

# **PiXL Independence:**

## **GCSE Chemistry – Student Booklet**

### **KS4**

#### **Structure, bonding and the properties of matter**

#### **Contents:**

- I. Level 1- Multiple Choice Quiz – 20 credits
- II. Level 2 - 5 questions, 5 sentences, 5 words – 10 credits each
- III. Level 3 - Science in The News – 100 credits
- IV. Level 4 - Scientific Poster – 100 credits
- V. Level 5 - Video summaries – 50 credits each

**PiXL Independence – Level 1**  
**Multiple Choice Questions**  
**GCSE Chemistry – Structure, bonding and properties of matter**

**INSTRUCTIONS**

Score: /20

- Read the question carefully.
  - Circle the correct letter.
  - Answer all questions.
1. A solid represented by the particle model is:
    - a. Lots of spheres all vibrating in a fixed position.
    - b. Lots of spheres all moving randomly.
    - c. A few spheres all vibrating around a fixed position.
    - d. A few spheres all moving randomly.
  
  2. In a gas, the particles have:
    - a. Less energy than a liquid and move around slowly.
    - b. Less energy than a liquid and move around quickly.
    - c. More energy than a liquid and move around quickly.
    - d. More energy than a liquid and move around slowly.
  
  3. The force in an ionic bond is:
    - a. Magnetic.
    - b. Electrostatic.
    - c. Between the atoms.
    - d. Equal the gravity.
  
  4. An ionic bond occurs:
    - a. Between oppositely charged ions.
    - b. Between oppositely charged atoms.
    - c. Between atoms of the same charge.
    - d. Between ions of the same charge.
  
  5. Giant covalent lattices such as diamond have a high melting point due to:
    - a. Weak intermolecular forces of attraction between the atoms.
    - b. Strong Ionic bonds that require a lot of energy to break them.
    - c. Strong covalent bonds that require a lot of energy to break them.
    - d. Strong intermolecular forces of attraction between the atoms.
  
  6. A covalent bond is:
    - a. The transfer of electrons.
    - b. Between two metals.
    - c. The sharing of a pair of electrons.
    - d. Between a metal and a non-metal.

7. Metallic bonds occur between:
  - a. Oppositely charged ions.
  - b. Oppositely charged atoms.
  - c. The ion and a free electron.
  - d. The atom and a free electron.
  
8. Simple covalent molecules have low melting points because:
  - a. They have weak bonds.
  - b. They need a lot of energy to overcome them.
  - c. They are gases.
  - d. They have weak intermolecular forces.
  
9. Ionic compounds form:
  - a. Giant lattices.
  - b. Weak bonds.
  - c. Simple molecules.
  - d. Metals.
  
10. To form an ionic bond, metals always:
  - a. Lose electrons.
  - b. Gain electrons.
  - c. Share electrons.
  - d. Become negative.
  
11. When an atom gains an electron it becomes:
  - a. A positive atom.
  - b. A positive ion.
  - c. A negative atom.
  - d. A negative ion.
  
12. Carbon can form:
  - a. 2 covalent bonds.
  - b. 5 covalent bonds.
  - c. 1 covalent bond.
  - d. 4 covalent bonds.
  
13. Graphite forms:
  - a. 2 covalent bonds.
  - b. 3 covalent bonds.
  - c. 1 covalent bond.
  - d. 4 covalent bonds.
  
14. Graphite can conduct electricity because:
  - a. It has a free electron that can move and carry charge.
  - b. It only has 2 bonds.
  - c. The atoms can vibrate and pass on energy.
  - d. The atoms are free to move and carry charge.

15. Graphite is slippery because:
- It has strong covalent bonds.
  - It has weak covalent bonds.
  - Strong intermolecular forces.
  - Weak intermolecular forces.
16. Nanoparticles have:
- A larger volume to surface area.
  - A larger density to surface area.
  - A smaller density to surface area.
  - A smaller volume to surface area.
17. Nanoparticles have:
- Different properties to the regular sized particle.
  - The same properties to the regular sized particles.
  - The same properties but on a smaller scale.
  - Cancer fighting properties.
18. Nanoparticles have health risks because:
- They cause cancer.
  - They have not been tested.
  - They are relatively new and so there are many unknowns.
  - They are absorbed by the skin.
19. Nanoparticles are \_\_\_\_\_ of normal sized particles:
- $10^{-10}$
  - $10^{-9}$
  - $10^9$
  - $10^{10}$
20. Thermosetting polymers have:
- Cross-link chains.
  - No links to connect the chains.
  - Weak intermolecular forces.
  - Strong intermolecular forces.

