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VCE Chemistry ½

Models of Atoms & Trends in the Periodic Table [0.1]

Workshop

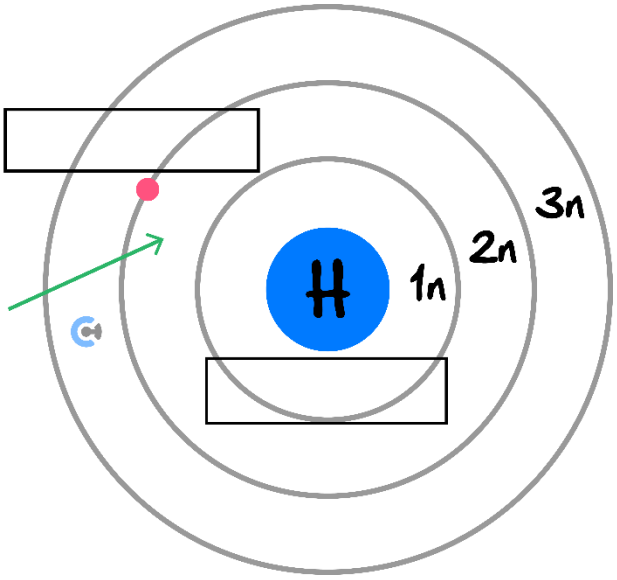
Section A: Recap

Rutherford's Gold Foil Experiment

- **Alpha particles** were fired at a **thin gold sheet.**
- Some particles **reflected** back, but most particles **passed through.**
- The majority of an atom is **empty space.**

Ground State

As positive _____ negative, electron naturally moves to the _____ shell



- Electrons always try to go to the _____ energy level possible.
- The first electron shell is known as **the ground state.**

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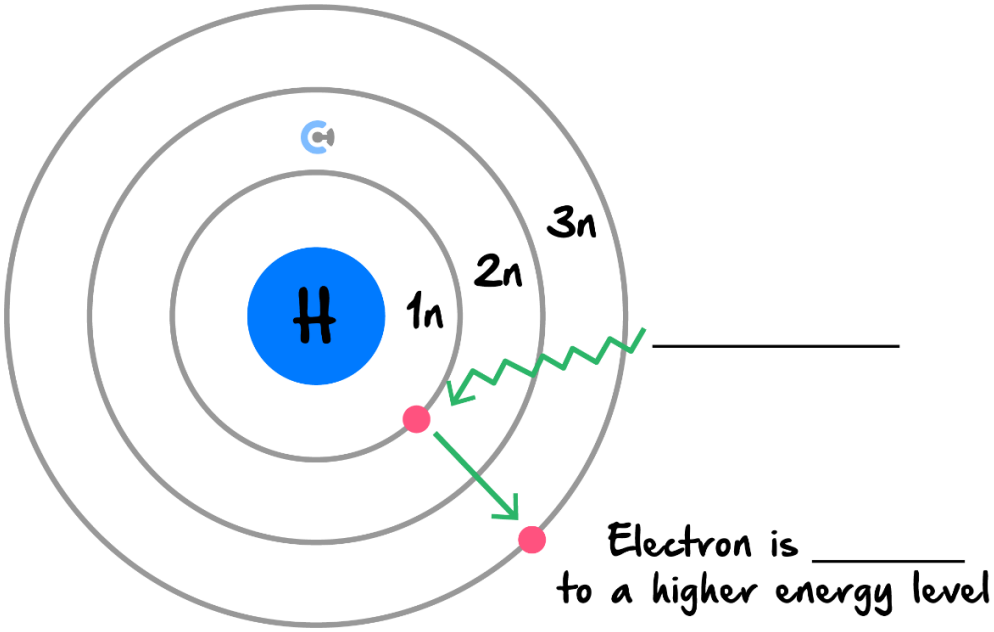
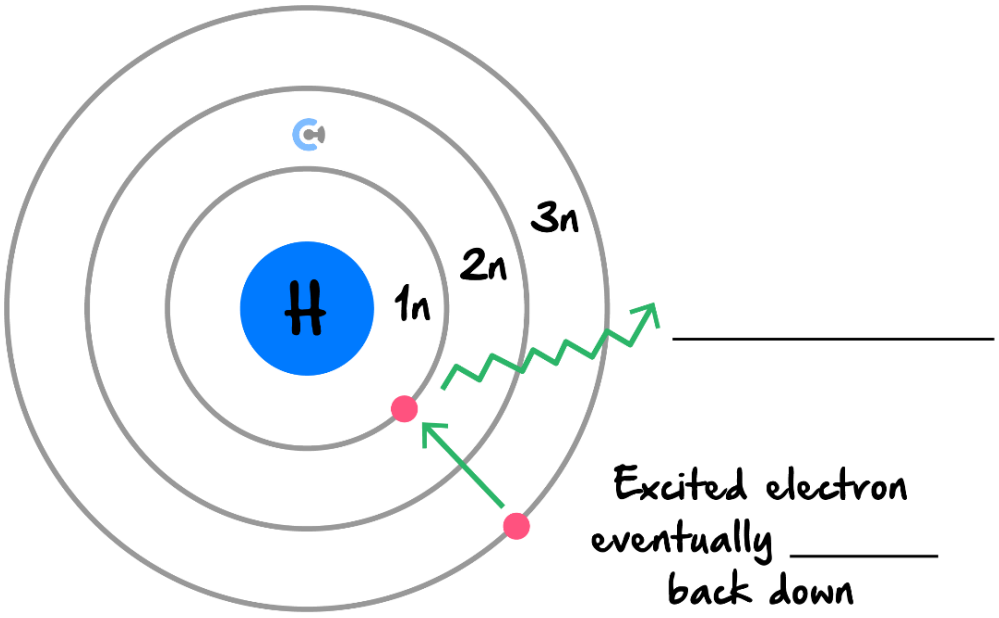
Electron Movement between Shells

