Cambridge Secondary 1 Science
Topic Book **Chemical Properties**

**Topic: C8p**

**Topic code: C8p**

**CIE Course specification for Chemistry Cp Material properties (UK KS3: 8E, 8F)**

- **8Cp1** Describe and explain the differences between metals and non-metals.
- **8Cp2** Give chemical symbols for the first twenty elements of the Periodic Table.
- **8Cp3** Understand that elements are made of atoms.
- **8Cp4** Explain the idea of compounds.
- **8Cp5** Name some common compounds including oxides, hydroxides, chlorides, sulfates and carbonates.
- **8Cp6** Distinguish between elements, compounds and mixtures.

**Contents**

- Topic: C8p........................................................................................................................................................................................................................................1
- CIE Course specification for Chemistry Cp Material properties (UK KS3: 8E, 8F).................................................................1
- What you should have done if you wanted the highest grade in this course for this topic: ............................................................2
- Where to find out more about this topic: ....................................................................................................................................................2
- The Notebooks ........................................................................................................................................................................................................3
- Sec1 Sci C8p WL Material Properties 27words core Extravaganza!!! ..................................................................................................4
- Final HEROS CHALLENGE Fill in the missing meanings: ............................................................................................................................18
- Sec1 Sci C7p Info Summary sheet of atoms and elements .........................................................................................................................19
- Mind map of the review sheets: Atoms and Elements .................................................................................................................................21
- Sec1 Sci C8p Info Summary Sheet Compounds and mixtures..................................................................................................................22
- Mind map of the review sheets: Compounds and mixtures .........................................................................................................................24
- Sec1 Sci C7p EQ Practice exam questions 2nd 61marks ..............................................................................................................................25
- Mark Scheme Sec1 Sci C7p EQ Practice exam questions 2nd 61marks.................................................................................................36
- Careers in science.........................................................................................................................................................................................................38
- Extension task: Expanding your mind using the C8p Material Properties topic ......................................................................................40
- The periodic table of elements (CIE iGCSE version) .................................................................................................................................42

<table>
<thead>
<tr>
<th>Notebook points</th>
<th>Word list test score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effort score for word list activities</td>
<td></td>
</tr>
<tr>
<td>Effort score for mind map</td>
<td></td>
</tr>
<tr>
<td>Effort score for past exam questions</td>
<td></td>
</tr>
<tr>
<td><strong>Overall effort score for this topic</strong></td>
<td><strong>Overall grade for topic</strong></td>
</tr>
</tbody>
</table>

Patrick Brannac  www.SmashingScience.org  Page 1 of 42
What you should have done if you wanted the highest grade in this course for this topic:

1. Complete notes taken from class, which clear headings underlined with a ruler and the date for each piece of work. All single sheets should be neatly stuck in your book, ideally with clear tape and with the edges cut off so that they don’t stick our of your book.

2. Cornell notes along the side with translations of new English words you don’t understand and a summary at the bottom of the page that explains in just one sentence what you. Only the very best students will probably be able to do this properly, but everyone should at least try.

3. Complete the exercises for the word list test you will have in the second week. Remember, when I take these topic books in, I will check and give you and effort score.

4. Compete the mind map based on the review sheets inside this topic book. This will help you to learn for the multiple choice question test.

5. Complete the past exam questions as the back of this topic book to help you prepare for the end of topic test, which is the most important of the assessed activities you will do.

6. EXTENSION ACTIVITIES: The ablest students will also have completed all of the questions in the workbook, and in the back of their exercise book, also completed the questions given in the textbook sections that have been handed out.

7. FOR THE VERY ABLEST STUDENTS: They will also have explored one part of this topic that they find fascinating and will have either made a poster, or a presentation, e.g. on power point and explained what they know during a chemistry gifted and talented session, which will be scheduled at the end of the topic.

Where to find out more about this topic:

https://www.smashingscience.org/cie-secondary-1.html

For help, games and resources about this topic’s keywords you can find them here: https://quizlet.com/_5a72yg
The Notebooks

All students are given a specialised exercise book designed to allow them to use the and Cornell notetaking method. At the back is an explanation of it from Cornell University. Briefly, in class they write their notes in the main part of the page, after class they translate new words and highlight key ideas at the sides. Then the write 1 or 2 sentence summary of the most important idea, in their own words. Eventually, when they get to university and beyond, it will be their ability to learn, of which notetaking and organisational skills are key that will allow them to access positions of leadership in whichever career they decide to pursue.

Main Area
Notes taken in class

Margin
Area for translations, further explanations, keywords or further questions to ask in the next lesson
DONE AFTER THE LESSON, IDEALLY THE SAME DAY!

Summary section
1 or 2 sentence summary of most important ideas
DONE AFTER THE LESSON