**PiXL Independence – Level 2**  
**5 questions, 5 sentences, 5 words**

**GCSE Chemistry – Structure, bonding and the properties of matter**  
**INSTRUCTIONS**

- For each statement, use either the suggested website or your own text book to write a 5-point summary. In examinations, answers frequently require more than 1 key word for the mark, so aim to include a few key words.
- It is important to stick to 5 sentences. It is the process of selecting the most relevant information and summarizing it, that will help you remember it.
- Write concisely and do not elaborate unnecessarily, it is harder to remember and revise facts from a big long paragraph.
- Finally, identify 5 key words that you may have difficulty remembering and include a brief definition. You might like to include a clip art style picture to help you remember it.

**Example:**

<b>QUESTION:</b>	Explain the bonding in diamond and how it relates to its properties.			
<b>Sources:</b>	<b>Website –</b> 1. <a href="http://chemguide.co.uk/atoms/structures/giantcov.html">http://chemguide.co.uk/atoms/structures/giantcov.html</a> <a href="http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/chemical_economics/nanochemistryrev1.shtml">http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/chemical_economics/nanochemistryrev1.shtml</a>			
	1. <b>Diamond has strong covalent bonds (the sharing of electrons).</b> 2. <b>It requires a lot of energy to break the bonds.</b> 3. <b>Which explains why diamond is very hard and has a high melting point.</b> 4. <b>Diamond does not conduct electricity.</b> 5. <b>As it uses all the 4 carbon bonds so has no free electrons.</b>			
<b>Reactivity</b>	<b>attraction</b>	<b>Further away</b>	<b>weaker</b>	<b>remove</b>

<b>QUESTION 1:</b>	<b>Explain the bonding in graphite and how this relates to its properties.</b>
<b>Sources:</b>	<b>Website –</b> 1. <a href="http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/chemical_economics/nanochemistryrev1.shtml">http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/chemical_economics/nanochemistryrev1.shtml</a> 2. <a href="http://www.gcscience.com/a34-structure-graphite-giant-molecule.htm">http://www.gcscience.com/a34-structure-graphite-giant-molecule.htm</a>

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<b>QUESTION 2:</b>	<b>Compare nanoparticles to their regular sized particles.</b>
<b>Sources:</b>	<b>Website –</b> 1. <a href="http://www.bbc.co.uk/schools/gcsebitesize/science/21c/materials_choices/nanotechnologyrev2.shtml">http://www.bbc.co.uk/schools/gcsebitesize/science/21c/materials_choices/nanotechnologyrev2.shtml</a> 2. <a href="https://www.youtube.com/watch?v=VB3nqIXzb0w">https://www.youtube.com/watch?v=VB3nqIXzb0w</a>

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<b>QUESTION 3:</b>	<b>Explain the three states of matter.</b>
<b>Sources:</b>	<b>Website –</b> 1. <a href="https://www.youtube.com/watch?v=KCL8zqjXbME">https://www.youtube.com/watch?v=KCL8zqjXbME</a> 2. <a href="http://www.bbc.co.uk/education/guides/zccmn39/revision">http://www.bbc.co.uk/education/guides/zccmn39/revision</a>

Blank area for student response.

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<b>QUESTION 4:</b>	<b>Explain the properties of Graphene and Fullerene in relation to their properties.</b>
<b>Sources:</b>	<b>Website –</b> 1. <a href="http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/bonding/structure_propertiesrev8.shtml">http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/bonding/structure_propertiesrev8.shtml</a> 2. <a href="https://www.youtube.com/watch?v=6jCXhusl2M">https://www.youtube.com/watch?v=6jCXhusl2M</a>

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<b>QUESTION 5:</b>	<b>Describe how polymers are bonded and how it affects their properties.</b>
<b>Sources:</b>	<b>Website –</b> 1. <a href="https://www.youtube.com/watch?v=rHxxLYzJ8Sw">https://www.youtube.com/watch?v=rHxxLYzJ8Sw</a> 2. <a href="http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/oils/polymersrev5.shtml">http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/oils/polymersrev5.shtml</a>

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## PiXL Independence – Level 3

### Science in the News

#### GCSE Chemistry – Structure, bonding and the properties of matter

#### INSTRUCTIONS

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#### Fake news

Sensationalized news stories have been around for some time, but with the mass growth of social media, the problem seems to have grown in recent years. At the very least, the US Presidential election has certainly highlighted the impact that misleading information can have. [www.tiny.cc/fakenews2](http://www.tiny.cc/fakenews2)

At home, the Brexit vote also suffered from the circulation of misleading news stories [www.tiny.cc/fakenews3](http://www.tiny.cc/fakenews3)

Therefore, the ability to identify real information, track it back to the source article and make your own judgement is a very important skill. This activity will help you develop that skill.

