

# **PiXL Independence:**

## **GCSE Physics – Student Booklet**

### **KS4**

**Topic: Particle model 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 Physics – Particle model of matter**

**INSTRUCTIONS**

Score: /20

- Read the question carefully.
- Circle the correct letter.
- Answer all questions.

- 
1. The correct equation for density is...
    - a.  $density = mass \times volume$
    - b.  $density = mass \times area$
    - c.  $density = \frac{mass}{volume}$
    - d.  $density = \frac{mass}{area}$
  
  2. A body of water of an area of  $2 \text{ m}^2$  and a depth of 4 m, has a mass of 8000 kg. Calculate the density of water.
    - a.  $1000 \text{ kg/m}^3$
    - b.  $4000 \text{ kg/m}^3$
    - c.  $16\,000 \text{ kg/m}^3$
    - d.  $128\,000 \text{ kg/m}^3$
  
  3. In which state can the volume be changed by compression?
    - a. Liquid
    - b. Gas
    - c. Solid
    - d. None of the above
  
  4. Changes of state are examples of...
    - a. property changes.
    - b. energy transfers.
    - c. chemical changes.
    - d. physical changes.
  
  5. Which statement about liquids is FALSE?
    - a. Liquid particles move randomly.
    - b. Liquids can be compressed.
    - c. Liquid particles are always in contact with each other.
    - d. Liquid particles are more energetic than solid particles.

6. Complete the following sentence.  
When a substance changes state, its mass stays the same because...
  - a. the energy of the particles stays the same.
  - b. the volume of the particles stays the same.
  - c. the density of the particles stays the same.
  - d. the number of particles stay the same.
  
7. Sublimation happens when...
  - a. a gas changes into a solid.
  - b. a solid changes into a gas.
  - c. a solid changes into a liquid.
  - d. a liquid changes into a gas.
  
8. The temperature at which a solid changes to a liquid is called its...
  - a. melting point.
  - b. boiling point.
  - c. freezing point.
  - d. sublimation point.
  
9. What is needed to melt a solid or boil a liquid?
  - a. Vaporisation.
  - b. Change of temperature.
  - c. An increase in energy.
  - d. Chemical change.
  
10. Evaporation can occur at the surface of a liquid when its temperature is...
  - a. below its melting point.
  - b. equal to its freezing point.
  - c. equal to its melting point.
  - d. below its boiling point.
  
11. The internal energy of a substance is the sum of the individual particles...
  - a. kinetic energy.
  - b. kinetic energy and potential energy.
  - c. potential energy.
  - d. kinetic energy and gravitational potential energy.
  
12. What determines whether a substance is a solid, liquid or gas?
  - a. The internal energy of the particles.
  - b. The random motion of the particles.
  - c. The strength of forces of attraction between the particles.
  - d. The temperature of the substance.
  
13. The pressure of a gas in a container is caused by...
  - a. the particles of the gas hitting the surface of the container.
  - b. the particles of the gas hitting each other.
  - c. the random motion of the gas particles.
  - d. the kinetic energy of the particles.

14. The energy needed to change the state of 1 kg of substance from solid to liquid at its melting point is known as...
- specific heat capacity,  $c$ .
  - specific energy of fusion,  $E_f$ .
  - the specific latent heat of fusion,  $L_f$ .
  - specific heat energy of fusion,  $E_H$ .
15. The unit of specific heat capacity,  $c$ , is ...
- $\text{J/kg } ^\circ\text{C}$
  - $\text{Kg/m}^3$
  - $\text{W/kg K}$
  - $\text{kW/hr}$
16. If the temperature of a gas in a sealed container is increased, the pressure of the gas will...
- depend on the volume of the container.
  - decrease.
  - remain the same.
  - increase.
17. The S.I. unit of pressure is...
- newton-meter<sup>2</sup>,  $\text{Nm}^2$ .
  - pascals, Pa.
  - bar, Ba.
  - atmospheres, atm.
18. The random motion of tiny particles in a fluid is also called...
- Einsteinian motion.
  - Newtonian motion.
  - Brownian motion.
  - Galileoian motion.
19. Boyles's law states that...
- temperature x volume = constant
  - pressure x volume = constant
  - pressure x temperature = constant
  - $\frac{\text{pressure}}{\text{volume}} = \text{constant}$
20. Which ONE of the following statements is FALSE for a gas whose temperature has increased?
- The gas has been compressed rapidly.
  - The gas has had work done on it.
  - The energy has not been transferred fast enough to the surroundings.
  - The volume of the gas has been increased.