- When electrons are moved up to a higher energy level, energy is **[inputted] / [outputted].**



- When electrons move down to a lower energy level, energy is **[inputted] / [outputted]** as _____.

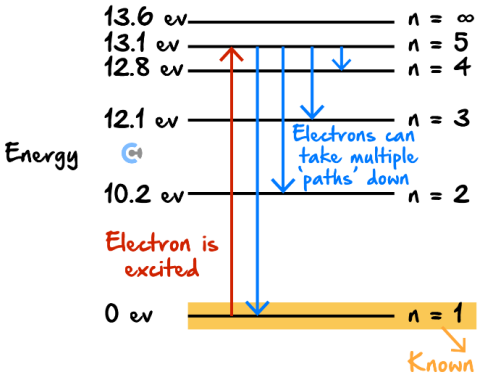


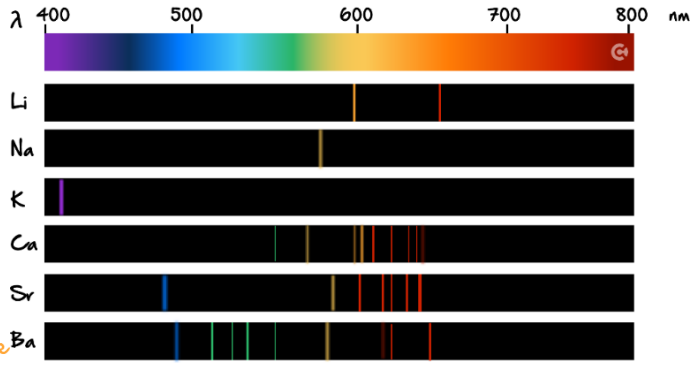
Electron Shell

- **Definition:** A _____ in the electron cloud of an atom at a _____ energy level, whereby an electron can be found.

Emission Spectra

- Electrons can take any path down, each with a different _____, resulting in different _____ emitted.
- Each element has a _____ spectra of light when its electrons return to the ground state after being excited.





Maximum Number of Electrons

- Maximum number of electrons that each shell can hold is:

$$\textbf{\textit{Maximum Number of Electrons}}: 2 \times n^2$$

  - n – Shell Number

Valence Shell / Valence Electrons

- **Definition:**
  - Valence – Outer.
  - Valence Shell – Outermost electron shell.
  - Valence Electrons – Electrons in the _____ electron shell.

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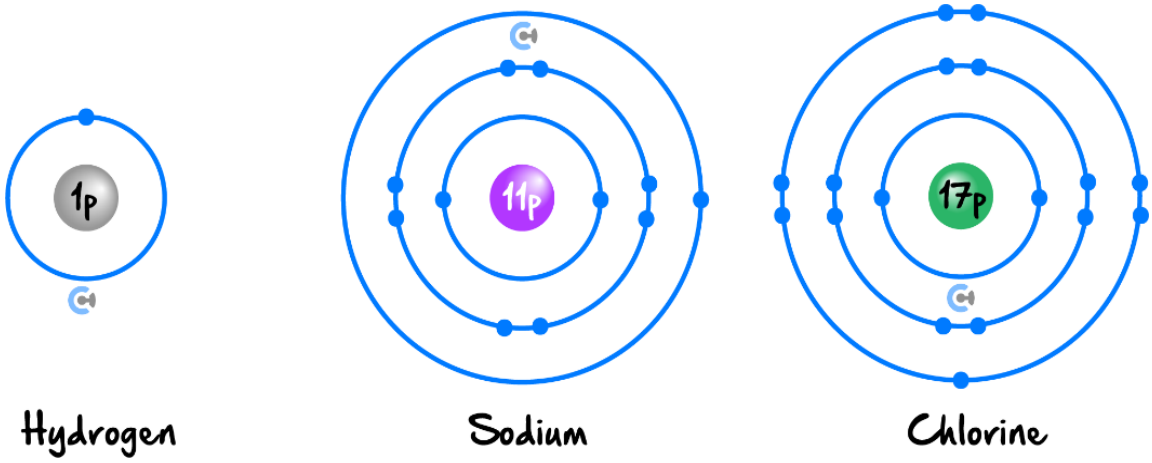
Octet Rule

- **Definition:** The valence electron shell can only hold a maximum of _____ electrons.

Shell Model Diagrams

- Shows the number of electrons which are present in each electron shell of an atom.



