



PiXL Independence:

GCSE Physics – Student Booklet

KS4

Topic: Forces

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
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PiXL Independence – Level 1

Multiple Choice Questions

GCSE Physics – Forces

INSTRUCTIONS

Score: /20

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

1. Identify the vector from the list below.
 - a. Speed
 - b. Weight
 - c. Time
 - d. Power
2. A recovery lorry tows a broken-down bus. The force of the tow rope on the bus is 400 kN. How much force is exerted by the tow rope on the recovery lorry?
 - a. 400 kN
 - b. 200 kN
 - c. 0 kN
 - d. 800 kN
3. Newton's first law states that if the forces acting on an object are balanced the resultant force is...
 - a. double the original forces acting.
 - b. at its maximum value.
 - c. the sum of the forces acting regardless of their direction.
 - d. zero.
4. Unbalanced forces can happen when an object is acted on by two unequal forces in opposite directions. Which ONE of the following statements about unbalanced forces is FALSE?
 - a. The resultant force is equal to the difference between the two forces.
 - b. The object experiencing the forces will be accelerating.
 - c. The object experiencing the forces will be moving at a constant speed.
 - d. The resultant force will be acting in the direction of the larger force.
5. If the resultant force on an object is zero, the object must be...
 - a. stationary or moving at a constant speed.
 - b. stationary.
 - c. stationary or accelerating.
 - d. stationary or decelerating.
6. Select the correct SI unit from the list for a moment of a force.
 - a. Nm
 - b. N/m
 - c. Nm²
 - d. Kgm

7. Which of the following is a correct statement?
- Weight depends on the mass of an object and gravitational field strength.
 - Gravity is a force caused by weight.
 - An object in space has more weight than mass.
 - Gravitational field strength gives an object more mass.
8. Which statement about gears is TRUE?
- Low gear gives high speed and a high turning effect.
 - Low gear gives a low speed and a low turning effect.
 - Low gear gives a high speed and a low turning effect.
 - Low gear gives low speed and a high turning effect.
9. The centre of mass of an object is the point at which...
- its weight can be thought of as being concentrated.
 - its mass can be thought of as being concentrated.
 - its symmetry can be thought of as being concentrated.
 - its gravity can be thought of as being concentrated.
10. A force of 6N due East and 8N due North act on a point. What is the magnitude and direction of the resultant force from due North?
- 10 N, 37°
 - 10 N, 53°
 - 14 N, 55°
 - 14 N, 45°
11. Identify the correct equation for calculating pressure.
- $Pressure = \frac{area}{force}$
 - $Pressure = force \times area$
 - $Pressure = force \times area^2$
 - $Pressure = \frac{force}{area}$
12. An elephant has a mass of 5400 kg and each foot has an area of 0.18 m². Calculate the pressure that the elephant exerts on the floor when it is stood still.
- 300 000 Pa
 - 75 000 Pa
 - 7500 Pa
 - 30 000 Pa
13. Calculate the pressure due to sea water, with a density of 1050 kg/m³, at the bottom of the Mariana trench in the Pacific Ocean. (Depth of Mariana trench = approx. 11 000m).
- 115 500 kPa
 - 10.5 Pa
 - 0.1 Pa
 - 11 550 kPa

14. The symbol for density is...
- M
 - Φ
 - ρ
 - d
15. For a ship to float in the sea, the weight of the ship must be...
- equal to the upthrust of the water.
 - less than the upthrust of the water.
 - greater than the upthrust of the water.
 - have changeable upthrust.
16. How does pressure in an open bottle of water vary?
- It doesn't, it remains the same all through the water.
 - The pressure at the top of the liquid is higher.
 - The pressure at the bottom of the liquid is higher.
 - It does not depend on atmospheric pressure.
17. The Earth's atmosphere is a layer of air around the Earth. What is the average value of the Earth's atmospheric pressure at sea level?
- 10 kPa
 - 100 Pa
 - 10 Pa
 - 100 kPa
18. At an altitude of 20 km, atmospheric pressure is 5.5 kPa. Calculate the density of the atmosphere at this altitude.
- 0.3 kg/m^3
 - 3.64 kg/m^3
 - 36.36 kg/m^3
 - 0.03 kg/m^3
19. A stone hanging from a force meter has a weight of 70N. The stone is lowered into water. The reading on the force meter will be....
- lower due to upthrust of the water
 - the same as the weight of the stone has not changed.
 - the same as mass is not affected by water.
 - higher as the wet stone is heavier.
20. Snow shoes are useful for walking across soft snow because...
- they provide a smaller surface area to walk on the snow with.
 - they reduce the amount of pressure on the soft snow.
 - they reduce the force of the person on the soft snow.
 - they reduce the weight of the person walking on the snow.