# PiXL Independence – Level 2

## 5 questions, 5 sentences, 5 words

### GCSE Physics – Particle model 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, as 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>	What is density and how do you measure the density of a solid object and a liquid?			
<b>Sources:</b>	Website – 1. <a href="http://www.bbc.co.uk/education/guides/zb7hyc/revision">http://www.bbc.co.uk/education/guides/zb7hyc/revision</a> 2. <a href="https://www.youtube.com/watch?v=DVQMWihs3wQ">https://www.youtube.com/watch?v=DVQMWihs3wQ</a>			
1. <i>density, <math>\rho = \frac{\text{mass, } m}{\text{volume, } V}</math></i>  2. The unit of density is kilograms per cubic metre, $\text{kgm}^{-3}$ . 3. Solid object – measure mass using a top pan balance, and volume using ruler, Vernier calipers or an Eureka can. 4. Liquid – measure mass using a top pan balance and a beaker of a known mass. Measure the volume using a measuring cylinder. 5. The instrument that is used to take the measurement should be of an appropriate resolution and range.				
$\rho = \frac{m}{V}$	$\text{kgm}^{-3}$	Solid – mass (balance) Volume (ruler, Eureka can).	Liquid – mass (balance) Volume (measuring cylinder).	Resolution – smallest change in the measurement. Range – max and min values of measurement.

<b>QUESTION 1:</b>	<b>What are the differences between the three states of matter?</b>
<b>Sources:</b>	<b>Website –</b> <b>1.</b> <a href="http://www.bbc.co.uk/education/guides/zgr2pv4/revision">http://www.bbc.co.uk/education/guides/zgr2pv4/revision</a> <b>2.</b> <a href="https://www.youtube.com/watch?annotation_id=annotation_4109161969&amp;feature=iv&amp;rc_vid=bMbmQzV-Ezs&amp;v=21CR01rlmv4">https://www.youtube.com/watch?annotation_id=annotation_4109161969&amp;feature=iv&amp;rc_vid=bMbmQzV-Ezs&amp;v=21CR01rlmv4</a>

--	--	--	--	--

--	--	--	--	--

<b>QUESTION 2:</b>	<b>What is the kinetic theory of matter and how does it link to each matter state?</b>
<b>Sources:</b>	<b>Website –</b> <b>1.</b> <a href="http://www.bbc.co.uk/education/guides/zgr2pv4/revision/2">http://www.bbc.co.uk/education/guides/zgr2pv4/revision/2</a> <b>2.</b> <a href="http://hyperphysics.phy-astr.gsu.edu/hbase/Kinetic/kinthe.html#c1">http://hyperphysics.phy-astr.gsu.edu/hbase/Kinetic/kinthe.html#c1</a>

--	--	--	--	--

--	--	--	--	--

<b>QUESTION 3:</b>	<b>Describe the trend and features of a latent heat graph of water.</b>
<b>Sources:</b>	<b>Website –</b> <b>1.</b> <a href="http://mrmackenzie.co.uk/wp-content/uploads/2013/03/Specific_Heat_Lf_and_Lv.pdf">http://mrmackenzie.co.uk/wp-content/uploads/2013/03/Specific_Heat_Lf_and_Lv.pdf</a> <b>2.</b> <a href="https://www.sciencelearn.org.nz/images/231-latent-heat-graph">https://www.sciencelearn.org.nz/images/231-latent-heat-graph</a>

--	--	--	--	--

--	--	--	--	--

<b>QUESTION 4:</b>	<b>What is Brownian motion and how can it be observed?</b>
<b>Sources:</b>	<b>Website –</b> <b>1.</b> <a href="https://www.youtube.com/watch?v=hy-clLi8gHg">https://www.youtube.com/watch?v=hy-clLi8gHg</a> <b>2.</b> <a href="http://www.gcsescience.com/e14-smoke-particles.htm">http://www.gcsescience.com/e14-smoke-particles.htm</a>

--	--	--	--	--

--	--	--	--	--

<b>QUESTION 5:</b>	Describe an experiment to measure the specific latent heat of fusion of ice.
<b>Sources:</b>	<b>Website –</b> 1. <a href="http://www.dominican-college.com/images/stories/science/to_find_the_specific_latent_heat_of_fusion_of_ice.doc">http://www.dominican-college.com/images/stories/science/to find the specific latent heat of fusion of ice.doc</a> 2. <a href="http://tap.iop.org/energy/thermal/608/page_47512.html">http://tap.iop.org/energy/thermal/608/page_47512.html</a> <b>(Episode 608-2)</b>

--	--	--	--	--

# PiXL Independence – Level 3

## Science in the News

### GCSE Physics – Particle model of matter

#### INSTRUCTIONS

---

#### Fake news

Sensationalised 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.

#### Scientists just developed snow melting concrete.

News article: <https://www.forbes.com/sites/trevornace/2017/09/18/scientists-just-developed-snow-melting-concrete/#72d05e0493fc>

News article: <http://news.nationalgeographic.com/energy/2016/01/16016-conductive-concrete-could-melt-mounds-of-snow/>

Discussion article: <https://www.sciencedaily.com/releases/2017/09/170913193103.htm>

Real article: <https://www.theatlantic.com/technology/archive/2016/01/conductive-concrete-melts-snow/433752/>

#### Task 1:

You need to produce a 1 page essay on how concrete can melt snow.

Essay section	Activity
<b>Introduction</b>	What are the two methods of how concrete can melt snow?
<b>Describe</b>	Describe how the two methods would cause a change in state to happen faster than ordinary concrete.
<b>Explore</b>	Explore where each method would be most suitable for use.
<b>Evaluate</b>	Evaluate both methods – what are the advantages and disadvantages of both methods of snow melting concrete?