Question 1 (2 marks) **Walkthrough.**

Draw the shell model diagram for calcium.

Sub-Section: Schrodinger's Model

Orbital

- **Definition:** A region of space in which electrons exist _____, not in fixed discrete energy levels.
- **Feature**: Can hold up to 2 electrons.

Orbital Capacity

- There are four types of orbitals: s, p, d and f.

Type of Orbital	Number of Orbitals
s	
p	
d	
f	

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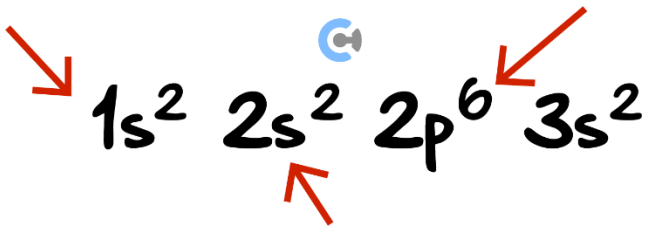
Subshells

- The number of subshells in a given shell matches the shell number.

Shell number (n)	Number of Subshells	Subshell Symbol	Number of Orbitals	Maximum Number of Electrons in the Subshell	Total Number of Electrons in the Shell
1	1	s			
2	2	s			
		p			
3	3	s			
		p			
		d			
4	4	s			
		p			
		d			
		f			

Schrödinger's Electron Configurations

- **Representation:**



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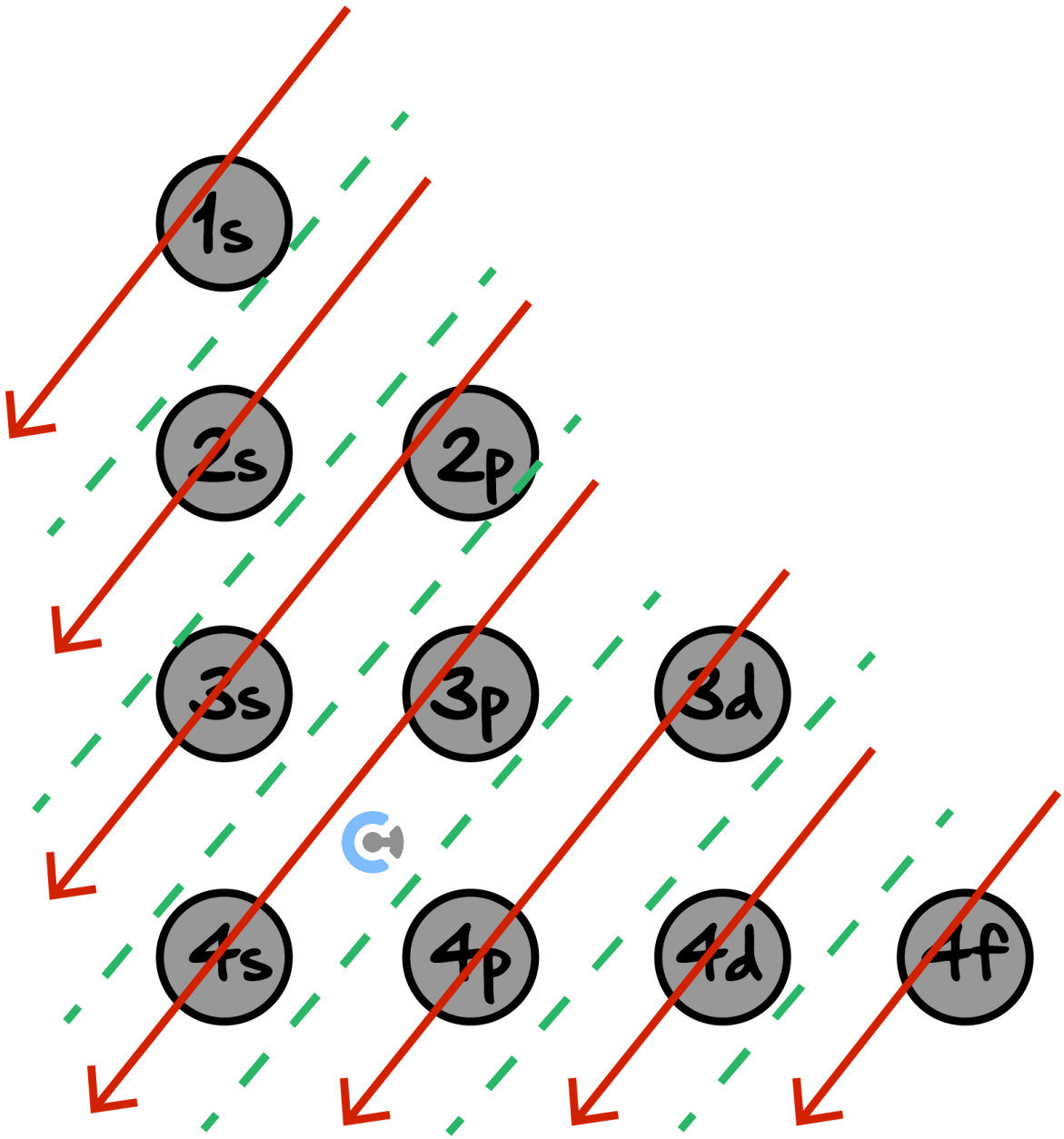
Schrodinger's Model Sub-Shell Energy Levels

- Each subshell has different energy levels.
- For electron configuration, start from the lower energy levels and fill up to the higher energy levels.



