

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:

✓	hydrogen	1	H	1.00794
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element name
atomic number
symbol
atomic weight (mean relative mass)

lithium 3 Li 6.941	beryllium 4 Be 9.0122											boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.0067	oxygen 8 O 15.9994	fluorine 9 F 18.9984032	neon 10 Ne 20.1797		
sodium 11 Na 22.990	magnesium 12 Mg 24.305	scandium 21 Sc 44.955912	titanium 22 Ti 47.887	vanadium 23 V 50.9415	chromium 24 Cr 51.9961	manganese 25 Mn 54.938045	iron 26 Fe 55.845	cobalt 27 Co 58.933195	nickel 28 Ni 58.6934	copper 29 Cu 63.546	zinc 30 Zn 65.38	gallium 31 Ga 69.723	germanium 32 Ge 72.64	arsenic 33 As 74.92160	selenium 34 Se 78.96	bromine 35 Br 79.904	argon 18 Ar 39.948		
potassium 19 K 39.098	calcium 20 Ca 40.078	yttrium 39 Y 88.90585	zirconium 40 Zr 91.224	niobium 41 Nb 92.90638	molybdenum 42 Mo 95.94	technetium 43 Tc 98	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.90550	palladium 46 Pd 106.42	silver 47 Ag 107.8682	cadmium 48 Cd 112.411	indium 49 In 114.818	tin 50 Sn 118.710	antimony 51 Sb 121.760	tellurium 52 Te 127.60	iodine 53 I 126.90447	krrypton 36 Kr 83.796		
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	caesium 55 Cs 132.91	barium 56 Ba 137.33	lanthanum 57 La 138.90549	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.222	platinum 78 Pt 195.084	gold 79 Au 196.96657	mercury 80 Hg 200.59	thallium 81 Tl 204.3833	lead 82 Pb 207.2	bismuth 83 Bi 208.98040	polonium 84 Po (209)	astatine 85 At (210)	radon 86 Rn (222)
francium 87 Fr (223)	radium 88 Ra (226)	actinium 89 Ac (227)	thorium 90 Th 232.0376	protactinium 91 Pa 231.03688	uranium 92 U 238.02891	neptunium 93 Np (237)	plutonium 94 Pu (244)	americium 95 Am (243)	curium 96 Cm (247)	berkelium 97 Bk (247)	californium 98 Cf (251)	einsteinium 99 Es (252)	fermium 100 Fm (257)	mendelevium 101 Md (258)	nobelium 102 No (259)				
*lanthanoids		lanthanum 57 La 138.90549	cerium 58 Ce 140.116	praseodymium 59 Pr 140.90765	neodymium 60 Nd 144.242	promethium 61 Pm (145)	samarium 62 Sm 150.36	europium 63 Eu 151.964	gadolinium 64 Gd 157.25	terbium 65 Tb 158.92535	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93032	erbium 68 Er 167.259	thulium 69 Tm 168.93421	ytterbium 70 Yb 173.04				
**actinoids		actinium 89 Ac (227)	thorium 90 Th 232.0376	protactinium 91 Pa 231.03688	uranium 92 U 238.02891	neptunium 93 Np (237)	plutonium 94 Pu (244)	americium 95 Am (243)	curium 96 Cm (247)	berkelium 97 Bk (247)	californium 98 Cf (251)	einsteinium 99 Es (252)	fermium 100 Fm (257)	mendelevium 101 Md (258)	nobelium 102 No (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)
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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	reynoldsium 75 186.21	osmium 76 190.23	iridium 77 192.227	platinum 78 195.084	gold 79 196.966569	mercury 80 200.59	thallium 81 204.3833	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	euporium 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