## 'Watermelon snow' is making glaciers in Alaska melt faster.

News article: <https://www.aol.co.uk/travel/2017/09/25/blood-snow-issue-alaska-glaciers-algae/>

News article: <http://uk.businessinsider.com/watermelon-snow-is-making-glaciers-in-alaska-melt-faster-2017-9?r=US&IR=T>

Discussion article: <https://www.youtube.com/watch?v=rohi25v2hXc>

Real article: <https://phys.org/news/2017-09-algae-ice-field-faster-alaska.html>

### Task 2:

You need to produce a 1 page essay on whether watermelon snow is making glaciers melt faster.

<b>Essay section</b>	<b>Activity</b>
<b>Introduction</b>	What is 'watermelon snow' and where has it been found?
<b>Describe</b>	Describe the conditions that have caused the algae to grow in Alaska.
<b>Explore</b>	Explore the consequences of the melting of glaciers in Alaska.
<b>Evaluate</b>	Evaluate the possible solutions to this problem.

# PiXL Independence – Level 4

## Scientific Posters

### GCSE Physics – Particle model of matter

#### INSTRUCTIONS

---

##### 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/postereg](http://www.tinyurl.com/postereg)

## Boyle's Law and Charles' Law

### Background

Boyle's Law and Charles Law are taught as an introduction to the equation of state, otherwise known as the Ideal Gas Law. These two laws investigate the relationship between two variables that can be studied within a laboratory setting. The variables that are investigated are pressure, volume and temperature. The equations also link to kinetic theory of matter.

### Source articles

<http://www.bbc.co.uk/education/guides/zc4xsbk/revision/3>

<http://www.passmyexams.co.uk/GCSE/physics/pressure-volume-relationship-of-gas-Boyles-law.html>

[http://www.cyberphysics.co.uk/topics/kinetic\\_theory/boyle.htm](http://www.cyberphysics.co.uk/topics/kinetic_theory/boyle.htm)

<http://www.passmyexams.co.uk/GCSE/physics/volume-temperature-relationship-of-gas-Charles-law.html>

<http://www.s-cool.co.uk/a-level/chemistry/states-of-matter/revise-it/the-gaseous-state-and-the-gas-laws>

**Use other sources as necessary.**

### Task:

Produce a scientific poster on

<b>Recall</b>	What are the definitions of Boyle's Law and Charles Law?
<b>Describe</b>	Describe the two experiments that you could do in a laboratory to test both Laws.
<b>Compare</b>	Compare how both Laws relate to kinetic theory of matter.
<b>Evaluate</b>	Evaluate the assumptions that have to be made about the gas particles in order to use the Boyle's Law and Charles Law equations.

# PiXL Independence – Level 5

## Video summaries

### GCSE Physics – Particle model 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 videos present two topics that link to your learning. The first is the formation of glacier caves, where warm air and water have caused changes of state with beautiful results. The second video discusses what triple point is and how to demonstrate it.

#### Source article:

##### Video 1 – My glacier cave discoveries

Ted Ed talks: [https://www.ted.com/talks/eddy\\_cartaya\\_my\\_glacier\\_cave\\_discoveries](https://www.ted.com/talks/eddy_cartaya_my_glacier_cave_discoveries)

##### Video 2 – Thermodynamics – explaining the triple point

YouTube: <https://www.youtube.com/watch?v=HEzkHqWliKM>

**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 how changes in state have led to the formation of glacier caves.
2. Discuss how to demonstrate the 'triple point'.

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

---

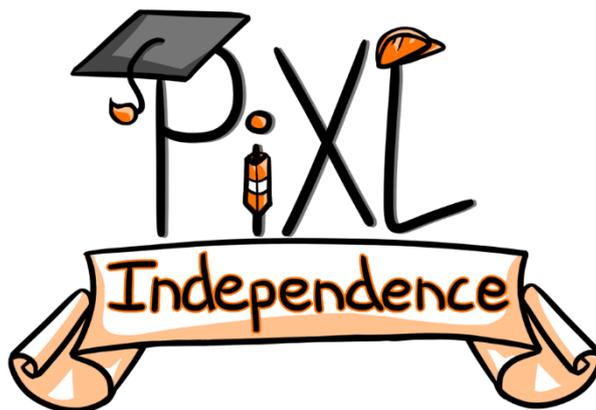
Sketch down note and key words  
Do not write in full sentences whilst you listen, put quick sketches, single words, mind maps, short hand etc.  
To help train you for university, try not to pause the video because you could not pause a live lecture (However, a lecture may give more natural pauses for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

---

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>	



**Commissioned by The PiXL Club Ltd.**

This resource is strictly for the use of member schools for as long as they remain members of The PiXL Club. It may not be copied, sold, or transferred to a third party or used by the school after membership ceases. Until such time it may be freely used within the member school.

All opinions and contributions are those of the authors. The contents of this resource are not connected with, or endorsed by, any other company, organisation or institution.

PiXL Club Ltd endeavour to trace and contact copyright owners. If there are any inadvertent omissions or errors in the acknowledgements or usage, this is unintended and PiXL will remedy these on written notification.