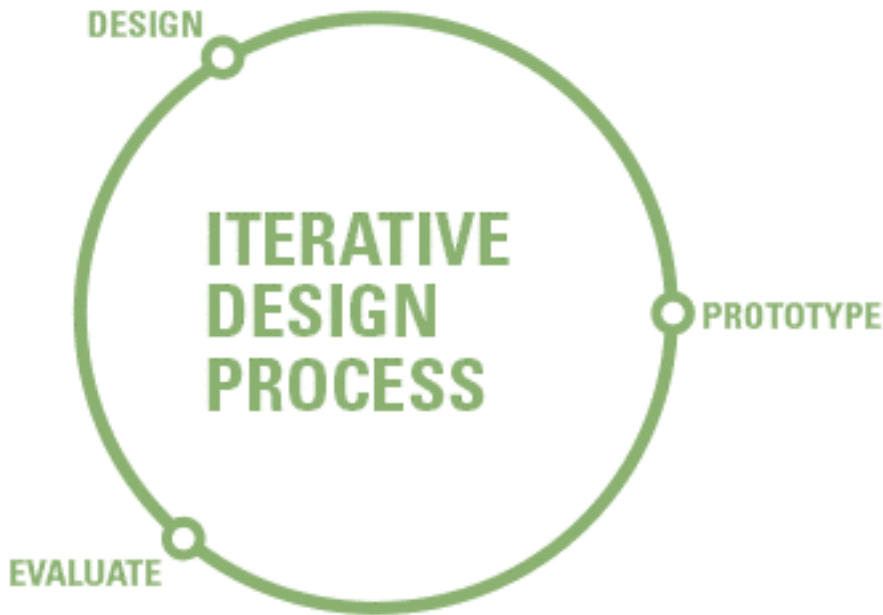


THE ITERATIVE DESIGN PROCESS



Iterative Design is a design strategy or philosophy. It is used to avoid design fixation which is when designers become overly attached to a particular idea.

Iterative design is a cyclic approach. Each Iteration of a design is tested and evaluated. Changes and refinements are then made, leading to a new Iteration.

Advantages of Iterative Design

Because each iteration is fully tested and evaluated it is more likely that problems with the design will be discovered earlier and dealt with.

It encourages focus on the most critical aspects of a product's design.

Evidence of progress in product design can be easily provided to the stakeholders.

Disadvantages of Iterative Design

Designers can be so focused on the current iteration that they sometimes lose sight of the bigger design picture.

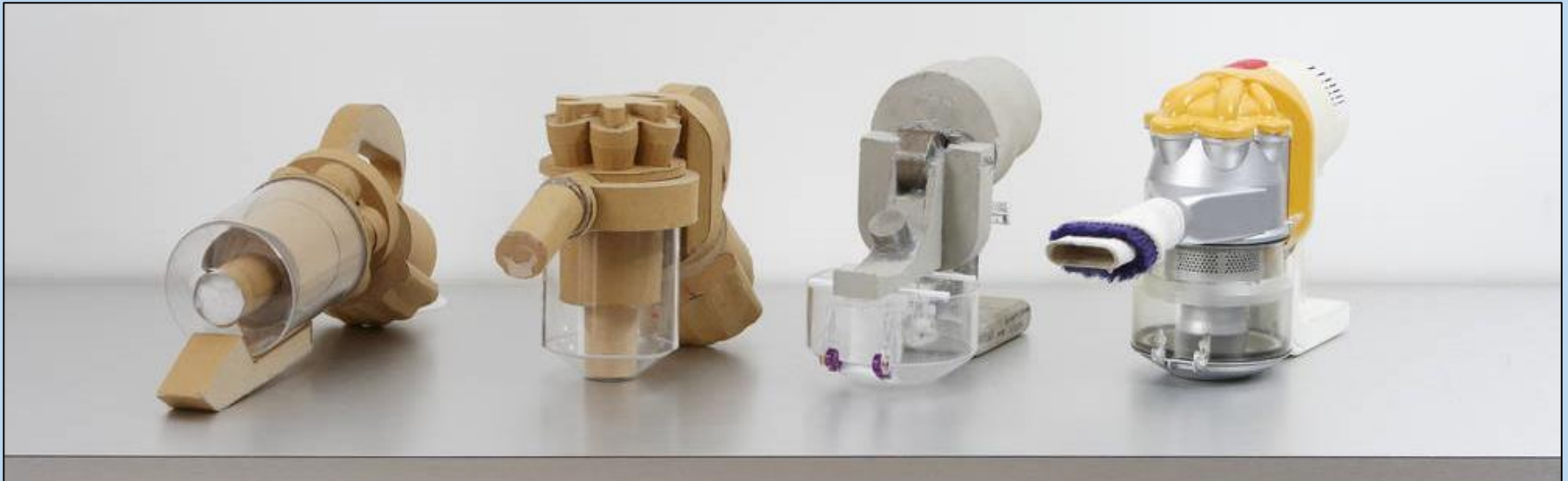
It can be time consuming if a lot of prototypes or iterations need to be produced.

