

# **PiXL Independence:**

## **GCSE Physics – Student Booklet**

### **KS4**

**Topic: Space physics**

**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 – Space physics

#### INSTRUCTIONS

Score: /20

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

1. The solar system was formed from...
  - a. rocks and dust clouds.
  - b. dust clouds.
  - c. gas clouds.
  - d. gas, rocks and dust clouds.
2. The earliest stage in the evolution of a star is called a...
  - a. supergiant.
  - b. protostar.
  - c. Red dwarf.
  - d. Black hole.
3. In a star, energy is released due to what process taking place?
  - a. Fission
  - b. Fusion
  - c. Gravitational attraction
  - d. Nuclear decay
4. A star emits what type of radiation?
  - a. Gamma
  - b. Infrared
  - c. Light, radio and microwaves
  - d. All of the above
5. Main sequence stars are stars within the main stage in the life of a star. These stars are stable because...
  - a. the forces within the star are in equilibrium.
  - b. the energy released by the star is constant.
  - c. the gravitational attraction is at a maximum.
  - d. the temperature of the star is maintained.
6. Stars become unstable when they have no more of which nuclei?
  - a. Uranium
  - b. Helium
  - c. Hydrogen
  - d. Lithium

7. Which ONE of the following are the correct life stages for a star which is larger than the Sun?
  - a. main sequence, red giant, supernova.
  - b. main sequence, red giant, white dwarf, black dwarf.
  - c. main sequence, red supergiant, white dwarf, black dwarf.
  - d. main sequence, red supergiant, supernova, neutron star.
  
8. Heavy elements are formed within a supernova. The force of the collapse fuses small nuclei into nuclei bigger than...
  - a. iron nuclei.
  - b. cobalt nuclei.
  - c. nickel nuclei.
  - d. manganese nuclei.
  
9. After a supernova, a black hole can be formed instead of a neutron star. Which ONE of the following would determine if a black hole would be formed?
  - a. The star has a super high temperature.
  - b. The star is massive.
  - c. The star still has nuclear fuel.
  - d. The star is more than 5,000 million years old.
  
10. The force of gravity on an orbiting body in a circular orbit acts towards the centre of the circle. This force is an example of...
  - a. G-force.
  - b. Coriolis force.
  - c. centrifugal force.
  - d. centripetal force.
  
11. As a body in a circular motion moves around an orbit, it experiences an acceleration...
  - a. parallel to velocity.
  - b. at right angles to the direction of force.
  - c. towards the centre of the circle.
  - d. away from the centre of the circle.
  
12. Which ONE of the following describes the correct type of orbit for a communications satellite?
  - a. Geostationary orbit.
  - b. Low Earth orbit.
  - c. Geosynchronous orbit.
  - d. High Earth Orbit.
  
13. Which ONE of the following statements is FALSE for a satellite which is further away from the Earth?
  - a. A lower particular speed is needed for it to stay in a circular orbit.
  - b. The force of gravity is weaker on the satellite.
  - c. The time for each complete orbit = speed  $\div$  circumference of the orbit.
  - d. The longer it takes the satellite to move around the Earth once.

14. Red shift is when...
  - a. the intensity of light is increased.
  - b. the wavelengths of light are increased.
  - c. the light appears red.
  - d. the frequency of light is increased.
  
15. The dark spectral lines that appear on a spectrum of light from a star are caused by...
  - a. refraction of light by large atoms.
  - b. reflection of light by small atoms.
  - c. diffraction of light by hydrogen atoms.
  - d. absorption of light by specific atoms.
  
16. The faster a distant galaxy is moving away from you...
  - a. the greater the red shift is.
  - b. the darker spectral lines will appear.
  - c. the greater the blue shift is.
  - d. the greater the frequency of light.
  
17. The speed at which a galaxy is moving away from Earth is called the...
  - a. withdrawal velocity.
  - b. speed of recession.
  - c. speed of inertia.
  - d. retrograde velocity.
  