#### How is diamond formed and how does this link to its properties?

News article: <http://geology.com/articles/diamonds-from-coal/>

Discussion article: <https://www.smithsonianmag.com/science-nature/diamonds-uneearthed-141629226/>

Real article: <https://www.scientificamerican.com/article/how-can-graphite-and-diam/>

#### Task 1:

You need to produce a 1 page essay on how diamond is formed; linking its structure to its properties.

Essay section	Activity
Introduction	Write about how diamond is made from carbon and include the conditions.
Describe	Describe how carbon bonds to form diamond and link it to the properties.
Explore	Why people choose to have diamonds as a precious commodity?
Evaluate	Does diamond deserve to be so precious? Give both side of the argument and then your opinion.

## What is the science behind nanoparticles?

News article: <http://www.mirror.co.uk/news/uk-news/solar-flare-power-billion-hydrogen-11139984>

Discussion video: <http://www.dailymotion.com/video/x60hy8f>

Real article: <http://www.msn.com/en-sg/news/techandscience/scientists-create-nanoparticles-that-help-antibiotics-kill-drug-resistant-bacteria/ar-AAfjLo?li=BBr8OIS>

### Task 2:

You need to produce a 1 page essay on the science behind nanoparticles.

<b>Essay section</b>	<b>Activity</b>
<b>Introduction</b>	What is a nanoparticle?
<b>Describe</b>	Describe how a nanoparticle relates to the regular size particles.
<b>Explore</b>	Explore the uses of nanoparticles for the human body.
<b>Evaluate</b>	Evaluate whether nanoparticles are safe to use on the human body. Give both sides of the argument and then your overall opinion.

# PiXL Independence – Level 4

## Scientific Posters

### GCSE Chemistry – Structure, bonding and the properties of matter

#### INSTRUCTIONS

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##### Scientific Posters

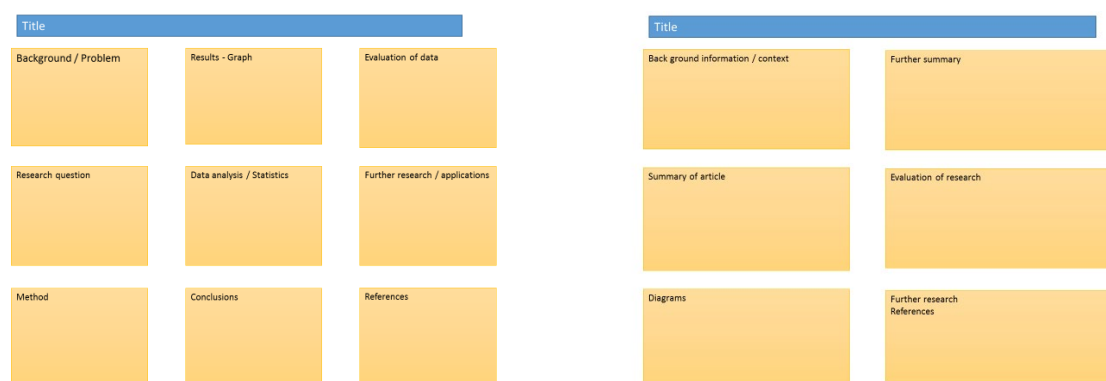
Scientists communicate research findings in three main ways. Primarily, they write journal articles much like an experiment write up. These are very concise, appraise the current literature on the problem and present findings. Scientists then share findings at conferences through talks and scientific posters. During a science degree, you would practice all three of these skills.

Scientific posters are a fine balance between being graphically interesting and attracting attention and sharing just the right amount of text to convey a detailed scientific message. They are more detailed than a talk and less detailed than a paper.

Use this information to help structure your poster – [www.tiny.cc/posterskills](http://www.tiny.cc/posterskills) (that's Poster Skills not Posters Kill!) More detailed guidance is available at : [www.tiny.cc/posterskills2](http://www.tiny.cc/posterskills2)

##### Creating your poster

It is easiest to create a poster in PowerPoint; however, you need to add custom text boxes rather than using the standard templates.



Posters need to be eye catching, but readable from a distance. If you use PowerPoint, start with a 4:3 slide (for easier printing, it can then be printed on A3) and use a 14-16 pt font. The first box could be larger to draw people in. You can use a background image, but pick a simple one that is of high quality. Select 'text box fill' and select 'change the transparency' to maintain the contrast and partially show the picture.

You can experiment with different layouts and you should include images. Avoid a chaotic layout, posters are read from top left column downwards.

Remember to include the authors and references.

Finally, look at the examples given on the University of Texas website which also offers an evaluation of each [www.tinyurl.com/postereq](http://www.tinyurl.com/postereq)

## Bonding

### Background

Bonding affects our everyday life and is very important to our very existence. Those bonding can occur in many different ways in different materials. This very bonding affects the properties and uses of the material that shape our lives.