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Excited State Electron Configurations

If electrons are in higher energy levels without lower ones being filled then,	Excited state (e.g., $\mathbf{4^{th}}$ shell filled before $\mathbf{3^{rd}}$).
If lower energy subshells are not filled but higher ones are being filled then,	Excited state (e.g., $3p$ orbital is filled but not $3s$).

Chromium and Copper: Atypical Electron Configurations

- Their Schrodinger electron configurations are:

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

Copper: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$

- Due to an **increased stability** in these forms.

Condensed Electron Configuration

- **Use**: To 'get rid' of entire shells-worth of notation, for tidiness and efficiency.
- **Notation:** _____ in square brackets, as these are the elements with _____ which may be condensed.

Question 2 (2 marks) **Walkthrough.**

a. Write the Schrödinger's electron configuration for cobalt. (1 mark)

_____

b. Write the condensed Schrödinger's electron configuration for Chromium (Cr). (1 mark)

_____

Sub-Section: The Periodic Table

The Periodic Table

- Contains all _____ known elements, arranged in terms of **increasing** _____.
- The periodic table arranges all of the chemical elements in terms of _____.

Periodic table of the elements

1 H 1.0 Hydrogen																	2 He 4.0 Helium
3 Li 6.9 Lithium	4 Be 9.0 Beryllium											5 B 10.8 Boron	6 C 12.0 Carbon	7 N 14.0 Nitrogen	8 O 16.0 Oxygen	9 F 19.0 Fluorine	10 Ne 20.2 Neon
11 Na 23.0 Sodium	12 Mg 24.3 Magnesium											13 Al 27.0 Aluminium	14 Si 28.1 Silicon	15 P 31.0 Phosphorus	16 S 32.1 Sulfur	17 Cl 35.5 Chlorine	18 Ar 39.9 Argon
19 K 39.1 Potassium	20 Ca 40.1 Calcium	21 Sc 45.0 Scandium	22 Ti 47.9 Titanium	23 V 50.9 Vanadium	24 Cr 52.0 Chromium	25 Mn 54.9 Manganese	26 Fe 55.8 Iron	27 Co 58.9 Cobalt	28 Ni 58.7 Nickel	29 Cu 63.5 Copper	30 Zn 65.4 Zinc	31 Ga 69.7 Gallium	32 Ge 72.6 Germanium	33 As 74.9 Arsenic	34 Se 79.0 Selenium	35 Br 79.9 Bromine	36 Kr 83.8 Krypton
37 Rb 85.5 Rubidium	38 Sr 87.6 Strontium	39 Y 88.9 Yttrium	40 Zr 91.2 Zirconium	41 Nb 92.9 Niobium	42 Mo 96.0 Molybdenum	43 Tc (98) Technetium	44 Ru 101.1 Ruthenium	45 Rh 102.9 Rhodium	46 Pd 106.4 Palladium	47 Ag 107.9 Silver	48 Cd 112.4 Cadmium	49 In 114.8 Indium	50 Sn 118.7 Tin	51 Sb 121.8 Antimony	52 Te 127.6 Tellurium	53 I 126.9 Iodine	54 Xe 131.3 Xenon
55 Cs 132.9 Cesium	56 Ba 137.3 Barium	57–71 Lanthanoids	72 Hf 178.5 Hafnium	73 Ta 180.9 Tantalum	74 W 183.8 Tungsten	75 Re 186.2 Rhenium	76 Os 190.2 Osmium	77 Ir 192.2 Iridium	78 Pt 195.1 Platinum	79 Au 197.1 Gold	80 Hg 200.6 Mercury	81 Tl 204.4 Thallium	82 Pb 207.2 Lead	83 Bi 209.0 Bismuth	84 Po (210) Polonium	85 At (210) Astatine	86 Rn (222) Radon
87 Fr (223) Francium	88 Ra (226) Radium	89–103 Actinoids	104 Rf (261) Rutherfordium	105 Db (262) Dubnium	106 Sg (266) Seaborgium	107 Bh (264) Bohrium	108 (267) Hassium	109 Mt (268) Meitnerium	110 Ds (271) Darmstadtium	111 Rg (272) Roentgenium	112 Cn (285) Copernicium	113 Nh (280) Nihonium	114 Fl (289) Flerovium	115 Mc (289) Moscovium	116 Lv (292) Livermorium	117 Ts (294) Tennessine	118 Og (294) Oganesson

Atomic number: 79 — Symbol of element: Au — Relative atomic mass: 197.0 — Name of element: Gold

57 La 138.9 Lanthanum	58 Ce 140.1 Cerium	59 Pr 140.9 Praseodymium	60 Nd 144.2 Neodymium	61 Pm (145) Promethium	62 Sm 150.4 Samarium	63 Eu 152.0 Europium	64 Gd 157.3 Gadolinium	65 Tb 158.9 Terbium	66 Dy 162.5 Dysprosium	67 Ho 164.9 Holmium	68 Er 167.3 Erbium	69 Tm 168.9 Thulium	70 Yb 173.1 Ytterbium	71 Lu 175.0 Lutetium