THE ITERATIVE DESIGN PROCESS



Dyson vacuum cleaners are a good example of a product range designed using an iterative design process. The original DC01 was developed as a result of thousands of different prototypes.

Using an Iterative design approach makes it more likely that problems will be discovered earlier in the process. See below different Dyson models which were created as part of an Iterate design process.



THE ITERATIVE DESIGN PROCESS



This awesome video goes into some detail about James Dyson and his ideas. Look out for why he thinks the iterative design process is so important to him?



THE ITERATIVE DESIGN PROCESS



To help you with your first initial idea sketches (seed ideas) for your lamp get as many different views of your inspiration product as possible.

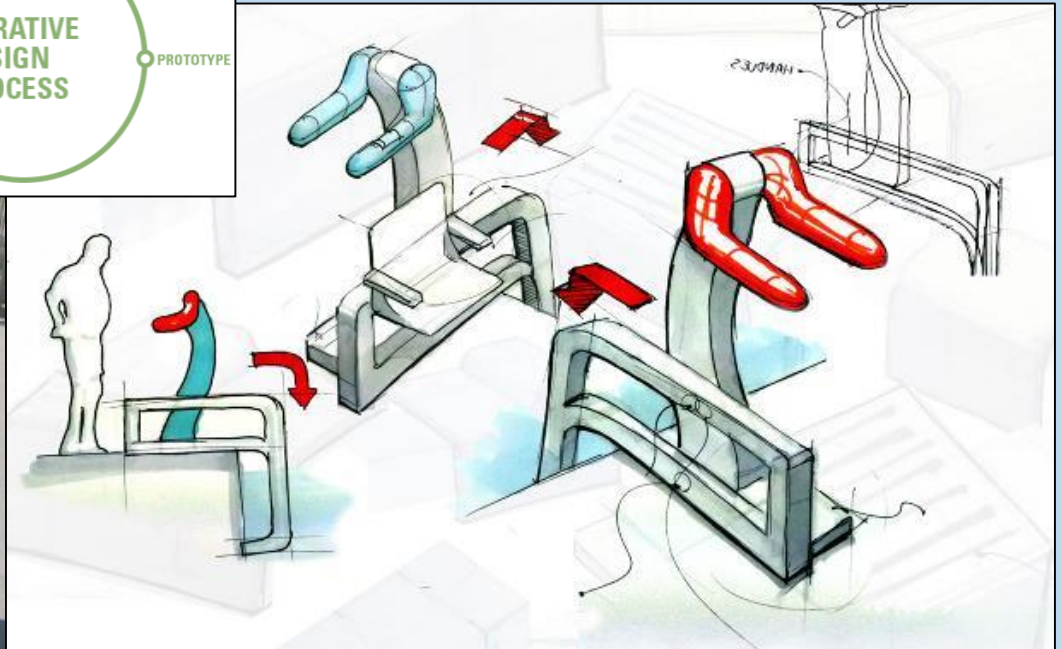
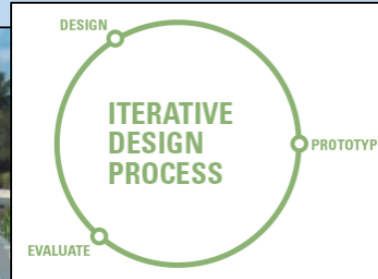


THE ITERATIVE DESIGN PROCESS



Let's say we are re-designing this pool aid for helping disabled people into swimming pools. Why would the Iterative design process be useful when coming up with ways to improve the chair and the design?

Talk to a partner for 5 minutes and come up with some reasons



THE ITERATIVE DESIGN PROCESS



Design a poster about the iterative design process.

It should be:

- A4
- Colour
- Portrait

You should include:

- A definition
- Some kind of diagram/image
- Examples of models
- Example of testing



THE ITERATIVE DESIGN PROCESS



You are designing a new pair of headphones with mega bass and really comfortable adjustable head strap. How would designing using the Iterative design process help you? (4 Marks)



Discuss why you think Dyson was so successful when he was designing and prototyping his very first vacuum cleaner. (4 Marks)

CARBON FOOTPRINT

A **carbon footprint** is defined as: The total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of **carbon** dioxide (CO₂).



GREENHOUSE GASES



Why are greenhouse gases bad?

They create a layer in the atmosphere that traps the Sun's rays, these heat up the Earth and can cause very harmful effects;

- Rise in sea level so land shrinks
- Plants die and land becomes desert
- Animals have nothing to eat and die
- Weather becomes more extreme – tsunamis, hurricanes droughts etc.

What makes Carbon Dioxide?

BURNING STUFF!!

WHY DO WE BURN STUFF?

1. To make heat



In Industry – Extracting natural resources (metal), making synthetic materials (plastics)



At Home – Cooking food and heating rooms and offices

WHY DO WE BURN STUFF?