Space to be left for teacher’s comments
### Core Words

<table>
<thead>
<tr>
<th>#</th>
<th>Difficulty</th>
<th>English</th>
<th>Chinese</th>
<th>Meaning in English</th>
<th>Meaning in Chinese</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Core</td>
<td>Atom</td>
<td>原子</td>
<td>The smallest part of an element you can get.</td>
<td>您可以获得的元素的最小部分。</td>
</tr>
<tr>
<td>2</td>
<td>Core</td>
<td>Bond</td>
<td>键</td>
<td>Force holding atoms together.</td>
<td>强迫原子在一起。</td>
</tr>
<tr>
<td>3</td>
<td>Core</td>
<td>Chemical symbols</td>
<td>化学符号</td>
<td>Letters which represent elements (usually one or two letters) which are understood in all languages. Each element has its own one.</td>
<td>代表所有语言都能理解的元素（通常是一个或两个字母）的字母。每个元素都有自己的元素。</td>
</tr>
<tr>
<td>4</td>
<td>Core</td>
<td>Compound</td>
<td>复合</td>
<td>A substance made up of atoms of two or more elements chemically joined together.</td>
<td>由化学连接在一起的两种或多种元素的原子组成的物质</td>
</tr>
<tr>
<td>5</td>
<td>Core</td>
<td>Element</td>
<td>元件</td>
<td>A substance that cannot be split up into anything simpler by chemical reactions.</td>
<td>一种不能通过化学反应分解成任何物质的物质。</td>
</tr>
<tr>
<td>6</td>
<td>Core</td>
<td>Filter</td>
<td>过滤</td>
<td>A way of removing pieces of solid that are mixed with a liquid or solution by pouring through special paper.</td>
<td>一种通过倾倒特殊纸张去除与液体或溶液混合的固体碎片的方法</td>
</tr>
<tr>
<td>7</td>
<td>Core</td>
<td>Formula (plural formulae)</td>
<td>公式 (复数公式)</td>
<td>This uses symbols and numbers to show the relative number of atoms of each element in a compound. For example, water is H20. This shows that water is made up of atoms of hydrogen and oxygen, strongly joined together. In a sample of water, there are two hydrogen atoms for every one oxygen atom.</td>
<td>这使用符号和数字来显示化合物中每种元素的相对原子数。例如，水是H2O。这表明水由氢和氧原子组成，强烈地连接在一起。在水样中，每一个氧原子有两个氢原子。</td>
</tr>
<tr>
<td>8</td>
<td>Core</td>
<td>Group</td>
<td>组</td>
<td>The elements in one vertical column of the periodic table. Usually, all elements in one of these share similar properties.</td>
<td>元素周期表的一个垂直列中的元素。通常，其中一个中的所有元素都具有相似的属性。</td>
</tr>
<tr>
<td>9</td>
<td>Core</td>
<td>Group 1</td>
<td>第 1 组</td>
<td>Elements the elements in the left vertical column of the periodic table. They are the most reactive metals.</td>
<td>元素周期表左侧垂直列中的元素。它们是最活泼的金属</td>
</tr>
<tr>
<td>10</td>
<td>Core</td>
<td>Group 2</td>
<td>第 2 组</td>
<td>Elements the elements in the vertical column that is second from the left of the periodic table.</td>
<td>元素垂直列中元素周期表左侧第二个元素</td>
</tr>
<tr>
<td>11</td>
<td>Core</td>
<td>Group 7</td>
<td>第 7 组</td>
<td>Elements the elements in the vertical column that is second from the right of the periodic table. They are also called the halogens.</td>
<td>元素垂直列中元素是元素周期表右侧的第二个元素。它们也被称为卤素。</td>
</tr>
<tr>
<td>12</td>
<td>Core</td>
<td>Hard</td>
<td>硬</td>
<td>A material is this if it is difficult to scratch, like glass or diamond.</td>
<td>如果难以刮擦，就像玻璃或钻石一样，这是一种材料。</td>
</tr>
<tr>
<td>13</td>
<td>Core</td>
<td>Hydroxide</td>
<td>氢氧化物</td>
<td>A compound made up of a metal, hydrogen, and oxygen, the most famous has this formula NaOH.</td>
<td>由金属、氢和氧组成的化合物。最著名的是这种配方NaOH。</td>
</tr>
<tr>
<td>14</td>
<td>Core</td>
<td>Malleable</td>
<td>可锻铸</td>
<td>The property of being able to bend without breaking, like a paper clip.</td>
<td>能够弯曲而不会破损的特性，如纸夹。</td>
</tr>
<tr>
<td>15</td>
<td>Core</td>
<td>Materials</td>
<td>物料</td>
<td>This includes all of the different types of matter that things are made of, like metals, plastics, and glass.</td>
<td>这包括所有不同类型的物质，如金属、塑料和玻璃。</td>
</tr>
<tr>
<td>16</td>
<td>Core</td>
<td>Matter</td>
<td>物</td>
<td>Stuff that takes up space and has mass.</td>
<td>占据空间并具有质量的东西。</td>
</tr>
<tr>
<td>#</td>
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<td>English</td>
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<td>---</td>
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<td>---------</td>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>17</td>
<td>Core</td>
<td>Measuring cylinder</td>
<td>量筒</td>
<td>A piece of apparatus that measures volumes of liquids or solutions.</td>
<td>一种测量液体或溶液体积的设备。</td>
</tr>
<tr>
<td>18</td>
<td>Core</td>
<td>Metals</td>
<td>金属</td>
<td>This class of elements are typically hard, shiny, malleable and conduct electricity well as solids and liquids.</td>
<td>这类元件通常是坚硬的、有光泽的、可延展的并且作为固体和液体导电良好。</td>
</tr>
<tr>
<td>19</td>
<td>Core</td>
<td>Molecule</td>
<td>分子</td>
<td>Two or more atoms joined together by a special bond (covalent).</td>
<td>两个或多个原子通过特殊键（共价键）连接在一起。</td>
</tr>
<tr>
<td>20</td>
<td>Core</td>
<td>Non-metals</td>
<td>非金属</td>
<td>Elements that are not shiny, and do not conduct heat and electricity well.</td>
<td>没有光泽的元素，不能很好地传导热量和电力。</td>
</tr>
<tr>
<td>21</td>
<td>Core</td>
<td>Period</td>
<td>期</td>
<td>A horizontal row of the periodic table.</td>
<td>周期表的水平行。</td>
</tr>
<tr>
<td>22</td>
<td>Core</td>
<td>Periodic table</td>
<td>周期表</td>
<td>A way to organise all of the different types of atoms that we have ever discovered.</td>
<td>一种组织我们所发现的所有不同类型原子的方法。</td>
</tr>
<tr>
<td>23</td>
<td>Core</td>
<td>Proton</td>
<td>质子</td>
<td>A tiny sub-atomic particle with a positive charge. They are found in the middle (nuclei) of atoms and the only thing that makes each atom of each element different is it's the number of these particles.</td>
<td>带有正电荷的微小亚原子粒子。它们存在于原子的中间（原子核）中，唯一使每个元素的每个原子不同的就是它们的这些粒子的数量。</td>
</tr>
<tr>
<td>24</td>
<td>Core</td>
<td>Proton number</td>
<td>质子数</td>
<td>This tells us which element the atom belongs to. The periodic table is arranged using this value.</td>
<td>这告诉我们原子属于哪个元素，使用该值排列周期表。</td>
</tr>
<tr>
<td>25</td>
<td>Core</td>
<td>Sodium chloride</td>
<td>氯化钠</td>
<td>The chemical name for common table salt which we can use in food.</td>
<td>可以在食品中使用的普通食盐的化学名称。</td>
</tr>
<tr>
<td>26</td>
<td>Core</td>
<td>Strong</td>
<td>强大</td>
<td>A large force is needed to break materials that have this property.</td>
<td>需要很大的力来破坏具有这种特性的材料。</td>
</tr>
<tr>
<td>27</td>
<td>Core</td>
<td>Sulfate</td>
<td>硫酸盐</td>
<td>A compound that includes atoms of the elements sulfur and oxygen. There are four oxygen atoms for every one sulfur atom.</td>
<td>包含元素硫和氧原子的化合物。每一个硫原子有四个氧原子。</td>
</tr>
<tr>
<td>28</td>
<td>Core</td>
<td>Symbol</td>
<td>符号</td>
<td>The letter or letters that represent an element.</td>
<td>表示元素的字母或字母。</td>
</tr>
</tbody>
</table>
### True/False questions

1. A compound that includes atoms of the elements sulfur and oxygen. There are four oxygen atoms for every one sulfur atom. → CHLORIDE
   - True
   - False

2. A combination of symbols and numbers that show how many atoms of different kinds there are in a particular compound. → CHEMICAL FORMULA
   - True
   - False

3. Elements the elements in the left vertical column of the periodic table → GROUP 2
   - True
   - False

4. A tiny sub-atomic particle with a positive charge. Protons are found in the nucleus of atoms. The relative mass of a proton is 1, the same as that of a neutron. → SULFATE
   - True
   - False

5. A polymer made by people and machines in factories or science laboratories → NATURAL POLYMER
   - True
   - False

6. The dried piece of paper produced by chromatography. → PROTON NUMBER
   - True
   - False

7. For more unbelievably middle and high school science resources (Secondary I, IGCESE, A Level & IB Diploma) for both teachers and students check out my website. Take things easy and have a marvelous day! → www.SmashingScience.org
   - True
   - False

8. Elements the elements in the vertical columns that is second from the left of the periodic table → GROUP 1
   - True
   - False

9. A mixture of different metals. → ALLOY
   - True
   - False

10. The number of protons in the nucleus of an atom → CHROMATOGRAM
    - True
    - False

11. A compound that is made up of chlorine and one other element; for example sodium chloride, NaCl → SULFATE
    - True
    - False

12. Carefully pouring off a liquid from a mixture of the liquid with a solid, in which the solid has settled to the bottom; or pouring off the top liquid from two liquids that have settled one on top of the other. → DECOMPOSE
    - True
    - False

13. Heating a liquid mixture to separate it into fractions with different boiling points → DISTILLATION
    - True
    - False

14. Letters which represent elements (usually one or two letters) which are understood in all languages. Each element has its own chemical symbol. → CHEMICAL SYMBOLS
    - True
    - False
15. A compound made up of a metal, hydrogen, and oxygen. → HYDROXIDE
   ○ True
   ○ False

16. A substance made up of atoms of two or more elements chemically joined together → POLYMER
   ○ True
   ○ False

17. A formula uses symbols and numbers to show the relative number of atoms of each element in a compound. For example, the formula of water is H2O. This shows that water is made up of atoms of hydrogen and oxygen, strongly joined together. In a sample of water, there are two hydrogen atoms for every one oxygen atom. → FORMULA (PLURAL FORMULAE)
   ○ True
   ○ False

18. A group of compounds which make carbon dioxide when they react with acid. Carbonates are made up of atoms of carbon, oxygen, and a metal element; here are 3 oxygen atoms for every 1 carbon atom. → GROUP 7
   ○ True
   ○ False

19. Break down into simpler parts. → COMPOUND
   ○ True
   ○ False

20. A horizontal row of the periodic table → GROUP
   ○ True
   ○ False

21. The elements in one vertical column of the periodic table → GROUP 1
   ○ True
   ○ False

22. Elements the elements in the vertical column that is second from the right of the periodic table. They are also called the halogens. → GROUP 2
   ○ True
   ○ False

23. A substance with large molecules made up of atoms joined together in long chains → COMPOUND
   ○ True
   ○ False

24. A material is malleable if it can be hammered into shape without cracking → MALLEABLE
   ○ True
   ○ False

25. A concentrated solution of common salt and water. → HYDROXIDE
   ○ True
   ○ False

26. A polymer that exists naturally, often made by plants or animals → SYNTHETIC POLYMER
   ○ True
   ○ False

27. A way of writing out what happens in a chemical reaction using the symbols that represent the substances involved. → CHEMICAL FORMULA
   ○ True
   ○ False

