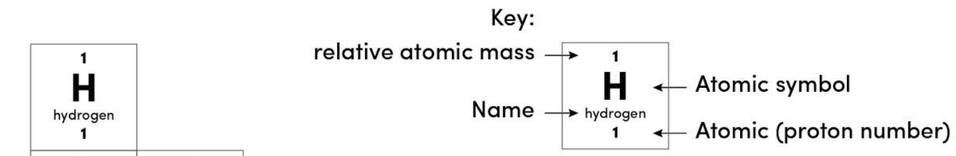
Structures and Bonding
Nanoparticles
Worksheet

Separate Science - Chemistry - Key Stage 4

Mr Robbins

Periodic Table of Elements



1 H hydrogen 1																	4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[97] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[267] Rf rutherfordium 104	[270] Db dubnium 105	[269] Sg seaborgium 106	[270] Bh bohrium 107	[270] Hs hassium 108	[278] Mt meitnerium 109	[281] Ds darmstadtium 110	[281] Rg roentgenium 87	[285] Cn copemicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[293] Ts tennessine 117	[294] Og organesson 118

* The lanthanides (atomic numbers 58 - 71) and the Actinides (atomic numbers 90 - 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.

1. A student says “A virus is 80 nm wide so it must be a nanoparticle.” Are they correct? Give a reason.
2. A nanocoated tennis ball lasts 10 times longer than a normal tennis ball. Why can the manufacturer advertise it as “the environmentally friendly tennis ball”?
3. Fine particles are between 100 nm and 2500 nm. How big are they in metres?
4. Coarse particles are between 1×10^{-5} m and 2.5×10^{-6} m. How big are they in nanometres?

   Air pollution consists of very small particles suspended in the air. This is called particulate matter, often abbreviated to ‘PM’. When scientists are describing particulate matter, they add a number to show the size of the particles. ‘PM2.5’ means that the particles are 2.5 micrometres.

   One micrometre is 1×10^{-6} m.

5. Knowing the size of airborne pollution particles is important to health departments because particles smaller than 1×10^{-5} m can enter the lungs, lodge there and have harmful effects.

   a) What does ‘PM10’ mean?

   b) How big are PM10 particles in nanometres?

   c) Write 1×10^{-4} as a PM number.

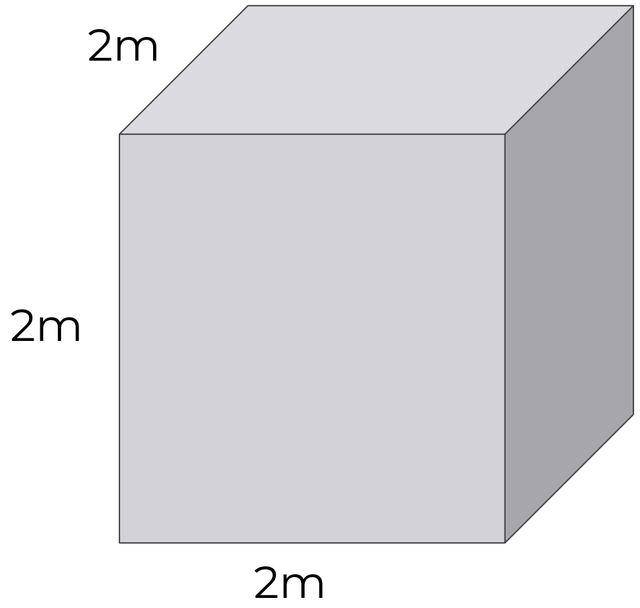
Answers

1. Yes because it is less than 100 nm
2. It does not have to be replaced so often
3. $1x10^{-7}$ - $2.5x10^{-6}$ m
4. 2500 nm - 10,000 nm
5. a) Particulates are 10 µm wide

   b) 10,000 nm

   c) PM_{100}

Quick check



1. Calculate the volume of the cube
2. Calculate the surface area of the cube
3. Calculate the surface area to volume ratio.

Independent task

1. Silver exists as nanocrystals. Each crystal is a cube and is 20 nm wide.

a) Convert 20 nm to m. Give your answer in standard form
b) Calculate the volume of the cube. Give your answer in standard form
c) Calculate the surface area of the cube. Give your answer in standard form
d) Calculate the surface area to volume ratio of the silver nanocrystal

Independent task

2. A company want to put nanocrystal of silver into their socks

a) Give a reason why they would prefer nanocrystals over coarse grains of silver?

b) Some of the public are worried about nanotechnology and potential health concerns. What could the company do to reduce the customers concerns?