

Lesson : (Reactivity of metals) Scholastic Year: 2022-2023 Grade: 8CS Date: October2022







Cambridge Assessment International Education Cambridge International School









Objective:

- 1. To investigate the reactivity of metals
- 2. To describe how metals react with oxygen, water& acid.

Resources:

Power point presentation

Videos

Complete Chemistry for Cambridge Secondary 1

Trends in the periodic table

- 1. As you go down the group, the atomic size **increases.**
- 2. As you go down the group (alkali metal& alkali earth metals), the reactivity increases.
- 3. As you go across the periodic table, the atomic radius **decreases**.

4. As you go down group 7(Halogens), the reactivity **decrease.**

1	Periodic Table of the Elements										18						
1 H 1.01	2											13	14	15	16	17	2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 0 16.00	F	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3	4	5	6	7	8	9	10	11	12	13 AI 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
v	Ca	6.	т:	V	C	Mm	Ea	Ca	NI:	<i>C</i>	7 m	Ca	Ga	٨٨	6.	D.,	V
K	Ca	Sc 44.95	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se 78 97	Br	Kr
К 39.10 37	Ca 40.08 38	Sc 44.96 39	Ti 47.88 40	V 50.94 41	Cr 51.99 42	Mn 54.94 43	Fe 55.85	Co 58.93 45	Ni 58.69 46	Cu 63.55 47	Zn 65.38 48	Ga 69.72 49	Ge 72.63 50	As 74.92 51	Se 78.97 52	Br 79.90 53	Kr 83.80 54
K 39.10 37 Rb	Ca 40.08 38 Sr	Sc 44.96 39 Y	Ti 47.88 40 Zr	V 50.94 41 Nb	Cr 51.99 42 Mo	Mn 54.94 43 Tc	Fe 55.85 44 Ru	Co 58.93 45 Rh	Ni 58.69 46 Pd	Cu 63.55 47 Ag	Zn 65.38 48 Cd	Ga ^{69.72} 49	Ge ^{72.63} 50	As 74.92 51 Sb	Se 78.97 52 Te	Br 79.90 53	Kr 83.80 54 Xe
K 39.10 37 Rb 85.47	Ca 40.08 38 Sr 87.62	Sc 44.96 39 Y 88.91	ті 47.88 40 Zr 91.22	V 50.94 41 Nb 92.91	Cr 51.99 42 Mo 95.95	Mn 54.94 43 Tc 98.91	Fe 55.85 44 Ru 101.07	Co 58.93 45 Rh 102.91	Ni 58.69 46 Pd 106.42	Cu 63.55 47 Ag 107.87	Zn 65.38 48 Cd 112.41	Ga ^{69.72} 49 In 114.82	Ge 72.63 50 Sn 118.71	As 74.92 51 Sb 121.76	Se 78.97 52 Te 127.6	Br 79.90 53 1 126.90	Kr 83.80 54 Xe 131.29
K 39.10 37 Rb 85.47	Ca 40.08 38 Sr 87.62 56	Sc 44.96 39 Y 88.91 57-71	Ti 47.88 40 Zr 91.22 72	V 50.94 41 Nb 92.91 73	Cr 51.99 42 Mo 95.95 74	Mn 54.94 43 Tc 98.91 75	Fe 55.85 44 Ru 101.07 76	Co 58.93 45 Rh 102.91 77	Ni 58.69 46 Pd 106.42 78	Cu ^{63.55} 47 Ag 107.87 79	Zn 65.38 48 Cd 112.41 80	Ga 69.72 49 In 114.82 81	Ge 72.63 50 Sn 118.71 82	As 74.92 51 Sb 121.76 83	Se 78.97 52 Te 127.6 84	Br 79.90 53 1 126.90 85	Kr ^{83.80} 54 Xe ^{131.29} 86
