^2 3d^4$	$4s^1 3d^5$
Cu	$4s^2 3d^9$	$4s^1 3d^{10}$

E5 A half-filled (d^5) or completely filled (d^{10}) d sublevel is more stable, so one 4s electron moves into the 3d sublevel.

E6 Score from the sim.

Part F

F1–F2 Score from the sim; the student's correction should match the sim's explanation.