28. Separating a liquid from a solution by evaporating the liquid and then condensing it. → FRACTIONAL DISTILLATION
   ○ True
   ○ False
<table>
<thead>
<tr>
<th>20 Matching questions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ____ FRACTIONAL DISTILLATION</td>
<td>A. Heating a liquid mixture to separate it into fractions with different boiling points</td>
</tr>
<tr>
<td>2. ____ GROUP</td>
<td>B. A group of compounds which make carbon dioxide when they react with acid. Carbonates are made up of atoms of carbon, oxygen, and a metal element; here are 3 oxygen atoms for every 1 carbon atom.</td>
</tr>
<tr>
<td>3. ____ DISTILLATION</td>
<td>C. A horizontal row of the periodic table</td>
</tr>
<tr>
<td>4. ____ COMPOUND</td>
<td>D. A compound that is made up of chlorine and one other element, for example sodium chloride, NaCl.</td>
</tr>
<tr>
<td>5. ____ PROTON NUMBER</td>
<td>E. For more unbelievable middle and high school science resources (Secondary, GCSE, A Level &amp; IB Diploma) for both teachers and students check out my website. Take things easy and have a marvelous day!</td>
</tr>
<tr>
<td>6. ____ HYDROXIDE</td>
<td>F. The number of protons in the nucleus of an atom</td>
</tr>
<tr>
<td>7. ____ GROUP 1</td>
<td>G. A compound that includes atoms of the elements sulfur and oxygen. There are four oxygen atoms for every one sulfur atom.</td>
</tr>
<tr>
<td>8. ____ ALLOY</td>
<td>H. A polymer made by people and machines in factories or science laboratories</td>
</tr>
<tr>
<td>9. ____ CHEMICAL FORMULA</td>
<td>I. A combination of symbols and numbers that show how many atoms of different kinds there are in a particular compound.</td>
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<tr>
<td>10. ____ POLYMER</td>
<td>J. The dried piece of paper produced by chromatography.</td>
</tr>
<tr>
<td>11. ____ NATURAL POLYMER</td>
<td>K. Carefully pouring off a liquid from a mixture of the liquid with a solid, in which the solid has settled to the bottom, or pouring off the top liquid from two Liquids that have settled one on top of the other.</td>
</tr>
<tr>
<td>12. ____ SYNTHETIC POLYMER</td>
<td>L. Elements the elements in the left vertical column of the periodic table</td>
</tr>
<tr>
<td>13. ____ GROUP 7</td>
<td>M. A mixture of different metals.</td>
</tr>
<tr>
<td>14. ____ BRISE</td>
<td>N. Elements the elements in the vertical column that is second from the right of the periodic table. They are also called the halogens.</td>
</tr>
<tr>
<td>15. ____ SYMBOL EQUATION</td>
<td>O. A formula uses symbols and numbers to show the relative number of atoms of each element in a compound. For example, the formula of water is H2O. This shows that water is made up of atoms of hydrogen and oxygen, strongly joined together. In a sample of water, there are two hydrogen atoms for every one oxygen atom.</td>
</tr>
<tr>
<td>16. ____ <a href="http://www.SmashingScience.org">www.SmashingScience.org</a></td>
<td>P. Elements the elements in the vertical column that is second from the left of the periodic table</td>
</tr>
<tr>
<td>17. ____ DECANTEING</td>
<td>Q. The elements in one vertical column of the periodic table</td>
</tr>
<tr>
<td>18. ____ CARBONATES</td>
<td>R. A polymer that exists naturally, often made by plants or animals</td>
</tr>
<tr>
<td>19. ____ CHROMATOGRAM</td>
<td>S. Letters which represent elements (usually one or two letters) which are understood in all languages. Each element has its own chemical symbol.</td>
</tr>
<tr>
<td>20. ____ SULFATE</td>
<td>T. Break down into simpler parts.</td>
</tr>
<tr>
<td>21. ____ PROTON</td>
<td>U. A substance made up of atoms of two or more elements chemically joined together</td>
</tr>
<tr>
<td>22. ____ GROUP 2</td>
<td>V. A substance with large molecules made up of atoms joined together in long chains</td>
</tr>
<tr>
<td>23. ____ DECOMPOSE</td>
<td>W. A concentrated solution of common salt and water.</td>
</tr>
<tr>
<td>24. ____ CHEMICAL SYMBOLS</td>
<td>X. A material is malleable if it can be hammered into shape without cracking.</td>
</tr>
<tr>
<td>25. ____ PERIOD</td>
<td>Y. A compound made up of a metal, hydrogen, and oxygen.</td>
</tr>
<tr>
<td>26. ____ MALLEABLE</td>
<td>Z. A way of writing out what happens in a chemical reaction using the symbols that represent the substances involved.</td>
</tr>
<tr>
<td>27. ____ CHLORIDE</td>
<td>AA. A tiny subatomic particle with a positive charge. Protons are found in the nuclei of atoms. The relative mass of a proton is 1, the same as that of a neutron.</td>
</tr>
<tr>
<td>28. ____ FORMULA (PLURAL FORMULAE)</td>
<td>AB. Separating a liquid from a solution by evaporating the liquid and then condensing it.</td>
</tr>
</tbody>
</table>
28 Multiple choice questions

1. Elements the elements in the vertical column that is second from the right of the periodic table. They are also called the halogens.
   A. GROUP
   B. GROUP 2
   C. GROUP 7
   D. GROUP 1

2. A polymer made by people and machines in factories or science laboratories
   A. CHEMICAL FORMULA
   B. SYMBOL EQUATION
   C. SYNTHETIC POLYMER
   D. NATURAL POLYMER

3. A compound made up of 2 metal, hydrogen, and oxygen.
   A. SULFATE
   B. CHLORIDE
   C. COMPOUND
   D. HYDROXIDE

4. Elements the elements in the vertical column that is second from the left of the periodic table
   A. GROUP 1
   B. GROUP 2
   C. GROUP 7
   D. GROUP

5. A combination of symbols and numbers that show how many atoms of different kinds there are in a particular compound.
   A. SYMBOL EQUATION
   B. CHEMICAL FORMULA
   C. CHEMICAL SYMBOLS
   D. NATURAL POLYMER

6. Elements the elements in the left vertical column of the periodic table
   A. GROUP 7
   B. GROUP 1
   C. GROUP 2
   D. GROUP

7. A group of compounds which make carbon dioxide when they react with acid. Carbonates are made up of atoms of carbon, oxygen, and a metal element. There are 3 oxygen atoms for every 1 carbon atom.
   A. GROUP 7
   B. GROUP 2
   C. CARBONATES
   D. GROUP 1

8. A compound that includes atoms of the elements sulfur and oxygen. There are four oxygen atoms for every one sulfur atom.
   A. HYDROXIDE
   B. CHLORIDE
   C. POLYMER
   D. SULFATE

9. A polymer that exists naturally, often made by plants or animals
   A. CHEMICAL FORMULA
   B. PROTON NUMBER
   C. NATURAL POLYMER
   D. SYNTHETIC POLYMER
10. Heating a liquid mixture to separate it into fractions with different boiling points
   A. CHEMICAL SYMBOLS
   B. DISTILLATION
   C. FRACTIONAL DISTILLATION
   D. SYNTHETIC POLYMER

11. A substance with large molecules made up of atoms joined together in long chains
   A. COMPOUND
   B. SULFATE
   C. CHLORIDE
   D. POLYMER

12. Carefully pouring off a liquid from a mixture of the liquid with a solid, in which the solid has settled to the bottom, or pouring off the top liquid from two liquids that have settled one on top of the other.
   A. DISTILLATION
   B. PROTON
   C. DECANTING
   D. DECOMPOSE

13. The dried piece of paper produced by chromatography.
   A. PROTON NUMBER
   B. NATURAL POLYMER
   C. HYDROXIDE
   D. CHROMATOGRAM

14. Letters which represent elements (usually one or two letters) which are understood in all languages. Each element has its own chemical symbol.
   A. NATURAL POLYMER
   B. CHEMICAL SYMBOLS
   C. SYMBOL EQUATION
   D. CHEMICAL FORMULA

15. A mixture of different metals.
   A. ALLOY
   B. PROTON
   C. MALLEABLE
   D. BRINE

16. A tiny sub-atomic particle with a positive charge. Protons are found in the nucleus of atoms. The relative mass of a proton is 1, the same as that of a neutron.
   A. COMPOUND
   B. CHLORIDE
   C. PROTON
   D. SULFATE