### Source articles

[http://www.bbc.co.uk/schools/gcsebitesize/science/add\\_aqa/bonding/](http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/bonding/)

[http://www.docbrown.info/page04/4\\_72bond.htm](http://www.docbrown.info/page04/4_72bond.htm)

<http://www.s-cool.co.uk/gcse/chemistry/chemical-bonding/revise-it/types-of-solids>

[https://www.xtremepapers.com/revision/gcse/chemistry/bonding\\_structures.php](https://www.xtremepapers.com/revision/gcse/chemistry/bonding_structures.php)

**Use other sources as necessary.**

### Task:

Produce a scientific poster on how bonding occurs in metals, non-metals and a combination of the two.

<b>Recall</b>	Write the types of bonding.
<b>Describe</b>	Describe how covalent, ionic and metallic bonding occurs.
<b>Compare</b>	Compare properties associated with each bonding type.
<b>Evaluate</b>	Can metals ever bond covalently? Include reasons for your answer.

## PiXL Independence – Level 5

### Video summaries

#### GCSE Chemistry – Structure, bonding and properties of matter

##### Cornell Notes

At A level and University, you will make large amounts of notes, but those notes are only of use if you record them in a sensible way. One system for recording notes is known as the Cornell notes system. This method encourages you to select relevant information, rather than trying to write a transcript of everything said. More importantly, it forces you to spend a few minutes reviewing what you have written, which has been scientifically proven to aid learning and memory retention.

The ideal is to write everything on one page, but some students may prefer to type and others will to handwrite their notes. Whichever option you use, remember the aim is to summarise and condense the content with a focus on the objectives that you are trying to learn and understand.

##### There are three main sections to the Cornell notes

- 1 **Cue/ Objectives** – This can be done before or after the lecture. You may have been provided with the objectives or you may need to decide what they were or you may want to make the link to your learning if this is an additional task or lecture you are viewing, such as this video.
- 2 **Notes** – In this space you record concisely, simply the things you are LESS likely remember - **The NEW knowledge**.
- 3 **Summary** – The most important step that is carried out after the lecture or video. This helps to reinforce learning.

##### Background

The following short TED talks present two topics that link to your learning. The first is a look at how nanotechnology is impacting medical science. The second video discusses what nanoparticles are and how they shape our future.

##### Source article:

##### Video 1 – New Nanotech to detect cancer earlier

##### Ted talks clip:

[https://www.ted.com/talks/joshua\\_smith\\_new\\_nanotech\\_to\\_catch\\_cancer\\_early](https://www.ted.com/talks/joshua_smith_new_nanotech_to_catch_cancer_early)

##### Video 2 – The strange new world of Nanoscience Nanotechnology

You tube clip: <https://www.youtube.com/watch?v=5JGiYSnkaZw>

**Task:**

**You need to produce a set of Cornell notes for the video given above.  
Use the following objective to guide your note taking, this links to your learning.**

- 1 Discuss what nanoparticles are.
- 2 Discuss what impacts nanoparticles and technology can have on our lives.

**Objectives**

**What are the main learning outcomes that have been shared with you?  
This will help guide you to taking the RIGHT notes during the video.**

Title  
Date

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Sketch down note and key words  
Do not write in full sentences whilst you listen, put quick sketches, single words, mind maps, short hand etc.  
To help train you for university, try not to pause the video because you could not pause a live lecture (However, a lecture may give more natural pauses for you to catch up).

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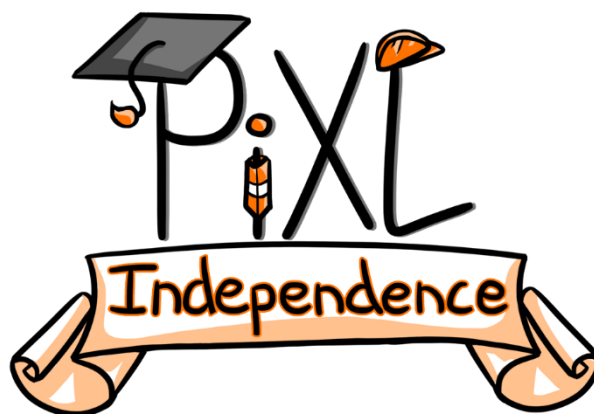
**Summary (after the video)**

What are your main points of learning from this video.  
This is your chance to make sense of your notes.  
Make clear connections to the things you need to know



<b>Objectives:</b>	<b>Title:</b>
	<b>Date:</b>
<b>Summary:</b>	

<b>Objectives:</b>	<b>Title:</b>
	<b>Date:</b>
<b>Summary:</b>	



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