89 Ac (227) Actinium	90 Th 232.0 Thorium	91 Pa 231.0 Protactinium	92 U 238.0 Uranium	93 Np (237) Neptunium	94 Pu (244) Plutonium	95 Am (243) Americium	96 Cm (247) Curium	97 Bk (247) Berkelium	98 Cf (251) Californium	99 Es (252) Einsteinium	100 Fm (257) Fermium	101 Md (258) Mendelevium	102 No (259) Nobelium	103 Lr (262) Lawrencium

The value in brackets indicates the mass number of the longest-lived isotope

- There are 7 horizontal **rows** in the periodic table called _____.
- The **period** number also represents how many _____ the element has.

Periodic table of the elements

s-block

p-block

d-block

f-block

Atomic number 79 | Symbol of element: Au
Relative atomic mass 197.0 | Name of element: Gold

1 H 1.0 Hydrogen																	2 He 4.0 Helium
3 Li 6.9 Lithium	4 Be 9.0 Beryllium											5 B 10.8 Boron	6 C 12.0 Carbon	7 N 14.0 Nitrogen	8 O 16.0 Oxygen	9 F 19.0 Fluorine	10 Ne 20.2 Neon
11 Na 23.0 Sodium	12 Mg 24.3 Magnesium											13 Al 27.0 Aluminium	14 Si 28.1 Silicon	15 P 31.0 Phosphorus	16 S 32.1 Sulfur	17 Cl 35.5 Chlorine	18 Ar 39.9 Argon
19 K 39.1 Potassium	20 Ca 40.1 Calcium	21 Sc 45.0 Scandium	22 Ti 47.9 Titanium	23 V 50.9 Vanadium	24 Cr 52.0 Chromium	25 Mn 54.9 Manganese	26 Fe 55.8 Iron	27 Co 58.9 Cobalt	28 Ni 58.7 Nickel	29 Cu 63.5 Copper	30 Zn 65.4 Zinc	31 Ga 69.7 Gallium	32 Ge 72.6 Germanium	33 As 74.9 Arsenic	34 Se 79.0 Selenium	35 Br 79.9 Bromine	36 Kr 83.8 Krypton
37 Rb 85.5 Rubidium	38 Sr 87.6 Strontium	39 Y 88.9 Yttrium	40 Zr 91.2 Zirconium	41 Nb 92.9 Niobium	42 Mo 96.0 Molybdenum	43 Tc (98) Technetium	44 Ru 101.1 Ruthenium	45 Rh 102.9 Rhodium	46 Pd 106.4 Palladium	47 Ag 107.9 Silver	48 Cd 112.4 Cadmium	49 In 114.8 Indium	50 Sn 118.7 Tin	51 Sb 121.8 Antimony	52 Te 127.6 Tellurium	53 I 126.9 Iodine	54 Xe 131.3 Xenon
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The value in brackets indicates the mass number of the longest-lived isotope

Groups

- **Definition:**
  - The 18 vertical columns of elements are called _____.
  - Groups **1-2 and 13-18** tells the number of _____.

Space for Personal Notes

Groups & Valence Electrons

Periodic table of the elements

1	2	3–12	13	14	15	16	17	18
1 H 1.0 Hydrogen								2 He 4.0 Helium
3 Li 6.9 Lithium	4 Be 9.0 Beryllium		5 B 10.8 Boron	6 C 12.0 Carbon	7 N 14.0 Nitrogen	8 O 16.0 Oxygen	9 F 19.0 Fluorine	10 Ne 20.2 Neon
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Atomic number: 79 — Symbol of element: Au — Relative atomic mass: 197.0 — Name of element: Gold

Transition metals

21	22	23	24	25	26	27	28	29	30
Sc 45.0 Scandium	Ti 47.9 Titanium	V 50.9 Vanadium	Cr 52.0 Chromium	Mn 54.9 Manganese	Fe 55.8 Iron	Co 58.9 Cobalt	Ni 58.7 Nickel	Cu 63.5 Copper	Zn 65.4 Zinc
Y 88.9 Yttrium	Zr 91.2 Zirconium	Nb 92.9 Niobium	Mo 96.0 Molybdenum	Tc (98) Technetium	Ru 101.1 Ruthenium	Rh 102.9 Rhodium	Pd 106.4 Palladium	Ag 107.9 Silver	Cd 112.4 Cadmium
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57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La 138.9 Lanthanum	Ce 140.1 Cerium	Pr 140.9 Praseodymium	Nd 144.2 Neodymium	Pm (145) Promethium	Sm 150.4 Samarium	Eu 152.0 Europium	Gd 157.3 Gadolinium	Tb 158.9 Terbium	Dy 162.5 Dysprosium	Ho 164.9 Holmium	Er 167.3 Erbium	Tm 168.9 Thulium	Yb 173.1 Ytterbium	Lu 175.0 Lutetium

89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac (227) Actinium	Th 232.0 Thorium	Pa 231.0 Protactinium	U 238.0 Uranium	Np (237) Neptunium	Pu (244) Plutonium	Am (243) Americium	Cm (247) Curium	Bk (247) Berkelium	Cf (251) Californium	Es (252) Einsteinium	Fm (257) Fermium	Md (258) Mendelevium	No (259) Nobelium	Lr (262) Lawrencium

The value in brackets indicates the mass number of the longest-lived isotope

- Across any period in the **d-block**, the number of **valence electrons** remains the same at **two**.
- The only exceptions are group 6 and 11 (chromium/copper exceptions).
- In the s- and p-blocks, the number of valence electrons corresponds to the _____.