17. A way of writing out what happens in a chemical reaction using the symbols that represent the substances involved.
   A. CHEMICAL FORMULA
   B. CHEMICAL SYMBOLS
   C. SYMBOL EQUATION
   D. DISTILLATION

18. A horizontal row of the periodic table
   A. GROUP 2
   B. GROUP
   C. GROUP 1
   D. PERIOD

19. The elements in one vertical column of the periodic table
   A. GROUP 7
   B. GROUP 1
   C. GROUP 2
   D. GROUP
20. A formula uses symbols and numbers to show the relative number of atoms of each element in a compound. For example, the formula of water is H2O. This shows that water is made up of atoms of hydrogen and oxygen, strongly joined together. In a sample of water, there are two hydrogen atoms for every one oxygen atom.
   A. FRACTIONAL DISTILLATION
   B. FORMULA (PLURAL FORMULAE)
   C. CHEMICAL FORMULA
   D. www.SmashingScience.org

21. A substance made up of atoms of two or more elements chemically joined together
   A. HYDROXIDE
   B. POLYMER
   C. COMPOUND
   D. CHLORIDE

22. For more funbelievable middle and high school science resources (Secondary 1, IGCSE, A Level & IB Diploma) for both teachers and students check out my website. Take things easy and have a marvellous day!
   A. FORMULA (PLURAL FORMULAE)
   B. DECANTING
   C. CHEMICAL SYMBOLS
   D. www.SmashingScience.org

23. The number of protons in the nucleus of an atom
   A. PROTON NUMBER
   B. HYDROXIDE
   C. NATURAL POLYMER
   D. CHROMATOGRAM

24. A compound that is made up of chlorine and one other element, for example sodium chloride, NaCl
   A. COMPOUND
   B. SULFATE
   C. CHLORIDE
   D. HYDROXIDE

25. Separating a liquid from a solution by evaporating the liquid and then condensing it
   A. MALLEABLE
   B. FRACTIONAL DISTILLATION
   C. DISTILLATION
   D. SYMBOL EQUATION

26. A material is malleable if it can be hammered into shape without cracking
   A. MALLEABLE
   B. HYDROXIDE
   C. SULFATE
   D. CHLORIDE

27. Break down into simpler parts.
   A. DECOMPOSE
   B. COMPOUND
   C. HYDROXIDE
   D. MALLEABLE

28. A concentrated solution of common salt and water.
   A. CHLORIDE
   B. ALLOY
   C. BRINE
   D. HYDROXIDE
28 Written questions

1. Break down into simpler parts.

2. Carefully pouring off a liquid from a mixture of the liquid with a solid, in which the solid has settled to the bottom; or pouring off the top liquid from two liquids that have settled one on top of the other.

3. A material is malleable if it can be hammered into shape without cracking

4. A polymer made by people and machines in factories or science laboratories

5. Separating a liquid from a solution by evaporating the liquid and then condensing it.

6. Elements the elements in the vertical column that is second from the right of the periodic table. They are also called the halogens.

7. Heating a liquid mixture to separate it into fractions with different boiling points

8. A mixture of different metals.

9. A compound that is made up of chlorine and one other element, for example sodium chloride, NaCl.

10. A substance made up of atoms of two or more elements chemically joined together

11. A polymer that exists naturally, often made by plants or animals

12. A horizontal row of the periodic table

13. The dried piece of paper produced by chromatography.


15. Letters which represent elements (usually one or two letters) which are understood in all languages. Each element has its own chemical symbol.

16. The number of protons in the nucleus of an atom

17. A tiny subatomic particle with a positive charge. Protons are found in the nuclei of atoms. The relative mass of a proton is 1, the same as that of a neutron.

18. The elements in one vertical column of the periodic table

19. A way of writing out what happens in a chemical reaction using the symbols that represent the substances involved.

20. Elements the elements in the left vertical column of the periodic table

21. A concentrated solution of common salt and water.

22. A substance with large molecules made up of atoms joined together in long chains
23. For more unbelievable middle and high school science resources (Secondary 1, IGCSE, A Level & IB Diploma) for both teachers and students check out my website. Take things easy and have a marvelous day!

24. A group of compounds which make carbon dioxide when they react with acid. Carbonates are made up of atoms of carbon, oxygen, and a metal element. Here are 3 oxygen atoms for every 1 carbon atom.

25. A formula uses symbols and numbers to show the relative number of atoms of each element in a compound. For example, the formula of water is H2O. This shows that water is made up of atoms of hydrogen and oxygen, strongly joined together. In a sample of water, there are two hydrogen atoms for every one oxygen atom.

26. A combination of symbols and numbers that show how many atoms of different kinds there are in a particular compound.

27. Elements in the vertical column that is second from the left of the periodic table.

28. A compound that includes atoms of the elements sulfur and oxygen. There are four oxygen atoms for every one sulfur atom.
c8p

Complete the crossword below

1

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**Across**

1. This tells us which element the atom belongs to. The periodic table is arranged using this value.
2. A piece of apparatus that measures volumes of liquids or solutions.
3. The chemical name for common table salt which we can use in food.
4. Stuff that takes up space and has mass.
5. Two or more atoms joined together by a special bond (covalent).
6. Elements that are not shiny, and do not conduct heat and electricity well.
7. Letters which represent elements (usually one or two letters) which are understood in all languages. Each element has its own one.
8. The smallest part of an element you can get.
9. This class of elements are typically hard, shiny, malleable and conduct electricity well as solids and liquids.
10. This uses symbols and numbers to show the relative number of atoms of each element in a compound. For example, water is H2O. This shows that water is made up of atoms of hydrogen and oxygen, strongly joined together. In a sample of water, there are two hydrogen atoms for every one oxygen atom.
11. A substance made up of atoms of two or more elements chemically joined together.
12. Elements the elements in the left vertical column of the periodic table. They are the most reactive metals.
13. A tiny sub-atomic particle with a positive charge. They are found in the middle (nucleus) of atoms and the only thing that makes each atom of each element different is its number of these particles.
15. The letter or letters that represent an element.
16. A material is this if it is difficult to scratch, like glass or diamond.
17. A compound that includes atoms of the elements sulfur and oxygen. There are four oxygen atoms for every one sulfur atom.
18. A way to organise all of the different types of atoms that we have ever discovered.
19. An element that cannot be split up into anything simpler by chemical reactions.
20. Elements the elements in the vertical column that is second from the right of the periodic table. They are also called the halogens.
21. A large force is needed to break materials that have this property.
22. The elements in one vertical column of the periodic table. Usually, all elements in one of these share similar properties.

**Down**

2. A piece of apparatus that measures volumes of liquids or solutions.
3. The chemical name for common table salt which we can use in food.
4. Stuff that takes up space and has mass.
5. Two or more atoms joined together by a special bond (covalent).
6. Elements that are not shiny, and do not conduct heat and electricity well.
7. Letters which represent elements (usually one or two letters) which are understood in all languages. Each element has its own one.
8. The smallest part of an element you can get.
9. This class of elements are typically hard, shiny, malleable and conduct electricity well as solids and liquids.
10. This uses symbols and numbers to show the relative number of atoms of each element in a compound. For example, water is H2O. This shows that water is made up of atoms of hydrogen and oxygen, strongly joined together. In a sample of water, there are two hydrogen atoms for every one oxygen atom.
11. A substance made up of atoms of two or more elements chemically joined together.
12. Elements the elements in the left vertical column of the periodic table. They are the most reactive metals.
13. A tiny sub-atomic particle with a positive charge. They are found in the middle (nucleus) of atoms and the only thing that makes each atom of each element different is its number of these particles.
15. The letter or letters that represent an element.
16. A material is this if it is difficult to scratch, like glass or diamond.
17. A compound that includes atoms of the elements sulfur and oxygen. There are four oxygen atoms for every one sulfur atom.
## Final HEROS CHALLENGE

**Fill in the missing meanings:**

*Try to do as much as you can without using the word list on the first page to help and circle those words whose meaning you were able to remember.*

