The Periodic Table

6092 CHEMISTRY GCE ORDINARY LEVEL SYLLABUS (2020)

The Periodic Table of Elements

Alkali Metals | Transition Elements | Halogens | Noble Gases

Group	I	II											III	IV	V	VI	VII	0
																		2 He helium 4
	3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
	11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
	37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
	55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
	87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key: proton (atomic) number / atomic symbol / name / relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

Properties of elements in a period
- Same number of electron shells
- Gradual change in properties

Properties of elements in a group
- Same number of valence electrons
- Similar reactivity

Trend across a period
- Number of protons increases
- Atomic radius decreases

Trend down a group
- Number of electron shells increases
- Atomic radius increases

1 Which statement about the elements in the Periodic Table is correct?

v standard qn

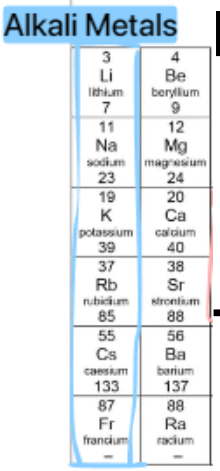
A Elements are arranged in order of their nucleon number.

B Elements are arranged in order of their proton number.

C The period number is related to the number of electrons in the outer shell.

D The reactivity of Group 1 elements decreases down the group.

Special Groups



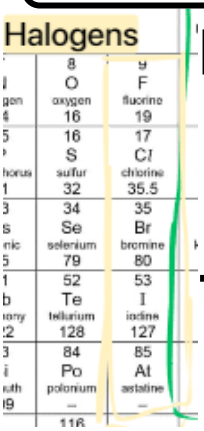
Physical Properties

- Soft and easily cut
- Low melting and boiling point
- Low density
- Good conductors of electricity and heat
- Shiny and silvery in color

Trends Down the Group

- Melting and boiling points decrease
- Reactivity of Alkali Metal increase

Group I elements are called alkali metals as they react with water to give alkaline solutions.



Physical Properties

- Colored non-metals
- Exists as diatomic molecules
- Low melting and boiling points

Trends Down the Group

- Reactivity decreases

Displacement Reactions:

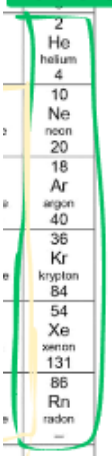
A more reactive halogen is able to displace a less reactive halogen from an aqueous solution of its ions.

$$Cl_2\,(aq) + 2KBr\,(aq) \rightarrow 2KCl\,(aq) + Br_2\,(aq)$$

The solution will turn reddish brown due to the aqueous bromine produced.

Special Groups

Noble Gases



Physical Properties

- Do not conduct electricity (lack of charge carriers)
- Very low melting and boiling points
- Increasing melting and boiling points going down the group
- Increasing densities of noble gases going down the group

All noble gases have a fully filled valence shell.
Noble gases are unreactive and inert since they have a stable electronic configuration.
They exist as mono-atomic particles (single atoms).

Transition Elements

21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65
39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112
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Physical Properties

- High MP
- High density
- Good electrical and thermal conductors
- Form coloured compounds

Key Property:
Transition metals can exhibit multiple oxidation states.
Hence, they are frequently used as catalysts.

For example, Iron is used in the Haber process to produce ammonia.

Reactivity Series

Please Stop Calling Me A Cute Zebra, I Like Hot Cute Sexy Girls/Guys

Potassium
Sodium
Calcium

Cold Water

Magnesium
Aluminium
Carbon

Steam

Zinc
Iron
Lead

Hydrogen
Copper
Silver
Gold

Step 1: Draw a line under Calcium
Step 2: Draw a line under Lead
This shows the metals that can react with Cold Water and Steam.

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Reactions

Metal Displacement

A more reactive metal can displace a less reactive metal from its compound.
This is because the more reactive metal can lose its electrons more easily to form cations.

$$CuO + Mg \rightarrow MgO + Cu$$

From this, we can deduce that Mg is more handsome than Cu, because it can steal Cu's girlfriend and form MgO.

$$Cu + MgO \rightarrow \text{no reaction}$$

The other way round, since Cu is less handsome than Mg, it can't steal his girlfriend and hence there is no reaction.

Represented in an Ionic Equation,

$$Cu^{2+} + Mg \rightarrow Cu + Mg^{2+}$$

Thermal Decomposition

The more reactive the metal, the more thermally stable its Carbonate is.

Extraction

Extraction Methods:

Potassium
Sodium
Calcium
Magnesium
Aluminium

Electrolysis

Carbon

Zinc
Iron
Lead
Hydrogen
Copper
Silver
Gold

Heating w/ Carbon

All you need to understand is that metals below Carbon can be extracted by metal displacement with Carbon.

Rusting

Rusting is a process that occurs when Iron is exposed to BOTH:

- Water
- Oxygen

Rusting can be prevented using these methods:

Barrier

Applying a layer of paint or oil, providing a physical barrier that prevent moisture and oxygen from coming into direct contact with iron

Alloying

Alloying iron with other metals enhances its resistance to rust.

Sacrificial Protection

When Iron is connected (physically) to a more reactive metal, the more reactive metal corrodes in place of Iron, protecting it from rust.

Galvanising

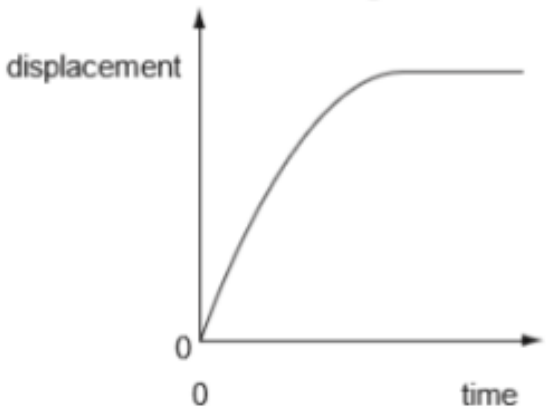
Coating with Iron or Steel with a layer of Zinc, which acts as a sacrificial metal, corroding in place of Iron

Definitions

Distance	Length of path taken.
Displacement	Net change in position of an object.
Speed	Rate of change of distance with respect to time
Velocity	Rate of change of displacement with respect to time
Acceleration	Rate of change of velocity over time
Freefall	An object is in freefall when the only force acting on it is due to gravity.
Uniform Acceleration	Constant rate of change of velocity
Terminal Velocity	A constant speed (with zero acceleration) at when the drag force of an object due to air resistance equals to the weight of the object such that it experiences zero net force.

Graphs

1) Graph
2) Gradient



First, think - is the graph increasing or decreasing? (or constant)

Second, think - is the gradient increasing or decreasing? (or constant)

Lastly, think - what does this mean in the context of the axes?

In this case, the object is moving at a ( ) velocity.

Deceleration always refers to acceleration in the direction opposite to the direction of the velocity. Deceleration always reduces speed.

Negative acceleration, however, is acceleration in the negative direction.