PiXL Independence – Level 2
5 questions, 5 sentences, 5 words
GCSE Physics – Forces

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:

QUESTION:	What is the difference between a vector and a scalar quantity?			
Sources:	Website – 1. http://www.bbc.co.uk/bitesize/higher/physics/mech_matt/vectors/revision/3/ 2. https://van.physics.illinois.edu/qa/listing.php?id=14225			
<ol style="list-style-type: none"> 1. Scalar quantities have only magnitude (size), examples include distance, speed and energy. 2. Vector quantities have both magnitude and direction, examples include velocity, acceleration and force. 3. Direction can be shown as an arrow, using compass points, an angle, or using terms such as horizontal, vertical and diagonal. 4. An example is when a geostationary satellite is in orbit around the Earth, it moves at a constant speed but the velocity is changing. 5. Another example is when a car is travelling around a roundabout, it is travelling a constant speed but velocity is changing. 				
Magnitude – Size of something	Vector – Size and direction	Scalar – Just size	Velocity – Example of a vector	Speed – Example of a scalar

QUESTION 1:	What is a resultant force and how can forces be calculated?
Sources:	Website – 1. http://www.phyley.com/find-resultant-force 2. http://www.bbc.co.uk/bitesize/higher/physics/mech_matt/vectors/revision/1/

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QUESTION 2:	What is a lever and give examples of each different class of lever?
Sources:	Website – 1. https://www.brainpop.com/technology/simplemachines/levers/ 2. http://www.school-for-champions.com/machines/levers_classes.htm#.Wbpjf8h95PY

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QUESTION 3:	Write a method describing how to determine the centre of mass of a real object.
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Sources:	Website – <ol style="list-style-type: none">1. https://www.khanacademy.org/science/physics/linear-momentum/center-of-mass/a/what-is-center-of-mass (Plumb line method)2. www.schoolphysics.co.uk/age11-14/Mechanics/Statics/experiments/centre_of_mass.doc
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QUESTION 4:	What is the principle of moments and show a worked example of a calculation using it?
Sources:	Website – 1. http://physicsnet.co.uk/a-level-physics-as-a2/mechanics/moments/ 2. http://www.passmyexams.co.uk/GCSE/physics/turning-effect-forces.html

Blank area for student response.

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QUESTION 5:	What are the similarities and difference between pressure, atmospheric pressure and pressure in a liquid?
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Sources:	Website – <ol style="list-style-type: none">1. https://www.khanacademy.org/science/physics/fluids/density-and-pressure/a/pressure-article2. http://www.school-for-champions.com/science/fluid_pressure.htm#.Wbplwsh95PY
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PiXL Independence – Level 3

Science in the News

GCSE Physics – Forces

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

At home, the Brexit vote also suffered from the circulation of misleading news stories 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.

Explaining why the Millennium bridge wobbled.

News article: <https://www.theguardian.com/uk/2000/jun/12/2>

Discussion article: <http://news.bbc.co.uk/1/hi/england/1829053.stm>

Real article: <https://www.sciencedaily.com/releases/2005/11/051103080801.htm>

Task 1:

You need to produce a 1 page essay on the design of the bridge, what happened to the bridge in its first days of being open and how the issues with the bridge were rectified.

Essay section	Activity
Introduction	Where is the Millennium bridge and why was it built, when and by whom?
Describe	Describe how it was engineered. What type of bridge is it? How does it work to distribute forces?
Explore	What happened to the bridge in the few days that it was opened to the public? What were the causes of the wobble?
Evaluate	How did engineers work to fix the bridge so that it could be reopened? Do you think that this delay and extra spend could have been avoided?

Is running bad for your knees?

News article: <http://www.mensfitness.com/training/pro-tips/worst-sports-your-knees-according-science>

NHS article: <http://www.nhs.uk/Conditions/Sports-injuries/Pages/Symptoms.aspx>

Discussion article: <https://www.livescience.com/36241-5-experts-answer-running-bad-knees.html>

Real article: <http://womensrunninguk.co.uk/health/running-bad-joints/>

Task 2:

You need to produce a 1 page essay on whether running is bad for your knees with reference to forces on joints, force diagrams and how to the body and/ or sports shoes are designed for running.