18. Since 1965, most scientists have supported the idea of the Big Bang Theory. What was the name of the previous idea about the evolution of the Universe?
  - a. Special theory of relativity.
  - b. Kepler's laws of planetary motion.
  - c. Titius-Bode law.
  - d. Steady state theory.
  
19. Cosmic microwave background radiation, CMBR, is...
  - a. nuclear radiation created just after the Big Bang.
  - b. gamma radiation created just after the Big Bang.
  - c. electromagnetic radiation created just after the Big Bang.
  - d. infrared radiation created just after the Big Bang.
  
20. CMBR has been detected in the Universe. It appears to come from...
  - a. the Sun.
  - b. the centre of the Earth.
  - c. from the centre of the Universe.
  - d. all directions.

## PiXL Independence – Level 2

### 5 questions, 5 sentences, 5 words

### GCSE Physics – Space physics

#### INSTRUCTIONS

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- 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>	How was the Solar System formed?			
<b>Sources:</b>	Website – 1. <a href="https://www.space.com/35526-solar-system-formation.html">https://www.space.com/35526-solar-system-formation.html</a> 2. <a href="https://www.youtube.com/watch?v=Uhy1fucSRQI">https://www.youtube.com/watch?v=Uhy1fucSRQI</a>			
<ol style="list-style-type: none"> <li>1. The Solar System consists of stars, planets, moons, comets, meteors, asteroids and dwarf planets.</li> <li>2. Stars are formed from clouds of gas, dust and rocks.</li> <li>3. Gravitational attraction pulls the particles in the clouds together and speeds them up.</li> <li>4. This then known as a protostar.</li> <li>5. The protostar then becomes denser, particles collide and move faster, temperature inside the protostar increases until fusion can start to take place (hydrogen nuclei fuse to become helium nuclei).</li> </ol>				
Clouds of dust, gas and rock	Gravitational attraction	Particles speed up and collide.	Protostar	Temperature increase until fusion can take place.

<b>QUESTION 1:</b>	<b>What is a supernova and what is left after it occurs?</b>
<b>Sources:</b>	<b>Website –</b> <b>1.</b> <a href="http://www.gcscience.com/pun36.htm">http://www.gcscience.com/pun36.htm</a> <b>2.</b> <a href="http://www.gcseastronomy.co.uk/space/stars/stardeath.html">http://www.gcseastronomy.co.uk/space/stars/stardeath.html</a>

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<b>QUESTION 2:</b>	<b>Explain what is meant by a circular motion? What is centripetal force? What factors effect centripetal force?</b>
<b>Sources:</b>	<b>Website –</b> <ol style="list-style-type: none"><li>1. <a href="http://www.physicsclassroom.com/mmedia/circmot/ucm.cfm">http://www.physicsclassroom.com/mmedia/circmot/ucm.cfm</a></li><li>2. <a href="https://www.youtube.com/watch?v=bpFK2VCRHUs">https://www.youtube.com/watch?v=bpFK2VCRHUs</a></li></ol>

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<b>QUESTION 3:</b>	<b>What is red-shift and blue-shift?</b>
<b>Sources:</b>	<b>Website –</b> <ol style="list-style-type: none"><li>1. <a href="https://www.space.com/25732-redshift-blueshift.html">https://www.space.com/25732-redshift-blueshift.html</a></li><li>2. <a href="https://www.universeguide.com/blogarticle/blueshift-and-redshift,-whats-the-difference">https://www.universeguide.com/blogarticle/blueshift-and-redshift,-whats-the-difference</a></li></ol>

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<b>QUESTION 4:</b>	<b>Who was Edwin Hubble and what is his evidence for an expanding universe?</b>
<b>Sources:</b>	<b>Website –</b> <ol style="list-style-type: none"><li>1. <a href="http://www.physicsoftheuniverse.com/topics_bigbang_expanding.html">http://www.physicsoftheuniverse.com/topics_bigbang_expanding.html</a></li><li>2. <a href="http://www.bbc.co.uk/science/space/universe/questions_and_ideas/hubbles_law">http://www.bbc.co.uk/science/space/universe/questions_and_ideas/hubbles_law</a></li></ol>