<table>
<thead>
<tr>
<th>English</th>
<th>Meaning in English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matter</td>
<td>Stuff that takes up space and has mass.</td>
</tr>
<tr>
<td>Metals</td>
<td>This class of elements are typically hard, shiny, malleable and conduct electricity well as solids and liquids.</td>
</tr>
<tr>
<td>Hydroxide</td>
<td>A compound made up of a metal, hydrogen, and oxygen, the most famous has this formula NaOH.</td>
</tr>
<tr>
<td>Filter</td>
<td>A way of removing pieces of solid that are mixed with a liquid or solution by pouring through special paper.</td>
</tr>
<tr>
<td>Chemical symbols</td>
<td>Letters which represent elements (usually one or two letters) which are understood in all languages. Each element has its own one.</td>
</tr>
<tr>
<td>Proton</td>
<td>A tiny subatomic particle with a positive charge. They are found in the middle (nuclei) of atoms and the only thing that makes each atom of each element different is it's the number of these particles.</td>
</tr>
<tr>
<td>Sulfate</td>
<td>A compound that includes atoms of the elements sulfur and oxygen. There are four oxygen atoms for every one sulfur atom.</td>
</tr>
<tr>
<td>Strong</td>
<td>A large force is needed to break materials that have this property.</td>
</tr>
<tr>
<td>Molecule</td>
<td>Two or more atoms joined together by a special bond (covalent).</td>
</tr>
<tr>
<td>Malleable</td>
<td>The property of being able to bend without breaking, like a paper clip.</td>
</tr>
<tr>
<td>Element</td>
<td>A substance that cannot be split up into anything simpler by chemical reactions.</td>
</tr>
<tr>
<td>Group 1</td>
<td>Elements the elements in the left vertical column of the periodic table. They are the most reactive metals.</td>
</tr>
<tr>
<td>Hard</td>
<td>A material is this if it is difficult to scratch, like glass or diamond.</td>
</tr>
<tr>
<td>Atom</td>
<td>The smallest part of an element you can get.</td>
</tr>
<tr>
<td>Group</td>
<td>The elements in one vertical column of the periodic table. Usually, all elements in one of these share similar properties.</td>
</tr>
<tr>
<td>Symbol</td>
<td>The letter or letters that represent an element.</td>
</tr>
<tr>
<td>Measuring cylinder</td>
<td>A piece of apparatus that measures volumes of liquids or solutions.</td>
</tr>
<tr>
<td>Group 2</td>
<td>Elements the elements in the vertical column that is second from the left of the periodic table.</td>
</tr>
<tr>
<td>Period</td>
<td>A horizontal row of the periodic table.</td>
</tr>
<tr>
<td>Compound</td>
<td>A substance made up of atoms of two or more elements chemically joined together.</td>
</tr>
<tr>
<td>Proton number</td>
<td>This tells us which element the atom belongs to. The periodic table is arranged using this value.</td>
</tr>
<tr>
<td>Formula (plural formulae)</td>
<td>This uses symbols and numbers to show the relative number of atoms of each element in a compound. For example, water is H2O. This shows that water is made up of atoms of hydrogen and oxygen, strongly joined together. In a sample of water, there are two hydrogen atoms for every one oxygen atom.</td>
</tr>
<tr>
<td>Sodium chloride</td>
<td>The chemical name for common table salt which we can use in food.</td>
</tr>
<tr>
<td>Bond</td>
<td>Force holding atoms together.</td>
</tr>
<tr>
<td>Materials</td>
<td>This includes all of the different types of matter that things are made of, like metals, plastics, and glass.</td>
</tr>
<tr>
<td>Non-metals</td>
<td>Elements that are not shiny, and do not conduct heat and electricity well.</td>
</tr>
<tr>
<td>Periodic table</td>
<td>A way to organise all of the different types of atoms that we have ever discovered.</td>
</tr>
<tr>
<td>Group 7</td>
<td>Elements the elements in the vertical column that is second from the right of the periodic table. They are also called the halogens.</td>
</tr>
</tbody>
</table>
**Elements**

An element is a simple substance that cannot be split into anything simpler by chemical reactions. Atoms are the smallest particles of an element that can exist. Atoms of one element are all the same, and are different from atoms of all the other elements.

There are over 100 different elements. All the elements are shown in the Periodic Table. Each element has a chemical symbol, which is usually one or two letters. A symbol is written with the first letter as a capital, and the second letter is small.

<table>
<thead>
<tr>
<th>element</th>
<th>symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbon</td>
<td>C</td>
</tr>
<tr>
<td>nitrogen</td>
<td>N</td>
</tr>
<tr>
<td>gold</td>
<td>Au</td>
</tr>
<tr>
<td>copper</td>
<td>Cu</td>
</tr>
<tr>
<td>oxygen</td>
<td>O</td>
</tr>
<tr>
<td>hydrogen</td>
<td>H</td>
</tr>
<tr>
<td>silver</td>
<td>Ag</td>
</tr>
<tr>
<td>aluminium</td>
<td>Al</td>
</tr>
</tbody>
</table>

**Metals and non-metals**

The properties of a substance are the words that we use to describe it, or measurements that we can make on it. Metals and non-metals have different properties.

<table>
<thead>
<tr>
<th>Metals</th>
<th>Non-metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>good conductors of heat and electricity</td>
<td>poor conductors of heat and electricity</td>
</tr>
<tr>
<td>shiny</td>
<td>dull</td>
</tr>
<tr>
<td>solids with a high melting point (except for mercury)</td>
<td>most are solids or gases</td>
</tr>
<tr>
<td>found on the left-hand side of the Periodic Table</td>
<td>found on the right-hand side of the Periodic Table</td>
</tr>
<tr>
<td>three metals are magnetic</td>
<td>no non-metals are magnetic</td>
</tr>
<tr>
<td>metals can burn to form alkaline oxides</td>
<td>non-metals can burn to form acidic oxides</td>
</tr>
<tr>
<td>flexible</td>
<td>brittle</td>
</tr>
</tbody>
</table>

**Compounds**

Elements can join together to make compounds. The name of the compound tells you the elements that are in it. Compounds made from two elements always have a name which ends in ‘-ide’.

<table>
<thead>
<tr>
<th>These elements join together ...</th>
<th>... to make these compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbon, oxygen</td>
<td>carbon dioxide</td>
</tr>
<tr>
<td>sodium, chlorine</td>
<td>sodium chloride</td>
</tr>
<tr>
<td>magnesium, oxygen</td>
<td>magnesium oxide</td>
</tr>
</tbody>
</table>
A chemical formula tells you the name and number of atoms in a compound. The smallest particle of many compounds is called a **molecule**. Molecules are made up of atoms. Some elements are also made of molecules. For example, a molecule of oxygen contains two oxygen atoms joined together. The formula is $\text{O}_2$.

<table>
<thead>
<tr>
<th>Elements</th>
<th>Compounds</th>
<th>Mixtures</th>
</tr>
</thead>
<tbody>
<tr>
<td>atoms of helium (He)</td>
<td>molecules of carbon dioxide ($\text{CO}_2$)</td>
<td>a mixture of helium and oxygen</td>
</tr>
<tr>
<td>molecules of oxygen ($\text{O}_2$)</td>
<td>molecules of water ($\text{H}_2\text{O}$)</td>
<td>a mixture of carbon dioxide and oxygen</td>
</tr>
<tr>
<td>a lump of carbon (C)</td>
<td>a lump of sodium chloride ($\text{NaCl}$)</td>
<td>a lump of bronze</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(an alloy of copper and tin)</td>
</tr>
</tbody>
</table>
Mind map of the review sheets: Atoms and Elements
Sec1 Sci C8p Info Summary Sheet Compounds and mixtures

Elements are simple substances which cannot be split up in chemical reactions. Atoms are the smallest particles of an element that can exist. Atoms of an element are all the same.

Each element has its own chemical symbol. For example, the chemical symbol for oxygen is O.

Some elements have their atoms joined to each other in small groups called molecules. Oxygen is an example.

A molecule of oxygen consists of two oxygen atoms joined together.

Compounds

Elements can join together to make compounds. A compound contains two or more elements joined together. The name of the compound tells you the elements that are in it. Compounds made from two elements always have a name which ends in ‘-ide’.

Many compounds exist as atoms attached to each other in small groups – molecules.

A molecule of water.

The chemical formula tells you the numbers of atoms of each element in a compound. Each element in the chemical formula is shown by its chemical symbol. For example:

A compound always contains the same elements in the same ratio.
The properties of a compound are different from the elements that make it up. For example, hydrogen is an explosive gas and oxygen will relight a glowing splint but water is a liquid which will put fires out.

**Chemical reactions**

Compounds can react chemically by mixing them with other chemicals, or by using heat or electricity. You can tell that a **chemical reaction** has occurred if there is a colour change or when a gas is given off.

