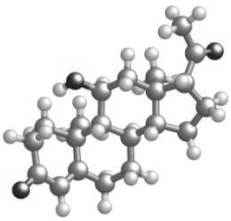

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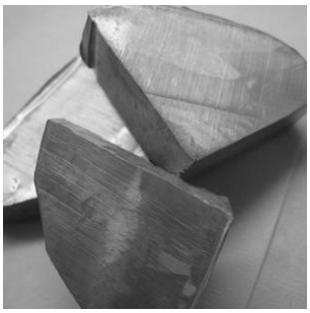
Name: …… **( )**

Class: ……

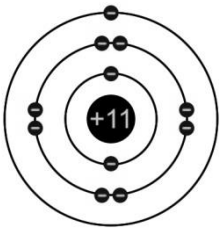
Date: …… **/** …… **/** ……

Atoms, Elements, Compounds and Mixtures – Worksheet 1

Atom:



• A *small sample* of the element sodium – Na



• An *atom* of the element sodium – Na

• Sodium is a metallic element. It is a shiny silver-grey solid at room temperature and pressure.

• Search http://www.YouTube.com for videos of sodium reacting with water.

1 a) If a *small piece* of sodium – containing billions of atoms of sodium – is added a beaker of cold water, a vigorous reaction takes place. A colourless solution and hydrogen gas are produced. The hydrogen gas burns with an orange-yellow coloured flame.

$$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$$

→ When a small piece of sodium is added to cold water, does a chemical or physical change take place? What evidence from the text supports your answer?

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b) If a *single atom* of sodium were added to a beaker of cold water, a vigorous reaction would still take place. A colourless solution and hydrogen gas would be produced. The hydrogen gas would burn with an orange-yellow coloured flame.

→ In what way(s) are the reactions between a small piece of sodium and water and a single atom of sodium and water **i)** similar to each other **ii)** different from each other?

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c) If a single atom of sodium could be *cut-in-half*, then atoms of two different chemical elements would be formed – one atom of *carbon* and one atom of *boron*. If the atoms of carbon and boron were added separately to beakers of cold water, they would *not* react to produce a colourless solution and hydrogen gas and *no* flame would be observed.

→ From the information provided in parts **a)**, **b)** and **c)**, define the term "atom".

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Element:

All known chemical elements are listed in the Periodic Table.

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							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	64 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	– 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	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

2. On the Periodic Table shown above:

a) Draw a red line to separate the metallic elements from the non-metallic elements.

b) Identify the two elements (one metallic and one non-metallic) that are liquids at room temperature and pressure. Shade them blue.

c) Identify the eleven non-metallic elements that are gases at room temperature and pressure. Shade them green.

d) Identify the seven non-metallic elements that are diatomic (composed of molecules that are made-up of two atoms covalently bonded together). Label each one using a red asterisk (∗). Produce a mnemonic to help you remember the diatomic elements.

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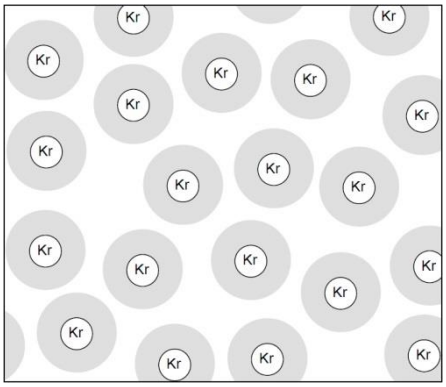
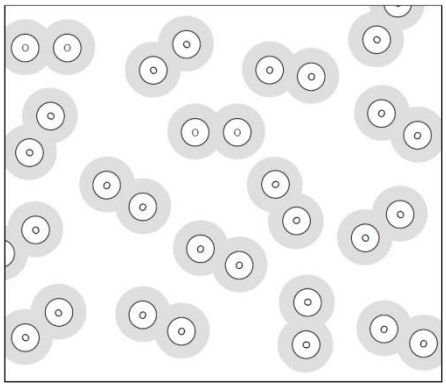
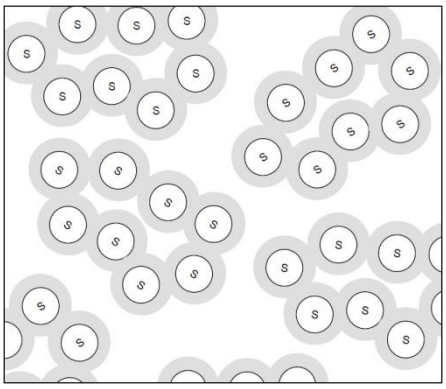
3. Describe the general properties of metallic elements and non-metallic elements.