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<b>QUESTION 5:</b>	<b>What is the Big Bang theory? Describe the evidence to support the Big Bang theory?</b>
<b>Sources:</b>	<b>Website –</b> <b>1.</b> <a href="http://www.bbc.co.uk/science/space/universe/questions_and_ideas/hubbles_law">http://www.bbc.co.uk/science/space/universe/questions_and_ideas/hubbles_law</a> <b>2.</b> <a href="https://www.big-bang-theory.com/">https://www.big-bang-theory.com/</a>

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# PiXL Independence – Level 3

## Science in the News

### GCSE Physics – Space physics

#### INSTRUCTIONS

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#### 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.

#### Aerospace giant reveals plan for space station orbiting planet Mars.

News article: <http://www.mirror.co.uk/science/mars-base-camp-lockheed-martin-11280084>

News article: <https://www.engadget.com/2017/09/29/lockheed-martin-mars-spacecraft-lander/>

Discussion article: <https://www.space.com/33692-mars-space-station-surface-missions.html>

Real article: <http://news.nationalgeographic.com/2016/05/160519-mars-missions-orbits-lockheed-martin-space-science/>

#### Task 1:

You need to produce a 1 page essay on plans for a space station orbiting Mars.

Essay section	Activity
<b>Introduction</b>	What is a space station? Where is Mars? How will the space station stay in orbit around Mars?
<b>Describe</b>	Describe the purpose of building the space station. Who is going to live on the station? What will the people do there?
<b>Explore</b>	Explore the reasons why scientists are so interested in Mars. What does the planet have to offer people on Earth?
<b>Evaluate</b>	Evaluate the advantages and disadvantages to putting a space station in orbit around Mars.

## **'Alien megastructures' star baffles scientists as new study fails to explain strange behaviour.**

News article: <http://www.independent.co.uk/news/science/alien-megastructure-star-dyson-sphere-kic-8462852-kepler-space-telescope-carnegie-a7343846.html>

News article: <https://www.inverse.com/article/36239-tabby-s-star-not-alien-megastructures-new-study-kic-8462852-nasa>

Discussion article: <https://www.space.com/38363-alien-megastructure-tabbys-star-dust.html>

Real article: <https://astronomynow.com/2017/10/07/mysterious-dimming-of-tabbys-star-may-be-caused-by-dust/>

### **Task 2:**

You need to produce a 1 page essay on the strange behavior of the star and why an alien megastructure might explain the observations.

<b>Essay section</b>	<b>Activity</b>
<b>Introduction</b>	Where is the star that has been found? What is it called? Who found the star and when?
<b>Describe</b>	Describe the observable phenomena that has been baffling scientists. What have scientists seen? Why is it strange?
<b>Explore</b>	Explore the two theories that would explain the strange behaviour of the star. What is an alien megastructure? What new evidence has been discovered?
<b>Evaluate</b>	Evaluate the two possible explanations for the star's strange behavior. Which is the more likely theory to explain Tabby's star?

# PiXL Independence – Level 4

## Scientific Posters

### GCSE Physics – Space physics

#### Scientific Posters

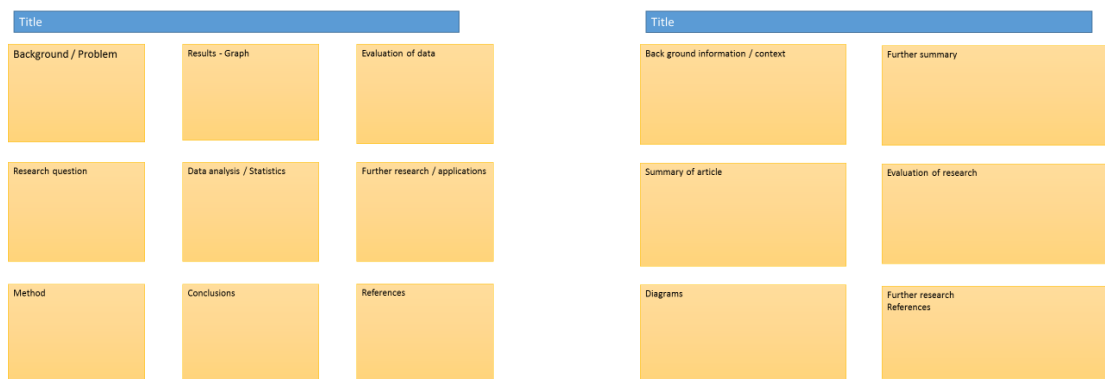
Scientists communicate research findings in three main ways. Primarily, they write journal articles much like an experiment write up. These are very concise, appraise the current literature on the problem and present findings. Scientists then share findings at conferences through talks and scientific 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)