K 39.10 37 Rb 85.47 55 Cs	Ca 40.08 38 Sr 87.62 56 Ba	Sc 44.96 39 Y 88.91 57-71	Ti 47.88 40 Zr 91.22 72 Hf	V 50.94 41 Nb 92.91 73 Ta	Cr 51.99 42 Mo 95.95 74 W	Mn 54.94 43 TC 98.91 75 Re	Fe 55.85 44 Ru 101.07 76 Os	Co 58.93 45 Rh 102.91 77 Ir	Ni 58.69 46 Pd 106.42 78 Pt	Cu ^{63.55} 47 Ag ^{107.87} 79 Au	Zn 65.38 48 Cd 112.41 80 Hg	Ga ^{69.72} 49 In ^{114.82} 81 TI	Ge 72.63 50 Sn 118.71 82 Pb	As 74.92 51 Sb 121.76 83 Bi	Se 78.97 52 Te 127.6 84 Po	Br 79.90 53 I 126.90 85 At	Kr 83.80 54 Xe 131.29 86 Rn
K 39.10 37 Rb 85.47 55 Cs 132.91	Ca 40.08 38 Sr 87.62 56 Ba 137.33	Sc 44.96 39 Y 88.91 57-71	Ti 47.88 40 Zr 91.22 72 Hf 178.49	V 50.94 41 Nb 92.91 73 Ta 180.95	Cr 51.99 42 MO 95.95 74 W 183.85	Mn 54.94 43 TC 98.91 75 Re 186.21	Fe 55.85 44 Ru 101.07 76 Os 190.23	Co 58.93 45 Rh 102.91 77 Ir 192.22	Ni 58.69 46 Pd 106.42 78 Pt 195.08	Cu 63.55 47 Ag 107.87 79 Au 196.97	Zn 65.38 48 Cd 112.41 80 Hg 200.59	Ga 69.72 49 In 114.82 81 TI 204.38	Ge 72.63 50 Sn 118.71 82 Pb 207.20	As 74.92 51 Sb 121.76 83 Bi 208.98	Se 78.97 52 Te 127.6 84 Po [208.98]	Br 79.90 53 I 126.90 85 At 209.98	Kr 83.80 54 Xe 131.29 86 Rn 222.02
K 39.10 37 Rb 85.47 55 Cs 132.91 87	Ca 40.08 38 Sr 87.62 56 Ba 137.33 88	Sc 44.96 39 Y 88.91 57-71 89-103	Ti 47.88 40 Zr 91.22 72 Hf 178.49 104 DC	V 50.94 41 Nb 92.91 73 Ta 180.95 105	Cr 51.99 42 Mo 95.95 74 W 183.85 106	Mn 54.94 43 Tc 98.91 75 Re 186.21 107	Fe 55.85 44 Ru 101.07 76 Os 190.23 108	Co 58.93 45 Rh 102.91 77 Ir 192.22 109	Ni 58.69 46 Pd 106.42 78 Pt 195.08	Cu 63.55 47 Ag 107.87 79 Au 196.97 111	Zn 65.38 48 Cd 112.41 80 Hg 200.59 112	Ga 69.72 49 In 114.82 81 TI 204.38 113	Ge 72.63 50 Sn 118.71 82 Pb 207.20	As 74.92 51 Sb 121.76 83 Bi 208.98 115	Se 78.97 52 Te 127.6 84 PO [208.98] 116	Br 79.90 53 I 126.90 85 At 209.98	Kr 83.80 54 Xe 131.29 86 Rn 222.02 118
K 39.10 37 Rb 85.47 55 Cs 132.91 87 Fr	Ca 40.08 38 Sr 87.62 56 Ba 137.33 88 Ra	Sc 44.96 39 Y 88.91 57-71 89-103	Ti 47.88 40 Zr 91.22 72 Hf 178.49 104 Rf	V 50.94 41 Nb 92.91 73 Ta 180.95 105 Db	Cr 51.99 42 Mo 95.95 74 W 183.85 106 Sg	Mn 54.94 43 Tc 98.91 75 Re 186.21 107 Bh	Fe 55.85 44 Ru 101.07 76 OS 190.23 108 HS	Co 58.93 45 Rh 102.91 77 Ir 192.22 109 Mt	Ni 58.69 46 Pd 106.42 78 Pt 195.08 110 Ds	Cu 63.55 47 Ag 107.87 79 Au 196.97 111 Rg	Zn 65.38 48 Cd 112.41 80 Hg 200.59 112 Cn	Ga 69.72 49 In 114.82 81 TI 204.38 113 Nh	Ge 72.63 50 Sn 118.71 82 Pb 207.20 114 Fl	As 74.92 51 Sb 121.76 83 Bi 208.98 115 MC	Se 78.97 52 Te 127.6 84 Po [208.98] 116 LV	Br 79.90 53 I 126.90 85 At 209.98 117 Ts	Kr 83.80 54 Xe 131.29 86 Rn 222.02 118 Og