Metallic Elements	Non-metallic Elements
……..	……..
……..	……..
……..	……..
……..	……..
……..	……..
……..	……..

4. The table below shows three different elements.

 • The chemical element krypton – Kr	 • The chemical element oxygen – O_2
 • The chemical element sulfur – S_8	• Your own example ……

a) In the space provided in the table above, give your own example of an element.

b) Is each chemical element a pure substance? Explain your reasoning.

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c) Can each element be converted into something more simple by a physical process? Explain your reasoning.

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d) Can each element be converted into something more simple by a chemical process? Explain your reasoning.

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e) Reflect on your answers to question **4** and use them to define the term “element”.

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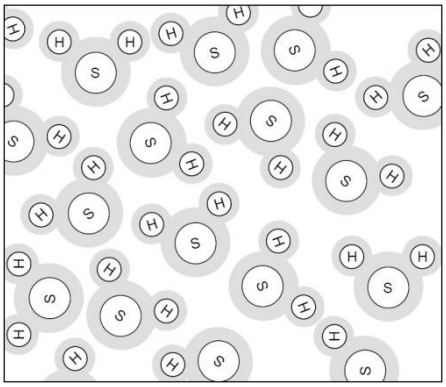
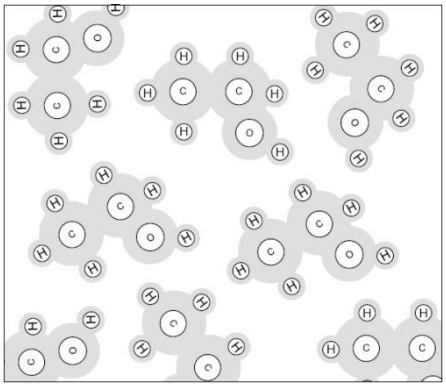
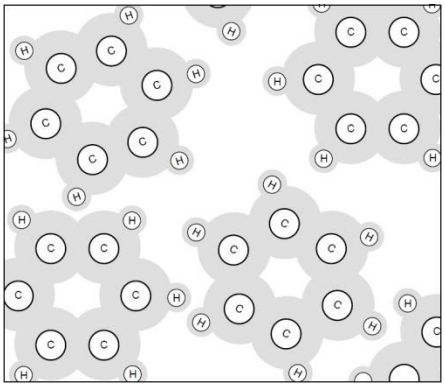
Compound:

5. The table below shows three different compounds.

 • The compound hydrogen sulphide Formula ……	 • The compound ethanol Formula ……
 • The compound benzene Formula ……	• Your own example …… ……

a) Complete the formulae of the compounds shown in the table above.

b) In the space provided in the table above, give your own example of a compound.

c) Is each compound a pure substance? Explain your reasoning.

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d) Is the ratio of elements in each compound fixed, or can it vary? Explain your reasoning.

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e) Can each compound be converted into something more simple by a physical process? Explain your reasoning.

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f) Can each compound be converted into something more simple by a chemical process? Explain your reasoning.

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g) Reflect on your answers to question **5** and use them to define the term “compound”.

