

# **PiXL Independence:**

## **GCSE Physics – Student Booklet**

### **KS4**

**Topic: Energy**

**Contents:**

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# PiXL Independence – Level 1

## Multiple Choice Questions

### GCSE Physics – Energy

#### INSTRUCTIONS

Score: /20

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

1. When a falling object hits the ground without bouncing back, its kinetic energy store decreases. The kinetic energy has been transferred to...
  - a. the surroundings
  - b. its gravitational potential energy store
  - c. its elastic potential energy store
  - d. its chemical energy store.
2. Which of the following statements about the conservation of energy is FALSE?
  - a. Energy cannot be created or destroyed.
  - b. Conservation of energy applies to all energy changes.
  - c. Conservation of energy refers to an open system where energy can transfer in and out of the system's energy stores.
  - d. When applying the principles of the conservation of energy, there would be no net changes to the energy stored in the system.
3. A force of 2 kN is applied to an object to make it move 3.6 m in the direction of the force.  
Select the correct value of work done on the object.
  - a. 1.8 J
  - b. 7200 J
  - c. 7.2 J
  - d. 555.6 J
4. Identify the correct equation to calculate gravitational potential energy.
  - a.  $E_p = m W h$
  - b.  $E_p = m g \Delta h$
  - c.  $E_p = m v^2$
  - d.  $E_p = \frac{1}{2} m v^2$

5. Running blades for Paralympic athletes are commonly made from carbon fibre polymers. They are designed to store elastic potential energy as the blade is pressed against the ground. The spring constant of the blade is 14 kN/m. Which of the following is the value of the elastic potential energy stored in the blade when it is compressed by 0.05 m?
- 17.5 J
  - 1.4 J
  - 700 J
  - 0.35 J
6. When a cyclist applied their brakes, a force acts between the brake blocks and the wheels. That force is called...
- air resistance
  - weight
  - friction
  - driving force.
7. Which ONE of the following options would be most useful in increasing the efficiency of a very loud machine?
- Streamline the shape of the machine.
  - Lubricate the moving parts to reduce friction.
  - Tighten loose parts to reduce vibration.
  - Use wires with low electrical resistance.
8. A laptop battery stores energy with an efficiency of 80%. If 16 000 J of energy are transferred to the laptop from the battery, how much energy must have been transferred to the battery?
- 20 kJ
  - 20 J
  - 1.28 kJ
  - 12 800 J
9. A lift motor transfers 24 000J of energy in 1 minute travelling between floors. Calculate the power of the motor.
- 1440 W
  - 1.44 MW
  - 24 kW
  - 400 W
10. Choose the correct statement below about thermal conductivity.
- The higher the thermal conductivity of a material, the higher the rate of energy transfer through it.
  - The greater the thermal conductivity of a material the less energy is transferred per second.
  - Wool and fibreglass have a higher value of thermal conductivity than metals.
  - To increase energy transfer, insulating material in a house should have a high value of thermal conductivity.

11. Identify the TRUE statement about infrared radiation.
- a. Not all objects emit and absorb infrared radiation.
  - b. The hotter an object is, the more infrared radiation it emits in a given time.
  - c. A good absorber of infrared radiation is always a poor emitter.
  - d. A body at a constant temperature is absorbing more infrared radiation than it is emitting.
12. The SI units of specific heat capacity are...
- a.  $\text{kg/J } ^\circ\text{C}$
  - b.  $\text{J/kg } ^\circ\text{C}$
  - c.  $\text{J/g } ^\circ\text{C}$
  - d.  $\text{J/kg } ^\circ\text{F}$
13. The symbol for specific heat capacity is...
- a.  $\alpha$
  - b.  $\Theta$
  - c.  $\Delta$
  - d. c
14. Which of the following is not a renewable energy resource?
- a. Hydroelectric power
  - b. Tidal power
  - c. Geothermal
  - d. Nuclear power
15. A geothermal power station has a power output of 300 000 W.  
Calculate how many kWh of energy the power station would generate in 2 days.
- a. 14 400 000 kWh
  - b. 6 250 kWh
  - c. 14 400 kWh
  - d. 600 kWh
16. Which of these power stations will NOT release greenhouse gases into the atmosphere?
- a. Gas
  - b. Oil
  - c. Coal
  - d. Nuclear
17. Which ONE of the following renewable energy sources would be MOST suitable for a small remote island in Scotland?
- a. Solar power
  - b. Wind power
  - c. Wave power
  - d. Tidal power

18. In order to do work, an energy store is...
- a. used up.
  - b. lost
  - c. transferred
  - d. burnt
19. The potential energy of a box on a shelf, relative to the floor, is a measure of?
- a. The work done putting the box on the shelf from the floor.
  - b. The weight of the box times the distance above the floor.
  - c. The energy the box has because of its position above the floor.
  - d. Any of these.
20. Select the power station with the shortest start up time.
- a. Coal
  - b. Nuclear
  - c. Gas
  - d. Oil