Noble Gases

- Elements in **group 18** are known as the noble gases. They do **not** participate in any type of intramolecular bonding, as they have **full outer shells.**

Sub-Section: Periodic Table Trends

First Ionisation Energy

- **Definition:** The first ionisation energy is the energy required to _____ one electron from an element in a gaseous state.

First Ionisation Energy Across a Period

- The first ionisation energy **increases** across the period, as it becomes easier to gain electrons instead of losing them to obtain a **full outer shell**.

First Ionisation Energy Down a Group

- First ionisation energy **[increases]/[decreases]** down the **group** as the valence electrons are located **further** from the nucleus, and thus, feel a **weaker** pull.

Sample Response: First Ionisation Energy

- As the effective nuclear charge of x is higher, it feels a **greater attraction** to the nucleus.
- Therefore, electrons are **harder to remove** from the atom.
- **More energy is required** to remove them from the atom.
- They have a **greater** first ionisation energy.

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Effective Nuclear Charge/Core Charge

- **Definition:**
  - The effective nuclear charge is the attractive force 'felt' by the valence electrons.
  - First ionisation energy and other trends can be discussed as **effective nuclear charge**.
- Formulae:

$$Effective\ nuclear\ charge = No.\ of\ protons - No.\ of\ core\ electrons$$

Metallic Character

- The metallic character is the tendency of an element to **lose electrons** and form _____.

Non-Metallic Character

- The non-metallic character is the tendency of an element to **gain electrons** and form _____.

Electronegativity

- **Definition:**
  - Electronegativity is the ability of an atom to attract _____ towards itself.

Atomic Radius

- **Definition:**
  - The atomic radius is the _____ of the atom or the distance between the centre of the nucleus to valence electrons.

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Electronegativity and Atomic Radius Across a Period

- Electronegativity **increases** across the period as **effective nuclear charge increases.**
- As electronegativity increases, electrons are pulled closer to the nucleus, **decreasing the atomic radius** of the atom.

Properties Going Down a Group

Effective Nuclear Charge	Atomic Radius	Electronegativity
Stays the same	Increases	Decreases

Sample Response: Electronegativity

- As we go across a period, core charge **increases**, so electrons have a **greater** attraction to the nucleus.
- Furthermore, as we go up a group, the **atomic radius** decreases as we have fewer shells, so the attraction between the nucleus and electrons **increases.**
- Therefore, electronegativity **increases.**

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Question 3 (3 marks) **Walkthrough.**

a. Rank the following three atoms in terms of increasing atomic size. (1 mark)

Pb, Bi, Cs

_____

b. Explain why this is the case. (2 marks)

_____

_____

_____

_____

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Section B: Warm Up (14 Marks)

INSTRUCTION: 14 Marks. 9 Minutes Writing.

Question 4 (2 marks)

For the following elements, determine the number of protons, neutrons, and electrons present in the isotope.

a. $^{16}_{8}O^{2-}$ (1 mark)

_____

b. $^{37}_{17}Cl$ (1 mark)

_____

Question 5 (2 marks)

For each of the following elements, write out their Bohr electronic configuration.

a. Carbon (0.5 marks)

b. Chlorine (0.5 marks)

c. Potassium (0.5 marks)

d. Scandium (0.5 marks)

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Question 6 (3 marks)

Provide the Schrodinger's electron configuration for each of the following elements:

a. B (1 mark)

_____

b. Na (1 mark)

_____

c. Fe (1 mark)

_____

Question 7 (2 marks)

Write the condensed Schrodinger's electron configuration for each of the following elements:

a. Ni (1 mark)

_____

b. Cu (1 mark)

_____

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Question 8 (2 marks)

For each of the following sets, rank them in terms of increasing first ionisation energy.

a. N, Be, O. (0.5 marks)

_____

b. Mg, P, Al. (0.5 marks)

_____

c. S, Cl, Si. (0.5 marks)

_____

d. H, C, F. (0.5 marks)

_____

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Question 9 (3 marks)

a. For the following elements, state their effective nuclear charges.

i. Fluorine (0.5 marks)

_____

ii. Magnesium (0.5 marks)

_____

iii. Sulphur (0.5 marks)

_____

b. Rank these elements above in terms of decreasing atomic radius. (1.5 marks)

_____

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Section C: Ramping Up (12 Marks)

INSTRUCTION: 12 Marks. 9 Minutes Writing.

Question 10 (1 mark)

What is the Bohr electronic configuration for an atom of calcium?