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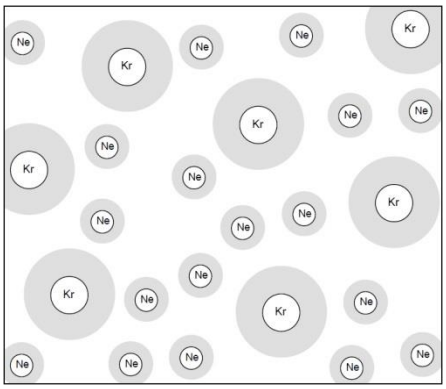
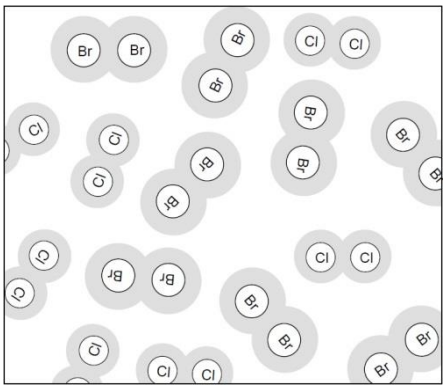
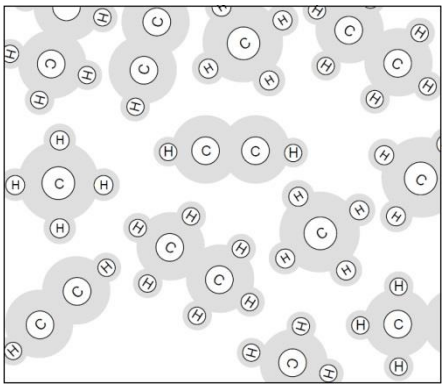
Mixture:

6. The table below shows three different mixtures.

 • Mixture of neon and krypton	 • Mixture chlorine and bromine
 • Mixture methane, ethyne and ethane	• Your own example ……

a) In the space provided in the table above, give your own example of a mixture.

b) Is each mixture a pure substance? Explain your reasoning.

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c) Is the ratio of components in each mixture fixed, or can it vary? Explain your reasoning.

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d) Can each mixture be converted into something more simple by a physical process? Explain your reasoning.

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f) Reflect on your answers to question 6 and use them to define the term “mixture”.

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g) Give examples of different separation techniques that could be used to separate the components of a mixture.

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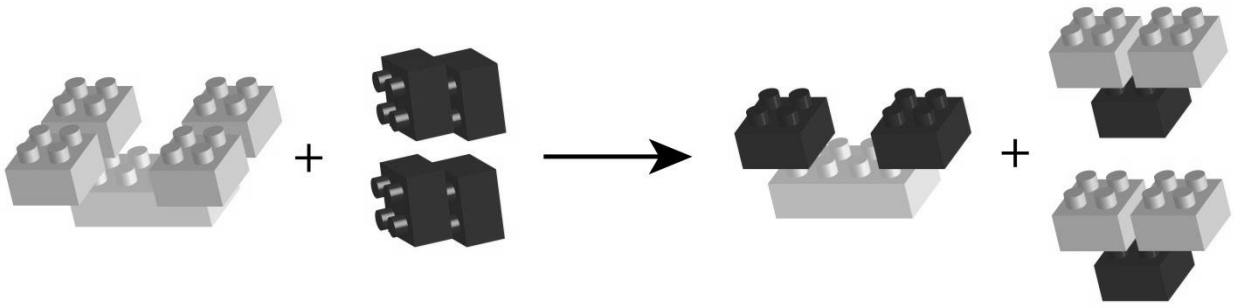
7. Scientists use models, both physical and mathematical, to help them visualise and understand complex ideas and phenomena that cannot be observed directly. The diagram below shows how Lego® bricks are used to model the reaction between methane and oxygen:

$$\text{methane} + \text{oxygen} \rightarrow \text{carbon dioxide} + \text{water}$$

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$



Use the Lego® model of the reaction to help you identify **a)** atoms, **b)** an element, **c)** compounds and **d)** mixtures.

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