

Starter Activity: Spot the Periodic Table – through the window

Introduction: This activity is intended as a warm-up ‘ice-breaker’ exercise, to stimulate thinking about how pupils might relate the chemistry they are taught to the world outside the window.

Key Stage: Chemistry KS4

National Curriculum Ref: Sc3 2g, 3a, 3j

Time: 15 minutes

Pupil learning outcomes: The things around us, both outside and inside, are made from just a few elements.

Context: To consider the idea that ‘chemistry is all around you’

Common misconceptions: It is often not appreciated how few elements make up the majority of the environment in which we live.

Resources: Participant cards

Activity: Participants look through a nearby window and attempt to ‘spot the compound or element’. This is best done in pairs or groups to encourage discussion. There is a help sheet available.

Follow-up: Pupils can continue to look for examples of common elements and compounds in the local environment on their way home from school.



The view through the window (*Starter Activity*)

Some possible answers to this activity are given below. Many suggestions regarding which compounds participants might spot are given on the Participant Card and are not repeated here. Elements making up these compounds are ticked. Elements (un-combined) are circled.

Key:

element name	atomic number	symbol	atomic weight (mean relative mass)
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hydrogen	1	H	1.00794
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lithium	beryllium	boron	carbon	nitrogen	oxygen	fluorine	neon											
3	4	5	6	7	8	9	10											
Li	Be	B	C	N	O	F	Ne											
6.941	9.0122	10.811	12.011	14.0067	15.9994	18.9984032	20.1797											
✓ Na	✓ Mg	Al	Si	✓ P	✓ S	Cl	Ar											
22.990	24.305	26.981539	28.0855	30.973762	32.065	35.453	39.948											
potassium	calcium	scandium	titanium	vanadium	chromium	manganese	iron	cobalt	nickel	copper	zinc	gallium	germanium	arsenic	selenium	bromine	krypton	
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	
39.098	40.078	44.955912	47.867	50.9415	51.9961	54.938045	55.845	58.933195	58.9332	63.546	65.38	69.723	72.64	74.92160	78.96	79.904	83.796	
rubidium	strontium	yttrium	zirconium	niobium	molybdenum	technetium	ruthenium	rhodium	palladium	silver	cadmium	indium	tin	antimony	tellurium	iodine	xenon	
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	
85.468	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	127.603	126.90447	131.293	
caesium	barium	lanthanum	hafnium	tantalum	tungsten	rhenium	osmium	iridium	platinum	gold	mercury	thallium	lead	bismuth	polonium	astatine	radon	
55	56	57-70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
✓ Cs	✓ Ba	**	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
132.91	137.33		174.97	178.49	180.95	183.84	186.21	190.23	192.217	195.084	200.59	204.3833	208.98040	208.98040	(209)	(210)	(211)	(222)
francium	radium	actinoids	lawrencium	rutherfordium	dubnium	seaborgium	bohrium	hassium	meitnerium	unnilium	ununium	unbinium	untrium	unquadrium	unpentium	unhexium	unseptium	unoctium
87	88	89-102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
Fr	Ra	**	Lr	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub	Uuq	Uuq	Uuq	Uuq	Uuq	Uuq
(223)	(226)		(260)	(261)	(262)	(263)	(264)	(265)	(266)	(267)	(268)	(269)	(270)	(271)	(272)	(273)	(274)	(275)
*lanthanoids	lanthanum	cerium	praseodymium	neodymium	promethium	samarium	europium	gadolinium	terbium	dysprosium	holmium	erbium	thulium	ytterbium				
	57	58	59	60	61	62	63	64	65	66	67	68	69	70				
	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb				
	138.90547	140.116	140.90765	144.242	(145)	150.36	151.964	157.25	158.92535	162.50	164.93032	167.259	168.93421	173.04				
**actinoids	actinium	thorium	protactinium	uranium	neptunium	plutonium	americium	curium	berkelium	californium	einsteium	fermium	mendelevium	nobelium				
	89	90	91	92	93	94	95	96	97	98	99	100	101	102				
	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No				
	(227)	232.03806	231.03688	238.02891	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)				

1. **Spot that compound.** Pupils might include the following – but, technically, they shouldn't do so, for the reasons given.