# PiXL Independence – Level 2

## 5 questions, 5 sentences, 5 words

### GCSE Physics – Energy

#### 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:

QUESTION:	Compare useful and wasted energy transfers for a range of electrical appliances.			
Sources:	<b>Website –</b> 1. <a href="http://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-transfer-surroundings-useful-wasted-energy.pdf">http://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-transfer-surroundings-useful-wasted-energy.pdf</a> 2. <a href="http://www.iop.org/resources/energy/">http://www.iop.org/resources/energy/</a>			
<div>1. Light bulb The input energy is electrical energy. This is then transferred into light (radiant) energy. This is the useful energy as it is what we want from a light bulb. The energy transferred from the filament is wasted heating the surroundings</div> <div>2. Television The useful energy from the television is transferred as light and sound, the wasted energy is transferred as heat to the surroundings.</div> <div>3. Power drill The useful energy is kinetic energy, the wasted energy is transferred as heat and sound.</div> <div>4. Hair dryer Useful energy is transferred as heat and kinetic energy, the wasted energy is transferred as sound.</div> <div>5. If an appliance is energy efficient, it means that more of the input energy is transferred into useful output energy. If the appliance is energy inefficient, then less of the input energy is transferred into useful output energy.</div>				
Efficient – more of the input energy transferred into useful energy.	Useful energy – the energy transfers or stores which are useful to us.	Wasted energy – the energy transfers or stores which are not useful to us.	Heat – energy is often transferred as heat to the surroundings.	Energy store – where energy is stored.

QUESTION 1:	What are energy stores and how is energy transferred from one store to another?			
Sources:	<b>Website –</b> 1. <a href="https://www.hoddereducation.co.uk/media/Documents/Science/ScienceProgress_Physics_sample_1.pdf">https://www.hoddereducation.co.uk/media/Documents/Science/ScienceProgress_Physics_sample_1.pdf</a> 2. <a href="https://www.youtube.com/watch?v=3HTdHgnwneg">https://www.youtube.com/watch?v=3HTdHgnwneg</a>			

QUESTION 2:	Describe the changes in energy stores taking place as a tennis ball falls to the ground and then rebounds.			
Sources:	<b>Website –</b> 1. <a href="http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa_pre_2011/forces/kineticenergyrev2.shtml">http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa_pre_2011/forces/kineticenergyrev2.shtml</a> 2. <a href="http://www.gcsescience.com/pen30-energy-ball-bounce.htm">http://www.gcsescience.com/pen30-energy-ball-bounce.htm</a>			



QUESTION 3:	Describe an experiment to determine the specific heat capacity of a material.			
Sources:	<b>Website –</b> 1. <a href="http://filestore.aqa.org.uk/resources/physics/AQA-8463-PRACTICALS.PDF">http://filestore.aqa.org.uk/resources/physics/AQA-8463-PRACTICALS.PDF</a> <b>Page 7 shows a student method. Use diagrams in your answer.</b> 2. <a href="https://tap.iop.org/energy/thermal/607/file_47504.doc">https://tap.iop.org/energy/thermal/607/file_47504.doc</a>			

QUESTION 4:	Compare the advantages and disadvantages of using nuclear power versus solar power.			
Sources:	<b>Website –</b> 1. <a href="https://www.youtube.com/watch?v=Z6riIA4uTIQ">https://www.youtube.com/watch?v=Z6riIA4uTIQ</a> 2. <a href="https://nuclear-energy.net/advantages-and-disadvantages-of-nuclear-energy.html">https://nuclear-energy.net/advantages-and-disadvantages-of-nuclear-energy.html</a>			

QUESTION 5:	Explain what is meant by the term 'supply and demand' and explain how the variable demand for electricity is met.			
Sources:	<b>Website –</b> 1. <a href="http://www.bbc.co.uk/bitesize/standard/physics/energy_matters/supply_and_demand/revision/1/">http://www.bbc.co.uk/bitesize/standard/physics/energy_matters/supply_and_demand/revision/1/</a> 2. <a href="http://euanmearns.com/electricity-supply-and-demand-for-beginners/">http://euanmearns.com/electricity-supply-and-demand-for-beginners/</a>			

# PiXL Independence – Level 3

## Science in the News

### GCSE Physics – Energy

#### 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.

#### The Future of Nuclear Power

News article

<http://www.dailymail.co.uk/news/article-42066/New-study-links-nuclear-sites-cancer.html>

NHS article

<http://www.nhs.uk/conditions/Radiation/Pages/Introduction.aspx>

Discussion article

<http://www.debatingeurope.eu/focus/infobox-arguments-for-and-against-nuclear/#.WbQxEMh95PY>

#### Task 1:

You need to produce a 1 page essay on 'How safe is nuclear power and does it have a future in energy generation?'

