

Properties of Matter – It Matters

Name: _____ **KEY** _____ class: _____ Date: _____

Matter is all around us and it is made of atoms. The things that we see and feel are not made of one atom, they are made of billions of atoms and in some cases, made of stable combinations of atoms called molecules. We use materials for specific functions or to serve a purpose based on the characteristics of that material. Take for instance a bicycle.



Each part of a bicycle is designed for the function that it serves, and the material used to make that part is purposefully used for the characteristics or properties that make it the best material for that purpose. The properties of the material come from the atoms and molecules that make up that material. The frame is strong and rigid and is made of metal alloys like aluminum or composite material like carbon fiber. The wheels' tires are made of rubber that is hard enough to withstand the road and sharp stones but soft enough to absorb the bumps on the road. The chain must bend but be strong and link the crank sprocket to the wheel sprockets on the back wheel. To make sure it does not rust and that it stays flexible, grease is applied to all moving parts.

So the material has characteristics or properties from the atoms and molecules and that leads us to the fact that all atoms have properties that are specific to each atom. Some atoms are very light and are gases at room temperature and others are solid or liquids. Some are highly reactive chemically and some are not reactive at all (this is called inert).

In Grade 7 we learn about Pure Substances and Mixtures and part of the unit involves separating mixtures into more pure substances. This can be done to a point when the entire substance is composed of just one type of atom. This is known as an elemental material. Through the last several thousand years, elements have been discovered – starting with element that occur naturally such as gold, silver, sulphur, and Copper. In the last four hundred years, chemistry has developed so that there were reliable techniques to isolate and purify elements and so, they were categorized by their properties. Each element has a unique set of properties and those properties are similar to other elements. For example, some elements are ‘metallic’ (they conduct electricity and heat well, they are malleable, ductile and have a shiny surface). Elements that have these properties include Iron, Nickel, Lead, Gold, Silver, Aluminum, Copper and Platinum.

Periodic Table of the Elements																		18 VIII 8A							
1 H Hydrogen 1.0079												13 IIIA 3A		14 IVA 4A		15 VA 5A		16 VIA 6A		17 VIIA 7A		2 He Helium 4.00260			
3 Li Lithium 6.941		4 Be Beryllium 9.01218												5 B Boron 10.811		6 C Carbon 12.011		7 N Nitrogen 14.00674		8 O Oxygen 15.9994		9 F Fluorine 18.998403		10 Ne Neon 20.1797	
11 Na Sodium 22.989768		12 Mg Magnesium 24.305		3 IIIB 3B		4 IVB 4B		5 VB 5B		6 VIB 6B		7 VIIB 7B		8 VIII 8		9 VIII 8		10 VIII 8		11 IB 1B		12 IIB 2B			
19 K Potassium 39.0983		20 Ca Calcium 40.078		21 Sc Scandium 44.95591		22 Ti Titanium 47.88		23 V Vanadium 50.9415		24 Cr Chromium 51.9961		25 Mn Manganese 54.938		26 Fe Iron 55.847		27 Co Cobalt 58.9332		28 Ni Nickel 58.6934		29 Cu Copper 63.546		30 Zn Zinc 65.39			
37 Rb Rubidium 85.4678		38 Sr Strontium 87.62		39 Y Yttrium 88.90585		40 Zr Zirconium 91.224		41 Nb Niobium 92.90638		42 Mo Molybdenum 95.94		43 Tc Technetium 98.9072		44 Ru Ruthenium 101.07		45 Rh Rhodium 102.9055		46 Pd Palladium 106.42		47 Ag Silver 107.8662		48 Cd Cadmium 112.411			
55 Cs Cesium 132.90543		56 Ba Barium 137.327		57-71		72 Hf Hafnium 178.49		73 Ta Tantalum 180.9479		74 W Tungsten 183.85		75 Re Rhenium 186.207		76 Os Osmium 190.23		77 Ir Iridium 192.22		78 Pt Platinum 195.08		79 Au Gold 196.9665		80 Hg Mercury 200.59			
87 Fr Francium 223.0197		88 Ra Radium 226.0254		89-103		104 Rf Rutherfordium [261]		105 Db Dubnium [262]		106 Sg Seaborgium [266]		107 Bh Bohrium [264]		108 Hs Hassium [269]		109 Mt Meitnerium [268]		110 Ds Darmstadtium [269]		111 Rg Roentgenium [272]		112 Cn Copernicium [277]			
113 Uut Ununtrium unknown		114 Fl Flerovium [289]		115 Uup Ununpentium unknown		116 Lv Livermorium [293]		117 Uus Ununseptium unknown		118 Uuo Ununoctium unknown		119		120		121		122		123		124			
131 Ts Tennessine [294]		132 Og Oganesson [294]		133		134		135		136		137		138		139		140		141		142			
151 Nh Nihonium [286]		152		153		154		155		156		157		158		159		160		161		162			
171 Lr Lawrencium [262]		172		173		174		175		176		177		178		179		180		181		182			
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Today, chemists, physicists and material scientists all over the world use this to look up properties of elements such as Atomic Number, Atomic Mass, Density, Boiling Point, Freezing Point, Electrical Conductivity, Chemical Reactivity and Valence Electrons – to name a few. Knowing the properties can allow scientists to design materials that are put together for all of us to enjoy – such as a bicycle.

Questions:

What are properties?

Properties are characteristics of materials or elements. (Properties are how materials appear or react to other materials or heat.)

What are some examples of properties of materials on a bicycle?

The frame is strong and rigid and is made of metal alloys like aluminum or composite material like carbon fiber. The wheels' tires are made of rubber that is hard enough to withstand the road and sharp stones but soft enough to absorb the bumps on the road. The chain must bend but be strong and link the crank sprocket to the wheel sprockets on the back wheel. To make sure it does not rust and that it stays flexible, grease is applied to all moving parts.

What elements occur as elements in nature?

Elements that occur naturally include gold, silver, sulphur, and Copper.

What are some examples of properties of elements?

There are many properties of elements such as Atomic Number, Atomic Mass, Density, Boiling Point, Freezing Point, Electrical Conductivity, Chemical Reactivity and Valence Electrons.

What are some examples of metals?

Metals include Iron, Nickel, Lead, Gold, Silver, Aluminum, Copper and Platinum.

What properties do metals all have in common?

Metals all have some properties in common: they conduct electricity and heat well, they are malleable, ductile and have a shiny surface.

What does 'ductile' mean?

Ductile means being able to draw a material out into a wire.

What does the word Period or Periodic mean in 'The Periodic Table'?

Period means Group. It is a group of materials that have similar or related properties due to their atomic structure.