https://www.rsc.org/periodic-table

Reactions of metals

We can examine the reactivity of metals by observing their reactions with **oxygen**, **water**, **acid** and whether it displaces other metals in **displacement reactions**.

To do this, we need to do three tests for the elements:

- 1. Reactions with oxygen.
- 2. Reactions with water.
- 3. Reactions with acids.



Reactions with oxygen metal+ oxygen \rightarrow metal oxide

Reaction with open air

 Most metals react with oxygen in the air. Some react fast, once they are exposed to open air, forming a layer of metal oxide, others need to be burned to allow the reaction to take place.

Burning metals

 When metals are burned in oxygen, they will give flames with different colours and different amounts of energy will be given out.

Understanding reactivity with oxygen https://www.youtube.com/watch?v=RA3rQ2JXtLl

Metal	Symbol	Appearance	Observation
Magnesium	Mg	Grey colour	Strong reaction, a white flash appeared after burning it.
			It changed into a white powder which is magnesium oxide.
Copper	Cu	Red- brown	A thin layer of grey colour formed on the surface (copper oxide)
		colour	An bluish- flame appeared during the test.
Iron	Fe	Grey colour	orange flash appeared during the test.
			The colour of iron wool changed into black forming iron oxide.
Zinc	Zn	Shiny silver	White flame is formed
		colour	After burning, some of the zinc changed into white powder which is zinc oxide (size of the sample had changed)







Fe



Zn





Reactions with water metal+ water (L) \rightarrow metal hydroxide + hydrogen

Reaction with cold water

 Some metals react with cold water (water at room temperature) such as potassium, sodium, lithium and calcium, forming metal hydroxide and hydrogen gas.

 An indicator (litmus paper or universal indicator) can be used to help to compare the rate of reactivity of the metal. The faster the change of colour the higher the rate of reactivity.

Reaction with steam



The damp mineral wool is heated to generate steam.

• The damp mineral wool is heated to generate steam.



- Steam will cause a chemical reaction with the metal sample.
- If the metal was reactive, hydrogen gas will be produced. The gas will pass through the delivery tube and then it will be collected in the measuring cylinder.
- The amount of gas produced helps to compare the reactivity rate of the metals. The more gas the higher the rate of reactivity.



Understanding reactivity with water/ steam

Metal	Observations in water
Calcium https://www.youtube.com/watch?v=QDKkdhXGv5c	calcium metal begins to bubble vigorously as it reacts with water, producing hydrogen gas, and a cloudy white precipitate of calcium hydroxide. Rise in temperature (exothermic reaction)
Magnesium https://www.youtube.com/watch?v=1oscKlyi_pY	Magnesium reacts slowly with cold water forming small bubbles on the surface of the ribbon. It burns in steam to produce white magnesium oxide and hydrogen gas.
Zinc (aluminium/ iron) https://www.youtube.com/watch?v=dBGx2PFhoGw	Slow reaction with cold water (The color of litmus paper changes slowly) then the reaction gets faster with hot water.
Sodium https://www.youtube.com/watch?v=jIJY7pqOM	Vigorous reaction with cold water, rapid change in color of the indicator, fizzing on the surface, hydrogen gas given out, exothermic reaction





Mg



Zn