Most chemical reactions also involve an energy change. This is usually in the form of heat, but can also involve light being given off, for example, in burning (**combustion**).

In a chemical reaction a new substance is always formed. Most chemical reactions are not easily reversed (they are **irreversible**).

Some chemical reactions take place just by mixing. When you make a solid by mixing two liquids, the solid is called a **precipitate**.

Other chemical reactions need energy to start them off. This energy can be in the form of heat, light or electricity. When you use energy to split up compounds they are **decomposed**.

We can write **word equations** to show a chemical reaction. The chemicals that you start with are called the **reactants**. The chemicals at the end are called the **products**. For example:

```
\text{magnesium + oxygen} \rightarrow \text{magnesium oxide}
```

**Physical changes**

In a **physical change** no new substance is formed. **Melting**, **evaporating**, **condensing** and **freezing** are all examples of physical changes.

For example:

```
\begin{align*}
\text{ice} &\rightarrow \text{water} &\rightarrow \text{steam} \\
\text{freezing} &\rightarrow \text{melting} &\rightarrow \text{evaporation}
\end{align*}
```

**Mixtures**

Elements and compounds can also be mixed together. A **mixture** is easier to separate than the elements in a compound. Soil, river water and sea water are examples of mixtures that occur naturally.

Elements and compounds melt and boil at a fixed temperature. Mixtures do not have definite **melting points** and **boiling points**.

Air is a mixture of gases – most of the air is nitrogen and oxygen. The gases in the air can be separated by **fractional distillation**.
Mind map of the review sheets: Compounds and mixtures

When it cooled it formed rock sulphur.

(b) Sulphur is a non-metallic element. It is yellow and melts at 115°C.

Complete the sentences about sulphur.

(i) Sulphur is a poor conductor of

.................................................................................................................

1 mark

(ii) At 115°C sulphur changes from

a ........................................ into a ..........................................

2 marks

(c) Sulphur burns in air to form an oxide.

What gas in the air reacts with sulphur when it burns?

..........................................................................................................

1 mark

Q# 2/ Q18. The list below shows properties that different elements can have.

- magnetic
- can be compressed
- very high melting point
- very low melting point
- good conductor of heat
- poor conductor of heat
- good conductor of electricity
- poor conductor of electricity

(a) Which two properties from the list above make aluminium suitable for saucepans?

1. .................................................................................................................

2. .................................................................................................................

2 marks

(b) Which property in the list above explains why:

(i) copper is used in the cable of a television?

..........................................................................................................

1 mark
(ii) a lot of oxygen gas can be pumped into a very small container?

.................................................................................................................

1 mark

Q# 3/ Q21. (a) The table below shows the melting points of four metals.

<table>
<thead>
<tr>
<th>metal</th>
<th>melting point, in °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>gold</td>
<td>1064</td>
</tr>
<tr>
<td>mercury</td>
<td>−37</td>
</tr>
<tr>
<td>sodium</td>
<td>98</td>
</tr>
<tr>
<td>iron</td>
<td>1540</td>
</tr>
</tbody>
</table>

(i) Which metal in the table has the highest melting point?

.................................................................................................................

1 mark

(ii) Which metal in the table has the lowest melting point?

.................................................................................................................

1 mark

(b) Gold can be a gas or a liquid or a solid.

Choose from these words to fill the gaps below.

When gold is heated from room temperature to 1070°C, the gold changes from a ......................... to a ......................... .

1 mark

(c) 5 g of gold is melted and all of it is poured into a mould to make a pendant as shown below.

What is the mass of the gold pendant?

............... g
(d) The table below shows how the four metals react with oxygen when heated in air.

<table>
<thead>
<tr>
<th>metal</th>
<th>reaction when heated in air</th>
</tr>
</thead>
<tbody>
<tr>
<td>gold</td>
<td>no change</td>
</tr>
<tr>
<td>mercury</td>
<td>slowly forms a red powder</td>
</tr>
<tr>
<td>sodium</td>
<td>bursts into flames straight away</td>
</tr>
<tr>
<td>iron</td>
<td>very slowly turns black</td>
</tr>
</tbody>
</table>

(i) Which is the most reactive metal in the table?
.............................................................................................................
   1 mark

(ii) Which is the least reactive metal in the table?
............................................................... 1 mark

Q# 4/ Q22. The drawing shows a gold mask from a tomb in Egypt. The gold is still shiny after thousands of years.

(a) What is pure gold? Tick the correct box.

- a compound   - a mixture
- an element   - a solution

(b) The list shows some of the properties of gold.

- It conducts electricity.
- It melts at 1064°C.
- It is yellow.
- It is easily scratched.
- It stays shiny.
- It conducts heat.

(i) Which one of these properties shows that gold does not react with oxygen in the air?
.............................................................................................................
   1 mark
(ii) Which **two** of the properties above are properties of **all** metals?

1. .........................................................................................................
2. .........................................................................................................

2 marks

(c) Old iron objects from tombs in Britain are often covered with rust.

Iron reacts with oxygen when it rusts.

What else is needed for iron to go rusty? Choose one substance from the list below.

lead     nitrogen     carbon dioxide     water

........................................................................................................

1 mark

(d) A box contains a collection of metal objects from a tomb.

What piece of equipment would you use to separate the iron objects from the other metal objects?

........................................................................................................

1 mark

Q# 5/ Q15. The diagram shows the parts of an iron.

(a) Choose words from the list below to fill the gaps in the sentences.

low high heat poor

sound gravity friction electricity

The bottom of the iron is made of steel because steel is a good conductor of ........................., and because steel has a

......................... melting point.

The steel is polished until it is very smooth to reduce the force of

......................... between the iron and the cloth.
(b) Suggest what material the handle could be made from.

………………………………….

Give a reason for your answer.

……………………………………………………………………………………….

1 mark

(c) The iron has three temperature settings.

The settings for different fabrics are shown below.

<table>
<thead>
<tr>
<th>symbol</th>
<th>(120°C Max) Cool</th>
<th>(180°C Max) Warm</th>
<th>(210°C Max) Hot</th>
</tr>
</thead>
<tbody>
<tr>
<td>control knob settings</td>
<td>●</td>
<td>● ●</td>
<td>● ● ●</td>
</tr>
<tr>
<td>fabric</td>
<td>nylon</td>
<td>wool or polyester</td>
<td>cotton or linen</td>
</tr>
</tbody>
</table>

What might happen if nylon clothes are ironed on the ● ● ● setting?

……………………………………………………………………………………….

1 mark

(d) After it is switched on, the iron heats up. The time it takes to heat up is shown below.

<table>
<thead>
<tr>
<th>setting</th>
<th>time to heat up, in seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>● ● ●</td>
<td>38</td>
</tr>
<tr>
<td>● ● ●</td>
<td>68</td>
</tr>
</tbody>
</table>

Suggest the time to heat up on the ● ● ● setting.

Write your answer in the table.

1 mark

Maximum 7 marks

Q# 6/ Q20. At school Ellen heated some copper powder until it went black.

(a) Give the name of the black substance formed when copper reacts with oxygen.

……………………………………………………………..

1 mark
(b) Ellen added the black substance to some dilute sulphuric acid. The black substance reacted with sulphuric acid forming a blue solution of copper sulphate.

What type of substance is copper sulphate?

Tick the correct box.

- an acid
- a compound
- an element
- a mixture

1 mark

(c) (i) Ellen poured 20 cm$^3$ of the blue copper sulphate solution into a dish, A, as shown below.

She left the dish in a room at 21°C for two days.

What two changes would Ellen observe in dish A two days later?

1. ...............................................................................................................
2. ...............................................................................................................

2 marks

(ii) Ellen poured 20 cm$^3$ of the same blue copper sulphate solution into another dish, B. She put a lid on dish B and left it in the room at 21°C for two days.

After two days the contents of dish B looked different from the contents of dish A.

Give one difference Ellen would observe and explain how the lid caused this difference.

........................................................................................................................................
........................................................................................................................................

2 marks
Q# 7/ Q14. The diagram shows an outline of part of the Periodic Table of Elements.

![Periodic Table Diagram]

(a) What is the name of the element with the symbol H?

………………………………………………………………………………………

(b) In which regions of the Periodic Table are the following types of element found?

(i) non-metals (such as oxygen and chlorine);

region ...........

(ii) very reactive metals (such as sodium and potassium);

region ...........

(iii) less reactive metals (such as copper and zinc).

Region ...........

(c) Why is copper sulphate not found in the Periodic Table?