A. 2,8,10

B. 2,8,6,4

C. 2,8,2,8

D. 2,8,8,2

Question 11 (5 marks)

The Periodic Table is systemically designed to classify elements.

a. Explain why there are two elements in the first period, hydrogen and helium. (2 marks)

_____

_____

_____

b. Helium is placed into group 8, but by normal conventions it should be in group 2. Explain this observation. (2 marks)

_____

_____

_____

c. State the Octet Rule. (1 mark)

_____

_____

Question 12 (6 marks)

For the following, choose which element would have a lower first ionisation energy, make sure to include effective nuclear charges.

a. Sodium and Chlorine. (3 marks)

_____

_____

_____

_____

b. Oxygen and Sulphur. (3 marks)

_____

_____

_____

_____

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Section D: Getting Trickier I (12 Marks)

INSTRUCTION: 12 Marks. 10 Minutes Writing.

Question 13 (7 marks)

Orbitals and subshells are important to our understanding of atom behaviour, particularly looking at electrons.

a. What specifically occurs when an electron is excited past the final energy level that exists for an atom? (1 mark)

_____

b. State the composition of the 3^{rd} shell of an atom. (1 mark)

_____

c. Explain why the exact location of an electron inside an atom is not known. (2 marks)

_____

_____

_____

d. Write the Schrödinger electronic configuration for an atom of Chromium. (1 mark)

_____

e. Explain your reasoning behind the configuration you wrote in **part d.** (2 marks)

_____

_____

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Question 14 (5 marks)

In the workbook, you've explored multiple ways to represent the atom through different models and methods.

a. Explain what the main observation and findings, that were gained from Rutherford's experiment. (2 marks)

_____

_____

_____

b. A student argues that if electrons are in constant motion, then the alpha particles that are shot by Rutherford should've hit the electrons a lot. Evaluate this statement. (2 marks)

_____

_____

_____

c. Draw the shell model diagram for an atom of phosphorus. (1 mark)

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Section E: Getting Trickier II (12 Marks)

INSTRUCTION: 12 Marks. 11 Minutes Writing.

Question 15 (1 mark)

What is the Schrödinger electronic configuration for an atom of neon?

A. $1s^2 2s^2 2p^5$

B. $1s^2 2s^2 2p^6$

C. $1s^2 2s^2 2p^6 3s^2$

D. $1s^2 2s^2 2p^5 3s^1$

Question 16 (11 marks)

A chemist wishes to create charged versions of certain elements such as lithium. To do this, the chemist creates a high-energy machine that can remove electrons from the atom.

a. What is a charged element referred to? (1 mark)

_____

b. How many electrons must be removed to form the lithium ion? (1 mark)

_____

c. Explain what is meant by first ionisation energy, and why some atoms have a higher first ionisation energy than others. (2 marks)

_____

_____

_____

d. Would boron or oxygen be expected to have a higher first ionisation energy? Why? (2 marks)

_____

_____

_____

e. During the same experiment, the chemist realises that the charge also plays a role in how much energy it takes to remove electrons from an atom. Explain what core charge is, and how it can be calculated. (3 marks)

_____

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_____

f. What is the effective nuclear charge of boron? (1 mark)

_____

g. Arrange the following atoms in order of lowest to highest core charge: Fe, Ti, Zn. (1 mark)

_____

Let's take a BREAK!

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Section F: VCAA-Level Questions I (11 Marks)

INSTRUCTION: 11 Marks. 0.5 Minutes Reading. 10 Minutes Writing.

Question 17 (11 marks)

a. Describe how elements are arranged in the periodic table based on their electronic configurations. (2 marks)

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b. How does atomic radius change, when we go:

i. Across a period. (1 mark)

_____

_____

ii. Down a group. (1 mark)

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c. Explain how electronegativity is related to the effective nuclear charge. (2 marks)

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d. Hence, compare the electronegativities of Carbon and Fluorine. (3 marks)

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e. Why are group 1 metals, the ones with the lowest first ionisation energies in their respective periods? (2 marks)

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Section G: Multiple Choice Questions (10 Marks)

INSTRUCTION: 10 Marks. 10 Minutes Writing.

Question 18 (1 mark)

Which one of the following aspects determines the light emitted from an electron descending to its ground state?

A. Whether the atom is a cation or an anion.

B. The shell of the current electron.

C. The atomic number of the atom.

D. Energy difference between energy levels.

Question 19 (1 mark)

The energy difference between the shells $n = 5$ and $n = 3$ is greater than the energy difference between $n = 5$ and $n = 2$. Is this statement true or false?

A. True

B. False

Question 20 (1 mark)

Which of the following statements about atomic models is correct?

A. Schrödinger's model explains why the $4s$ subshell is filled before the $3d$ subshell.

B. Bohr's model explains why each shell can only fill $2n^2$ electrons.

C. Rutherford's model explains that electrons behave like light waves.

D. Both Bohr and Rutherford suggested the idea that electrons can inhabit discrete energy levels.

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Question 21 (1 mark)

What block does the element Fe belong to?

A. *S*-block

B. *P*-block

C. *D*-block

D. *F*-block

Question 22 (1 mark)

Why does the second period of the periodic table have 8 elements?