Essay section	Activity
Introduction	Who was the first country to use nuclear power and when was it first used to generate electricity?
Describe	Describe arguments for and against the use of nuclear power.
Explore	Explore the effects of radiation fallout should an incident occur. How could this be contained? Or risks reduced?
Evaluate	Give your opinion as to the future of nuclear power. Support your opinion with evidence from the articles.

## Energy Saving and Vacuum Cleaners

News article:

<http://www.bbc.co.uk/news/business-41119355>

Discussion article:

<http://www.which.co.uk/news/2017/08/eu-vacuum-cleaner-ban-2017-everything-you-need-to-know/>

Real article:

<https://www.theccc.org.uk/2014/09/01/saving-carbon-with-efficient-vacuum-cleaners/>

### Task 2:

You need to produce a 1 page essay on whether the use of high wattage vacuum cleaners should be restricted in favour of lower wattage models.

Essay section	Activity
<b>Introduction</b>	Who has decided that there should be a restriction on the sale of high wattage vacuum cleaners and why?
<b>Describe</b>	Describe what the terms wattage, power and energy mean and how the link to each other.
<b>Explore</b>	Explore how much energy will saved if the wattage of vacuum cleaners were lowered.
<b>Evaluate</b>	Give your opinion, support with evidence from the articles, as to the restriction ban. Are you in support of the ban or should it be removed?

# PiXL Independence – Level 4

## Scientific Posters

### GCSE Physics – Energy

#### 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 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)

## Energy and Power

### Background

Energy conservation and saving energy is important to many people as it is linked to saving money on living costs and reducing the energy you use to help to protect the environment. Knowing about appliances power ratings and their efficiency ratings are part of making informed decisions in the future.

### Source articles

[https://www.hoddereducation.co.uk/media/Documents/Science/ScienceProgress\\_Physics\\_sample\\_1.pdf](https://www.hoddereducation.co.uk/media/Documents/Science/ScienceProgress_Physics_sample_1.pdf)

<http://www.bbc.co.uk/education/guides/zssk7ty/revision>

<https://www.cse.org.uk/advice/advice-and-support/how-much-electricity-am-i-using>

<http://www.ukwhitegoods.co.uk/help/buying-advice/all-appliances/2715-energy-labels>

**Use other sources as necessary.**

### Task:

Produce a scientific poster on Energy and Power including definitions, equations, worked examples, energy stores & transfers and diagrams.

<b>Recall</b>	Clearly identify the equations and units for Energy and Power. Write a definition for each.
<b>Describe</b>	Describe what 'energy conservation' is and why people would want to save energy.
<b>Compare</b>	Compare different appliances and their power ratings. How does the power rating affect how much energy is transferred by each appliance?
<b>Evaluate</b>	Evaluate how new appliances to the consumer market and their efficiency ratings will have to meet consumer demand for saving energy.

## PiXL Independence – Level 5

### Video summaries

### GCSE Physics – Energy

#### 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 prefer to hand write their notes. Whichever option you use, remember the aim is to summarize 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 (in a less well-structured lecture) 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 to 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 using 100% renewable energy sources to produce electricity in Costa Rica. The second video discusses how a small country, Bhutan, which is deep in the Himalayas, has pledged to remain carbon neutral and hopes to be carbon negative.

**Source article:**

**Video 1 – A small country with big ideas to get rid of fossil fuels.**

**Ted Ed talks :**

[https://www.ted.com/talks/monica\\_araya\\_a\\_small\\_country\\_with\\_big\\_ideas\\_to\\_get\\_rid\\_of\\_fossil\\_fuels](https://www.ted.com/talks/monica_araya_a_small_country_with_big_ideas_to_get_rid_of_fossil_fuels)

**Video 2 – This country isn't just carbon neutral, it's carbon negative**

**Ted Ed talks:**

[https://www.ted.com/talks/tshering\\_tobgay\\_this\\_country\\_isn\\_t\\_just\\_carbon\\_neutral\\_it\\_s\\_carbon\\_negative](https://www.ted.com/talks/tshering_tobgay_this_country_isn_t_just_carbon_neutral_it_s_carbon_negative)



**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 the reasons for reducing the amount of fossil fuels.
2. Discuss what impact renewable energy and being carbon neutral can have economically and in society.

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.

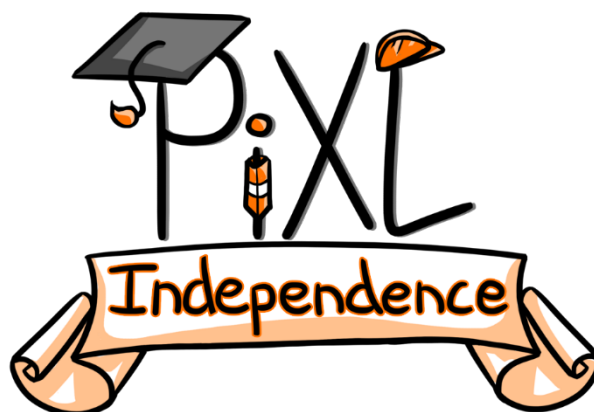
Title  
Date

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







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