## The Life History of a Star

### Background

Stars are formed in clouds of gas, dust and rocks, known as nebulae. Nuclear reactions at the centre of stars provide enough energy to make them shine brightly for many years. The exact lifetime and what happens to the star as it starts to go through its life cycle depends very much on its size.

### Source articles

<http://www.telescope.org/pparc/res8.html>

[http://www.astro.keele.ac.uk/workx/starlife/Starpages\\_26M.html](http://www.astro.keele.ac.uk/workx/starlife/Starpages_26M.html)

<http://www.schoolobservatory.org.uk/learn/astro/stars/cycle>

<http://www.bbc.co.uk/education/guides/z496fg8/revision>

<https://www.youtube.com/watch?v=PM9CQDIQIOA>

Use other sources as necessary.

### Task:

Produce a scientific poster on the life cycle of a star.

<b>Recall</b>	State the names of the different stages of a star's life cycle.
<b>Describe</b>	Describe the different stages in terms of forces, temperature, appearance and size.
<b>Compare</b>	Compare stars that are the same size as our Sun and stars that are much bigger. How are their life cycles different?
<b>Evaluate</b>	Evaluate the difference between a neutron star and a black hole. How likely is a star to become a black hole?

# PiXL Independence – Level 5

## Video summaries

### GCSE Physics – Space physics

#### 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 on how LIGO discovered the existence of gravitational waves. The second video discusses what impact the discovery of gravitational waves has on our understanding of the Universe.

#### Source article:

**Video 1 – How LIGO discovered gravitational waves.**

**Ted Ed talks :**

[https://www.ted.com/talks/gabriela\\_gonzalez\\_how\\_ligo\\_discovered\\_gravitational\\_waves\\_and\\_what\\_might\\_be\\_next](https://www.ted.com/talks/gabriela_gonzalez_how_ligo_discovered_gravitational_waves_and_what_might_be_next)

**Video 2 – What the discovery of gravitational waves means.**

**Ted Ed talks :**

[https://www.ted.com/talks/allan\\_adams\\_what\\_the\\_discovery\\_of\\_gravitational\\_waves\\_means](https://www.ted.com/talks/allan_adams_what_the_discovery_of_gravitational_waves_means)

**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 the discovery of gravitational waves.
2. Discuss the significance of the discovery of gravitational waves.

<b>Objectives</b> 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.

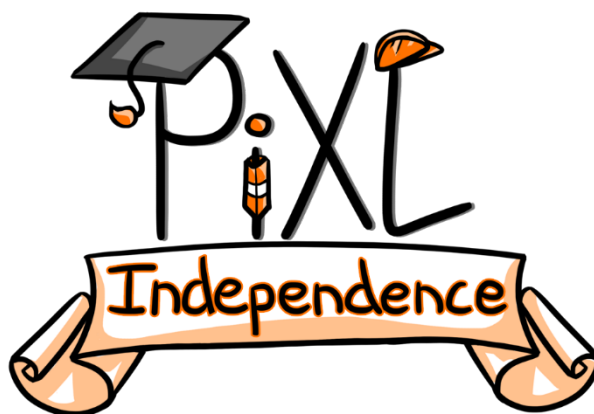
This is your chance to make sense of your notes.

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>	



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