Material	Constituent(s)	Chemical make-up
Steel is iron alloyed with other elements for various purposes. It cannot be 'seen' because either it is covered by a protective coating (paint, plastic) or it has rusted to iron oxides/hydroxides. Also, it is neither an element nor a compound, but a mixture	Common alloys are iron with carbon, chromium, cobalt, niobium, molybdenum, nickel, titanium, tungsten, vanadium or zirconium	Fe plus C, Cr, Co, Nb, Mo, Ni, Ti, W, V, Zr
Air – but this cannot be 'seen' since it is transparent. It is also a mixture		N ₂ , O ₂ , Ar, H ₂ O, CO ₂
Salt – if a path has been gritted in the winter, the salt, if visible at all, will not be there for long – it will dissolve in the next rain shower, leaving just the grit behind	Salt – sodium chloride	NaCl

2. **What do all these compounds have in common?**

- They are all insoluble
- They are all solids (unless water is visible)

3. **Spot that element.** Which elements (uncombined) from the periodic table above can you see? Circle the elements you can spot – answers are shown on the periodic table above.

Material	Element/symbol	Comment
Lead, in flashings (edgings) on roofs	Lead - Pb	Often is dull due to a lead carbonate coating
Copper in pipes or, unusually, as a roof covering	Copper - Cu	Pure copper is usually not visible, it is usually coated with a weathering veneer of green copper carbonate compounds
Steel galvanised by zinc in wire fencing, corrugated iron or in the metal steps of telegraph poles	Zinc - Zn	This usually has a surface coating of zinc carbonate minerals
Aluminium – in ladders or car hubcaps	Aluminium - Al	This usually has a white surface coating of aluminium oxides
Jewellery on a person – of gold, silver or platinum	Gold - Au, Silver - Ag, Platinum - Pt	Doesn't become coated, so stays bright – which is why it is used for jewellery
Diamond in jewellery may be visible	Carbon - C	
A burnt area will be black with carbon	Carbon - C	

4. **What do all these elements have in common?**

- They are relatively un-reactive – which is why they were chosen for this purpose
- Apart from carbon – they are all metals
- They are mostly different from those in the first list (Fe, Al, C and Pb are exceptions)

5. **Spot the difference.** How do your answers differ if you ask which elements and compounds can be spotted in the ordinary room where you are now?

Elements and elements of compounds seen outside but not in the room	Elements and elements of compounds seen in the room but not outside
There may be slightly fewer elements and elements in compounds in the room, but the answers are likely to be quite similar – indicating that we normally interact with rather few elements in our daily lives. However, some items, such as light bulbs, contain an unexpectedly large number of elements.	

All photographs can be found in colour on the Earth Science Education Unit website.

Spot the Periodic Table - through the window

Key:

element name	
atomic symbol	
atomic weight (mean relative mass)	