………………………………………………………………………………………

(d) An iron nail is placed into some blue copper sulphate solution.

A reaction takes place between the iron and the copper sulphate.

(i) Complete the word equation for the reaction.

    iron + copper sulphate → ..............................................................+........................................

(ii) Describe one change you would see on the surface of the nail.

………………………………………………………………………………………

1 mark
Q# 8/ Q12. The diagrams represent the arrangement of atoms or molecules in four different substances, A, B, C and D.

Each of the circles, ○, □ and ● represents an atom of a different element.

(a) (i) Which substance is a compound?

............

1 mark

(ii) Which substance is a mixture?

............

1 mark

(iii) Which two substances are elements?

............ and ...........

1 mark

(iv) Which two substances could be good thermal conductors?

............ and ...........

1 mark

(v) Which substance could be carbon dioxide?

............

1 mark

(b) The following experiment was set up. Test-tubes containing substances B and C were placed together as shown. The substances did not react.

They were left for five minutes.
(i) How many molecules are there in the mixture compared to the total number in substances B and C?

.................................................................................................................. 1 mark

(ii) Complete the diagram which is a model of this experiment.

Q# 9/ Q16 The table shows the melting points and boiling points of four substances present in the air.

<table>
<thead>
<tr>
<th>substance</th>
<th>melting point, in °C</th>
<th>boiling point, in °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbon dioxide</td>
<td>–78</td>
<td>–78</td>
</tr>
<tr>
<td>nitrogen</td>
<td>–210</td>
<td>–196</td>
</tr>
<tr>
<td>oxygen</td>
<td>–219</td>
<td>–183</td>
</tr>
<tr>
<td>water vapour</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

(a) What happens to a piece of solid carbon dioxide if it is heated from –100°C to –78°C?

.................................................................................................................. 1 mark

(b) ‘Liquid air’ can be formed from air in a heat exchanger. As the air passes through, thermal energy is transferred from the air to the surroundings. This is shown in the flow diagram below.
(i) Suggest a likely temperature for the ‘liquid air’ that leaves the heat exchanger.

.............°C

1 mark

(ii) Use the information in the table to explain why carbon dioxide and water vapour need to be removed from the air before it is pumped through pipes to the heat exchanger.

State the consequences of not removing these two gases.

............................................................................................................................................
............................................................................................................................................

2 marks

(c) The ‘liquid air’ is a mixture of liquid nitrogen and liquid oxygen.

Use the information in the table to suggest how liquid oxygen could be obtained from the mixture.

.............................................................................................................................................

1 mark

(d) A room measures 4 m x 3 m x 2.5 m.

(iii) How does the distance between the particles in atmospheric air compare to the size of the particles themselves?

.............................................................................................................................................

1 mark

Q# 10/ Q17. Chris has two rubber party balloons. One is filled with air and the other is filled with helium. Both balloons contain the same volume of gas.

(a) (i) Explain why the helium balloon rises.

.............................................................................................................................................

1 mark

(ii) Explain why the air balloon drops to the ground.

.............................................................................................................................................

1 mark

(b) The chemical symbol for helium is He.

Explain why air does not have a chemical symbol or formula.

.............................................................................................................................................

1 mark
(c) The diagram below shows seven arrangements of particles.

![Diagram of particle arrangements]

The two party balloons are coated with a thin layer of aluminium.

Give the letter of the diagram which best represents the particles in:

(i) the helium gas; .....................
1 mark

(ii) the air; .........................
1 mark

(iii) the thin layer of aluminium. .....................
1 mark

(d) Over several days, the balloons shrink because the particles of gas diffuse through the balloon and escape. The helium balloon shrinks more quickly than the air-filled balloon.

Answer the following questions in terms of particles.

(i) Why does helium escape more quickly than air from a balloon?

.............................................................................................................
1 mark

(ii) A rubber balloon coated with aluminium takes longer to shrink than a rubber balloon without an aluminium coating.

Suggest a reason why gas particles diffuse more slowly through aluminium than through rubber.

.............................................................................................................
1 mark

Maximum 8 marks
Q#1/ M13. (b) (i) any one from
• thermal energy
  accept ‘heat’ or ‘energy’
• electricity
1 (L3)
(ii) answers may be in either order
• solid
1 (L3)
• liquid
  accept ‘fluid’
1 (L3)
(c) oxygen
1 (L4)
[6]

Q#2/ M18. (a) very high melting point
answers may be in either order
1 (L3)
good conductor of heat
do not accept ‘good conductor’
1 (L3)
(b) (i) good conductor of electricity
do not accept ‘good conductor’
1 (L3)
(ii) can be compressed
1 (L4)
[4]

Q#3/ M21. (a) (i) iron
do not accept ‘1540°C’
1 (L3)
(ii) mercury
do not accept ‘−37°C’
1 (L3)
(b) solid to a liquid
answers must be in the correct order
both answers are required for the mark
1 (L3)
(c) 5
1 (L3)
(d) (i) sodium
1 (L3)
(ii) gold
1 (L3)
[6]

Q#4/ M22. (a) an element ✓
if more than one box is ticked, award no mark
1 (L4)
(b) (i) it stays shiny
1 (L3)
(ii) it conducts electricity
1 (L3)
it conducts heat
answers may be in either order
accept ‘it conducts’ for one mark if neither of the fully correct answers is given
accept ‘it stays shiny’
1 (L3)
(c) water
1 (L4)
(d) any one from
• a magnet
1 (L4)

Q#5/ M15. (a) heat
1 (L3)
high
1 (L4)
friction
answers must be in the correct order
1 (L4)
(b) plastic
accept a suitable, named plastic
accept ‘wood’ or ‘rubber’
1 (L3)
any one from
• it is a poor conductor of heat or electricity
  accept ‘it does not conduct’ or ‘it is an insulator’
or ‘your hand does not get hot’
• it is light
• it is easy to shape
  accept ‘it is rigid or stiff’
do not accept ‘it is strong’
1 (L4)
(c) they might melt
accept ‘it makes a hole’ or ‘they burn’
1 (L3)
(d) accept any time from 45 to 60 seconds
1 (L4)
[7]

Q#6/ M20. (a) copper oxide
1 (L6)
(b) compound ✓
if more than one box is ticked, award no mark
1 (L5)
(c) (i) less solution or liquid or water
answers may be in either order
accept ‘no liquid’ or ‘the liquid had gone’
or ‘liquid had evaporated’
crystals formed
accept ‘solid copper sulphate formed’
or ‘a blue solid appeared’
1 (L5)
(ii) any one from
• there would be more of the solution left
  accept ‘the solution would still be there’
• there would be fewer crystals
  accept ‘no crystals’
  accept ‘no change in dish B’
any one from
• it prevented the evaporation
  accept ‘it stopped the water leaving the dish’
• less water would have evaporated or gone
1 (L5)
[6]

Q#7/ M14. (a) hydrogen
1 (L6)
(b) (i) region 3
(ii) region 1

(iii) region 2

(c) any one from
- it is a compound
- it is not an element
- it is made up of more than one element
do not accept ‘it is not a single substance’

(d) (i) copper + iron sulphate
answers may be in either order
both are required for the mark

(ii) the nail becomes brown or pink or copper coloured
accept ‘it is covered in copper’
accept ‘it is rust coloured’
do not accept ‘it goes rusty’

Q# 8/ M12. (a) (i) C

(ii) D

(iii) A and B
answers may be in either order
both answers are required for the mark

(iv) A and D
answers may be in either order
both answers are required for the mark

(v) C

(b) (i) the same
accept ‘seven’

(ii) a random, mixed arrangement of both types of molecule should be drawn with the molecules not touching each other

Q# 9/ M16. (a) changes from a solid to a gas
accept ‘it sublimes’
accept ‘it remains solid’

(b) (i) any temperature from −196°C to −210°C

(ii) they would become solid or freeze
they would block the pipes
accept ‘the pipes could burst’

(c) any one from
- boil away the nitrogen
accept ‘by fractional distillation’
- warm it to between −196°C and −183°C
accept ‘warm it to above −196°C’
accept ‘cool it to below −210°C’ or ‘freeze the nitrogen’

(d) (iii) any one from
- distance is much larger than the size of the particles
accept ‘it is larger’
- in the gas the volume includes the space between particles,
but in the liquid it is the volume of the particles only

Q# 10/ M17. (a) (i) helium is less dense than air
accept ‘helium is lighter than air’
accept ‘the upthrust on the helium balloon is greater than the weight of the balloon’

(ii) any one from
- the air in the balloon is denser than the air in the room
accept ‘the air in the balloon is compressed’
- the rubber has weight
accept ‘rubber is heavier than air’
accept ‘the rubber is denser than air’
accept ‘the upthrust on the air balloon is less than the weight of the balloon’

(b) any one from
- air is a mixture
accept ‘air contains different gases’
- air is not a single element or compound
‘air is not a single substance’ is not sufficient

(c) (i) B

(ii) C

(iii) G

(d) (i) any one from
- helium particles are smaller
accept ‘molecules’ or ‘atoms’ for particles
- helium particles move faster

(ii) any one from
- aluminium particles or atoms are closer together
- rubber particles or molecules are further apart
accept ‘rubber particles’
or molecules have bigger gaps between them’
Careers in science

Most students who continue to study chemistry at A Level will not become chemists, but they will instead be doctors, lawyers, or work in big businesses. This list is just of the best paying careers in the US at the moment, but the top 13 are doctors which require chemistry at A Level.