Essay section	Activity
Introduction	Is running a popular form of exercise now in the UK? Who is likely to take up running i.e. age range, gender?
Describe	What benefits are there to people who have taken up running and what kinds of injuries could these athletes sustain?
Explore	What evidence is there that running does or doesn't cause increased wear on joints?
Evaluate	How can people avoid injuries when running? Refer to forces and pressure in your explanation.

PiXL Independence – Level 4

Scientific Posters

GCSE Physics – Forces

INSTRUCTIONS

Scientific Posters

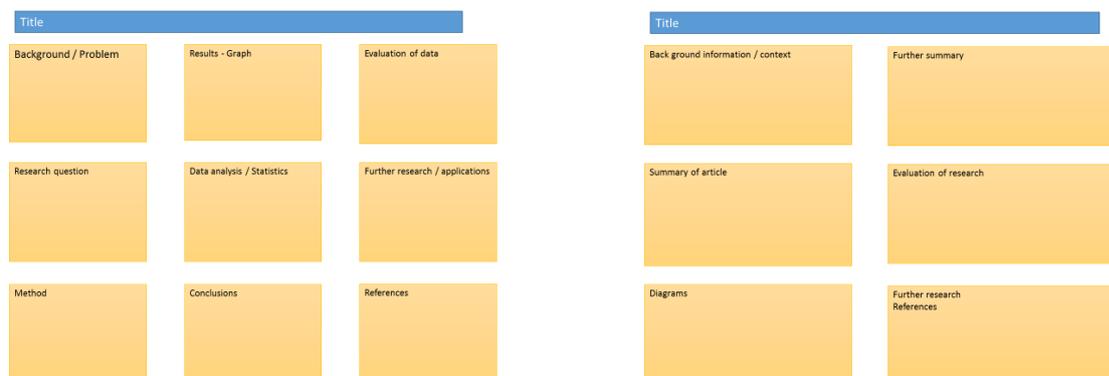
Scientists communicate research findings in three main ways. Primarily, they write journal articles much like an experiment write up. These are very concise, appraise the current literature on the problem and present findings. Scientists then share findings at conferences through talks and scientific 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 (that's Poster Skills not Posters Kill!) More detailed guidance is available at : 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

Newton's First and Third Laws of Motion

Background

Sir Isaac Newton worked in many areas of mathematics and physics. His first theories were on gravity when he was just 24 years old in 1666. In 1687, he published the 'Principia Mathematica Philosophiae Naturalis', it was in this book that he first introduced his laws of motion. Newton's laws of motion are still relevant in today's society to explain how objects move.

Source articles

<http://hyperphysics.phy-astr.gsu.edu/hbase/Newt.html>

<https://www.grc.nasa.gov/www/k-12/airplane/newton.html>

<https://www.youtube.com/watch?v=kKKM8Y-u7ds>

Use other sources as necessary.

Task:

Produce a scientific poster on Newton's first and third laws of motion, use diagrams to show how the laws relate to objects that are being acted on by forces in different directions and worked examples on your poster.

Recall	Write definitions of Newton's first and third laws using diagrams to support them.
Describe	Describe how Newton's laws relate to objects that are being acted on by forces coming from different directions.
Compare	Compare different force diagrams, showing how to calculate the resultant force and how you can use this to comment on the direction and action of the object.
Evaluate	Evaluate how the complexity of resolving the force diagram changes when forces are in straight lines compared to on an angle.

PiXL Independence – Level 5

Video summaries

GCSE Physics – Forces

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 video clips present two topics that link to your learning. The first is on Sir Isaac Newton and his work on forces which led him to write his three Laws of Motion. The second video discusses how resultant forces can change for different situations using worked examples.

Source article:

Video 1 – Newton's Laws

Crashcourse: https://www.youtube.com/watch?v=kKKM8Y-u7ds&list=PL8dPuuaLjXtN0ge7yDk_UA0ldZJdhwkoV&index=5

Video 2 – Resultant Forces

Doodle Science: <https://www.youtube.com/watch?v=fRwq8cRCko0>

Task:

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

1. Discuss Newton's work and how it links to his three laws of motion.
2. Discuss resultant forces.

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

Objectives:	Title:
	Date:
Summary:	



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