hydrogen 1 1.00794																	argon 2 4.002602	
lithium 3 6.941	beryllium 4 9.0122											boron 5 10.811	carbon 6 12.0107	nitrogen 7 14.0067	oxygen 8 15.9994	fluorine 9 18.9984032	neon 10 20.1797	
sodium 11 22.990	magnesium 12 24.305											aluminum 13 26.9815386	silicon 14 28.0855	phosphorus 15 30.973762	sulfur 16 32.065	chlorine 17 35.453	argon 18 39.948	
potassium 19 39.098	calcium 20 40.078	scandium 21 44.955912	titanium 22 47.887	vanadium 23 50.9415	chromium 24 51.9961	manganese 25 54.938045	iron 26 55.845	cobalt 27 58.933195	nickel 28 58.6934	copper 29 63.546	zinc 30 65.409	gallium 31 69.723	germanium 32 72.64	arsenic 33 74.92160	selenium 34 78.96	bromine 35 79.904	krypton 36 83.798	
rubidium 37 85.468	strontium 38 87.62	yttrium 39 88.90585	zirconium 40 91.224	niobium 41 92.90638	molybdenum 42 95.94	technetium 43 98	ruthenium 44 101.07	rhodium 45 102.90550	palladium 46 106.42	silver 47 107.8682	cadmium 48 112.411	indium 49 114.818	tin 50 118.710	antimony 51 121.760	tellurium 52 127.60	iodine 53 126.90447	xenon 54 131.293	
cesium 55 132.91	barium 56 137.33	**	lutetium 71 174.97	hafnium 72 178.49	tantalum 73 180.95	wolfram 74 183.84	reuterium 75 186.21	osmium 76 190.23	iridium 77 192.217	platinum 78 195.084	gold 79 196.966569	mercury 80 200.59	thallium 81 204.383	lead 82 207.2	bismuth 83 208.98040	polonium 84 [209]	astatine 85 [210]	radon 86 [222]
francium 87 [223]	radium 88 [226]	89-102 **	lanthanum 57 138.90547	cerium 58 140.116	praseodymium 59 140.90765	neodymium 60 144.242	promethium 61 [145]	samarium 62 150.36	eucptium 63 151.964	gadolinium 64 157.25	terbium 65 158.92535	dysprosium 66 162.50	holmium 67 164.93032	erbium 68 167.259	thulium 69 168.93421	ytterbium 70 173.04		
			actinium 89 [227]	thorium 90 232.03806	protactinium 91 231.03688	uranium 92 238.02891	neptunium 93 [237]	plutonium 94 [244]	americium 95 [243]	curium 96 [247]	berkelium 97 [247]	californium 98 [251]	einsteinium 99 [252]	fermium 100 [257]	mendelevium 101 [258]	nobelium 102 [259]		

1. **Spot that compound:** Look out of the window - you can see many different compounds made of different elements. Tick the elements which make up the compounds you can spot. A help sheet is available if you need help.

2. What do all these compounds have in common?

Spot that element: Which elements (uncombined) from the periodic table above can you see? Circle the elements you can spot.

4. What do all these elements have in common?

5. **Spot the difference:** How do your answers differ if you ask which elements and compounds can be spotted in the ordinary room where you are now?

Elements and elements of compounds seen outside but not in the room	Elements and elements of compounds seen in the room but not outside

Spot the Periodic Table - through the window - help sheet

The chemistry of common outdoor compounds

Material	Constituent(s)	Chemical make-up
Bricks/tiles - these are made from clays which are baked in a kiln to form bricks/tiles. Clays contain clay minerals and the most common ones are:	Kaolinite - contains:	Al, Si, O, H
	Montmorillonite - contains:	Na, Ca, Al, Mg, Si, Al, O, H
	Illite - contains:	K, Al, Si, O, H
Cement - cement is usually mixed with sand in mortar or with sand and rock chips in concrete. Major cement constituents include:	Tricalcium silicate - contains:	Ca, O, Si
	Dicalcium silicate - contains:	Ca, O, Si
	Tricalcium aluminate - contains:	Ca, O, Al
	Tetracalcium aluminoferrite - contains:	Ca, O, Al, Fe
	Calcium sulfate (gypsum)	CaSO ₄
Bitumen (asphalt or tar)	Long chains of hydrocarbon molecules including:	H, C, N, S, O
Rock - made of minerals (roofing slate is a rock)	The most common minerals are made of the most common elements in the Earth crust:	O, Si, Al, Fe, Ca, Na, K, Mg, Ti
Glass - the main constituents of float glass - the most common form of glass today, are:	Silicon dioxide (silica sand, quartz)	SiO ₂
	Sodium carbonate	Na ₂ CO ₃
	Calcium carbonate	CaCO ₃
	Magnesium carbonate	MgCO ₃
Plastic - polymers	Plastic polymer chains are made mainly of:	C, H, O, Si
Paint - include a form of glue (resin), a primary pigment, secondary pigments and colorants and a solvent. In dry paint, the solvent evaporated when the paint dried	Resin - compounds mainly of:	C, O, H
	Primary pigment - commonly titanium dioxide	TiO ₂
	Simple secondary pigments include: iron oxide, used to give yellows, reds and browns chromium oxide giving green lead oxide giving red	Fe ₂ O ₃ Cr ₂ O ₃ , Pb ₃ O ₄
Human body	99% of the mass of the human body is made of just six elements:	O, C, H, N, Ca, P
Plants	Plants are formed mainly of the following elements, with trace amounts of around ten others:	O, C, H, N, P, S, Si