The best job, possibly, recommended to me by a retired eye surgeon is a nurse anesthesiologist, a special type of nurse that has an average annual income of $160 000 and carefully controlled working conditions.

https://nurse.org/resources/nurse-anesthetist/

These are the 25 best-paying jobs in America in 2018

Courtney Connley | @classicalycourt
8:00 AM ET Wed, 10 Jan 2018

If you want to bring home serious money — and you can withstand years of training and long, sometimes unpredictable hours — you may want to consider a medical career.

According to U.S. News & World Report’s 2018 Best Jobs data, the best-paying jobs in this field will carry the highest salary this year, followed by careers in engineering and business.

"Health care jobs are prominent on our list year after year and are predicted to continue growing rapidly within the job market by 2026," said Rebecca Koenig, careers reporter at U.S. News.

"Health care goes beyond doctors and nursing professions – there is high demand for people to fill positions available in health care technology, at hospitals and elsewhere within the industry that tap into a variety of the categories we rank and that offer a low unemployment rate, a high median salary and robust job growth."

The occupations listed below are the 25 best paying, according to U.S. News & World Report and data from the Bureau of Labor Statistics.

1. Anesthesiologist
   Mean salary: $269,600
2. Surgeon
   Mean salary: $252,910
3. Obstetrician and Gynecologist
   Mean salary: $234,310
4. Oral and Maxillofacial Surgeon
   Mean salary: $232,870
5. Orthodontist
   Mean salary: $228,780
6. Physician
   Mean salary: $201,840
7. Psychiatrist
   Mean salary: $200,220
8. Pediatrician  
Mean salary: $184,240
9. Dentist  
Mean salary: $173,860
10. Prosthodontist  
Mean salary: $168,140

11. Nurse Anesthetist  
Mean salary: $164,030

12. Petroleum Engineer  
Mean salary: $147,030
13. IT Manager  
Mean salary: $145,740
14. Marketing Manager  
Mean salary: $144,140
15. Podiatrist  
Mean salary: $144,110
16. Lawyer  
Mean salary: $139,880
17. Financial Manager  
Mean salary: $139,720
18. Sales Manager  
Mean salary: $135,090
19. Financial Advisor  
Mean salary: $123,100
20. Business Operations Manager  
Mean salary: $122,090
21. Pharmacist  
Mean salary: $120,270
22. Optometrist  
Mean salary: $117,580
23. Actuary  
Mean salary: $114,120
24. Political Scientist  
Mean salary: $112,250
Extension task: Expanding your mind using the C8p Material Properties topic

Use the information below to create a 2 to 5 minute power point presentation, or poster, to explain something that really interests you about this topic. There will be a special extra session in the last week of this topic, or the first week of the next topic when you can explain to others your idea.

- Only students who are really interested in becoming the best at science need to try this, it is up to you if you want to give it a go. All students in any teaching group are welcome to try though.
- Try to include colorful pictures, especially ones you have drawn yourself, they will make your project much better than simply copying and pasting from the internet.
- Include lots of details.
- Explaining one thing clearly is much better than just stating many facts.
- Ask a science teacher for help if you want more information about how to do a great presentation, or about the idea you are interested in.

Extra information to help you get ideas is available here:

Virtual tours of museums:

Smithsonian in the US: https://naturalhistory2.si.edu/VT3/#

Interesting things done with atoms or about atoms:
The image above was the first thing to be written in single atoms: https://en.wikipedia.org/wiki/IBM_(atoms)
How small can a CPU get? https://computer.howstuffworks.com/small-cpu.htm
Build your own molecule with this simulation: https://phet.colorado.edu/en/simulation/build-a-molecule
Want to find out about Quantum Mechanics? This is a fantastic explanation: http://www.physics4kids.com/files/mod_quantum.html
Looking for the God particle?
For an entertaining tour of CERN (where the world wide web was invented): http://www.cernland.net/index.php

Interesting things about elements:
Most expensive elements: https://moneyinc.com/most-expensive-elements-in-the-world/

Interesting things about mixtures
Mud worth more than gold: https://www.sciencenewsforstudents.org/article/mud-worth-more-gold

Links to the International Union of Pure and Applied Chemists IUPAC
(they’re like the NBA of chemistry, except they’re not as famous or wealthy)
For the very latest version of the periodic table: https://iupac.org/what-we-do/periodic-table-of-elements/
Could you be the on their periodic table of Younger chemists one day? https://iupac.org/100/pt-of-chemist/
Amazing scientists:

Some of this is very hard to read, but just reading a little and not understanding nearly all of it, might still change your life!

Rutherford (ask Mr Aarts about him!): [https://www.phy.cam.ac.uk/history/years/rutherford](https://www.phy.cam.ac.uk/history/years/rutherford)


Marie Curie. This site, Ducksters also includes an audio version of the text, so particularly useful to listen to while you read it! [https://www.ducksters.com/biography/women_leaders/marie_curie.php](https://www.ducksters.com/biography/women_leaders/marie_curie.php)

Simple Wikipedia

This uses simpler English words in its articles. It is still run by the same non-profit foundation as Wikipedia, but you might find it easier to read

Homepage is: [https://simple.wikipedia.org/wiki/Main_Page](https://simple.wikipedia.org/wiki/Main_Page)

Careers in science

Highest paid jobs in science: [https://www.trade-schools.net/articles/highest-paying-science-jobs.asp](https://www.trade-schools.net/articles/highest-paying-science-jobs.asp)


Most satisfying jobs (chemistry at A level is needed for at least some of these): [https://www.thebalancecareers.com/what-are-the-most-satisfying-jobs-4163539](https://www.thebalancecareers.com/what-are-the-most-satisfying-jobs-4163539)


Meaningful and satisfying careers, ranked (check out the bottom of the list, these are jobs you definitely don’t want!): [https://www.payscale.com/data-packages/most-and-least-meaningful-jobs/full-list](https://www.payscale.com/data-packages/most-and-least-meaningful-jobs/full-list)

For up to date news on science in general

For interested but less able students: [https://www.dogonews.com/category/science](https://www.dogonews.com/category/science)

For more able students: [https://www.sciencenewsforstudents.org/](https://www.sciencenewsforstudents.org/)

ONLY for the most interested and ablest students:

For interested but less able students: [https://www.dogonews.com/category/science](https://www.dogonews.com/category/science)

For more able students: [https://www.sciencenewsforstudents.org/](https://www.sciencenewsforstudents.org/)

BBC Bitesize - you may not be able to access all of the content in some parts of the world, but the notes here about space are at the iGCSE level and are excellent: [https://www.bbc.com/bitesize/levels/z4kw2hv](https://www.bbc.com/bitesize/levels/z4kw2hv)
The periodic table of elements (CIE iGCSE version)

<table>
<thead>
<tr>
<th>Group</th>
<th>(\text{I} )</th>
<th>(\text{II} )</th>
<th>(\text{III} )</th>
<th>(\text{IV} )</th>
<th>(\text{V} )</th>
<th>(\text{VI} )</th>
<th>(\text{VII} )</th>
<th>(\text{O} )</th>
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</thead>
<tbody>
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<td>Tm</td>
<td>Yb</td>
<td>Lu</td>
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<td></td>
</tr>
</tbody>
</table>

*58–71 Lanthanoid series

*190–103 Actinoid series

Key

- \(a\) = relative atomic mass
- \(b\) = atomic symbol
- \(c\) = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).