A. It contains only s and p orbitals.

B. It includes, s, p, and d orbitals.

C. It contains 8 valence electrons.

D. It follows the Octet Rule.

Question 23 (1 mark)

Which of the following elements has the highest first ionisation energy?

A. Sodium

B. Silicon

C. Chlorine

D. Sulphur

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Question 24 (1 mark)

What is the term for the energy required to remove the outermost electron from an atom?

A. Atomic Radius

B. Electronegativity

C. First ionisation Energy

D. Electron Affinity

Question 25 (1 mark)

Noble gases have the highest first ionisation energies because:

A. They have low atomic numbers.

B. They have incomplete valence shells.

C. They are in the *p*-block.

D. They are the most stable group.

Question 26 (1 mark)

What is the effective nuclear charge experienced by Phosphorus?

A. +3

B. +5

C. +6

D. +7

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Question 27 (1 mark)

As you go across a period in the periodic table, the atomic radius:

A. Increases.

B. Decreases.

C. Remains constant.

D. Varies based on their isotope.

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Section H: VCAA-Level Questions II (13 Marks)

INSTRUCTION: 13 Marks. 0.5 Minutes Reading. 12 Minutes Writing.

Question 28 (7 marks)

Consider the Schrödinger and Bohr models of the atom.

a. Compare the two models, highlighting their main differences. (3 marks)

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b. Explain what the Octet rule is. (1 mark)

_____

_____

c. Draw the shell model diagram for an atom of Argon. (1 mark)

d. Write out its Bohr electronic configuration. (1 mark)

_____

e. Hence, what can be said about the Argon atom in relation to the Octet rule? (1 mark)

_____

_____

Question 29 (6 marks)

Consider the emission spectrum that is observed with every element.

a. Are these emission spectra unique for each element? Explain. (2 marks)

_____

_____

b. What aspect of the Bohr model of the atom do emission spectra prove? (2 marks)

_____

_____

c. According to the Bohr model, as the shell number increases for an atom, what else also increases? (1 mark)

_____

d. Suggest a way that we can observe or verify that emission spectra between Hydrogen and Helium will be unique. (1 mark)

_____

_____

Section I: Summary

What have we learnt today?

TIPS

- Use the s, p, d, and f blocks in the periodic table to write Schrodinger's Electronic Configurations.
- The most electronegative element is on the top-right of the periodic table, and most trends are similar to that.

Pitfalls

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Section J: Extension Questions (29 Marks)

Question 30 (1 mark)

What are the rows in the periodic table called?

A. Groups

B. Periods

C. Blocks

D. Rows

Question 31 (1 mark)

Which of the following elements has the lowest electronegativity?

A. Lithium

B. Oxygen

C. Fluorine

D. Neon

Question 32 (1 mark)

Which of the following ranks in increasing atomic radius?

A. Mg, S, Si

B. Si , S, Mg

C. S, Si, Mg

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Question 33 (7 marks)

Nitrogen is the element that comprises the majority of Earth's atmosphere.

a. Nitrogen gas naturally exists as N_2.

i. Is this considered an element? Explain. (2 marks)

_____

_____

ii. Can a compound be considered a molecule but not an element? Justify your answer by providing an example. (2 marks)

_____

_____

_____

b. Suggest a reason as to why nitrogen cannot be found naturally as N. (1 mark)

_____

_____

c. Explain why the nucleus of atoms cannot change, or why we can't just turn an element into another element. (2 marks)

_____

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Question 34 (7 marks)

Leo is exploring some of the basic properties of the periodic table, focusing on the arrangement of elements within the table.

a. What is the "*D* block?" Explain with reference to an example. (2 marks)

_____

_____

_____

b. Provide an example of an "*S* block" element. (1 mark)

_____

c. Leo wishes to understand why some atoms are stable in their pure state, whereas others are unstable in their pure state. To do this, he compares Neon with fluorine. With reference to these two atoms, explain this finding. (3 marks)

_____

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_____

d. What group are noble gases found in? (1 mark)

_____

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Question 35 (3 marks)

Electronegativity is a key factor to consider for chemists when formulating new compounds to establish the polarity of said compounds. Explain what is meant by electronegativity. Refer to factors that can determine electronegativity, alongside the link between electronegativity and atomic radius.

Question 36 (9 marks)

Saanvi wants to annotate her VCE chemistry period table, to be the star pupil in her class. To do this, she wishes to outline several trends and key elements on her periodic table.

a. Saanvi first highlights the most electronegative atom on her periodic table. What would this be, and why? (2 marks)

b. Next, Saanvi labels each row. However, she is unsure of whether these are called groups or periods. What name should Saanvi label the rows as, and what properties do elements in the same row have? (2 marks)

c. Saanvi indicates that the first ionisation energy decreases going from left to right. Is this correct? Why or why not? (2 marks)

_____

_____

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d. Would boron or aluminium be expected to have a higher electronegativity? Explain why with reference to relevant trends. (2 marks)

_____

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_____

e. Rank each of the following atoms in terms of increasing atomic radius: Al, Cl, Si. (1 mark)

_____

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