2. To make electricity



WHY DO WE BURN STUFF?

3. To make movement



In Industry – Moving products around the globe (planes, trains, lorries, boats etc.)

At Home – Moving people around (cars, motorbikes, buses, trains etc.)

WHY DO WE BURN STUFF?



4. To get rid of it



Incineration is a main way of disposing of waste

LIFE – CYCLE ANALYSIS



A **life-cycle analysis (LCA)** is a systematic inventory of **environmental impacts** at **every stage** of a **product's life**

NON-RENEWABLE ENERGY SOURCES



COAL

Advantages

Stable, large-scale and high power electricity generation
Relatively cheap to extract and convert
Reliable

Disadvantages

Emits pollution such as CO₂, Sulphur, Mercury, Selenium and Arsenic
Technologies to reduce emissions are expensive
Mining impacts significantly on landscape



OIL

Advantages

Stable, large-scale and high power electricity generation
Relatively cheap to extract and convert

Disadvantages

Highly polluting
Oil extraction impacts on landscape
Oil extraction risks environmental disasters



GAS

Advantages

Stable, large-scale and high power electricity generation
Relatively cheap to convert
Cleaner than coal or oil

Disadvantages

Highly polluting

NON-RENEWABLE ENERGY SOURCES



Nuclear Power:

The steam needed to turn turbines and hence drive the generators is created using a nuclear reactor. Nuclear fission controls the reactor heat. This requires the use of Uranium, which is a non-renewable resource.

Making greater use of nuclear power means there is less need for fossil fuels.

Advantages of using Non-Renewable Energy Sources	Disadvantages of using Non-Renewable Energy Sources
Stable, large-scale and high-power electricity generation.	They use up lots of non-renewable energy sources such as coal, oil and gas.
Relatively cheap to convert and extract as ready made fuel.	Burning gases and coal is highly polluting. Oil power plants are highly polluting.

LIFE – CYCLE ANALYSIS



**DISCUSSION
TIME!**



What materials have been used to manufacture this product?

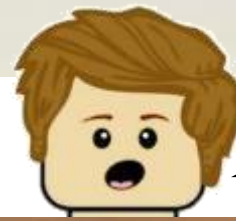
How is it assembled? All at once?

How long will its product use be?

What will happen to it at its end of life?



NON-RENEWABLE ENERGY SOURCES



**DISCUSSION
TIME!**



Is this the answer?

If you buy a Tesla are you are no longer using fossil fuels?

How do you charge it?

Discuss!





NON-RENEWABLE ENERGY SOURCES

Why do we burn so many fossil fuels? Discuss (4 Marks)



Discuss the advantages and disadvantage to building more nuclear power plants in the UK (5 Marks)



RENEWABLE ENERGY SOURCES



Renewable energy plays an important role in reducing greenhouse gas emissions. When renewable energy sources are used, the demand for fossil fuels is reduced. Unlike fossil fuels, non-biomass renewable sources of energy (hydropower, geothermal, wind, and solar) do not directly emit greenhouse gases.



RENEWABLE ENERGY SOURCES



What is renewable energy?

- Renewable energy comes from sources that won't run out, including:
 - the wind
 - the sun
 - the waves and tides
 - natural underground heat
 - energy crops, wood and waste.
- We can use renewable energy to provide electricity and heat for homes and businesses.

Why do we need renewable energy?

- Most of the electricity we use in the UK comes from non-renewable sources, such as coal and gas.
- These 'fossil fuels' are running out.
- Burning them to provide energy also releases gases that contribute to climate change.
- Renewable sources of energy don't run out or pollute the environment.

Why don't we get all our electricity from renewable energy?

- It is important to have a mix of energy sources so, if one fails, another can be used. Also, many renewable technologies are still being developed.

Wind energy

Giant machines, called wind turbines, can be used to make electricity in windy places. Groups of wind turbines – or wind farms – are being built on land and out at sea.

Hydroelectric energy

Hydroelectric energy means energy from moving water. Water flowing from a reservoir to a river through a hydroelectric dam can be used to make power.

Biomass energy

Biomass is plant and animal matter (e.g. wood, straw, sewage and waste food), or trees grown for fuel. We can burn biomass to produce heat and electricity.

Solar energy

Solar energy means energy from the sun. The sun's light and heat can be captured by solar panels and turned into electricity or used to heat water.

Geothermal energy

Geothermal energy means the natural heat of the Earth. Geothermal power stations use heat from deep underground to generate electricity.

Hydrogen fuel cells

Hydrogen fuel cells make 'clean' electricity from hydrogen gas. They work like batteries, and can power cars or buses.

Tidal energy

Every day, the tide at the seaside goes in and out, as the sea rises and falls. Marine turbines can use this movement to generate electric power.

Wave energy

Waves are made when wind blows across the sea. The energy in waves can be used to make electricity by new technology such as the Pelamis wave machine.

It's Only Natural

See www.dti.gov.uk/renewables/schools

WIND POWER

Wind power in the UK clip



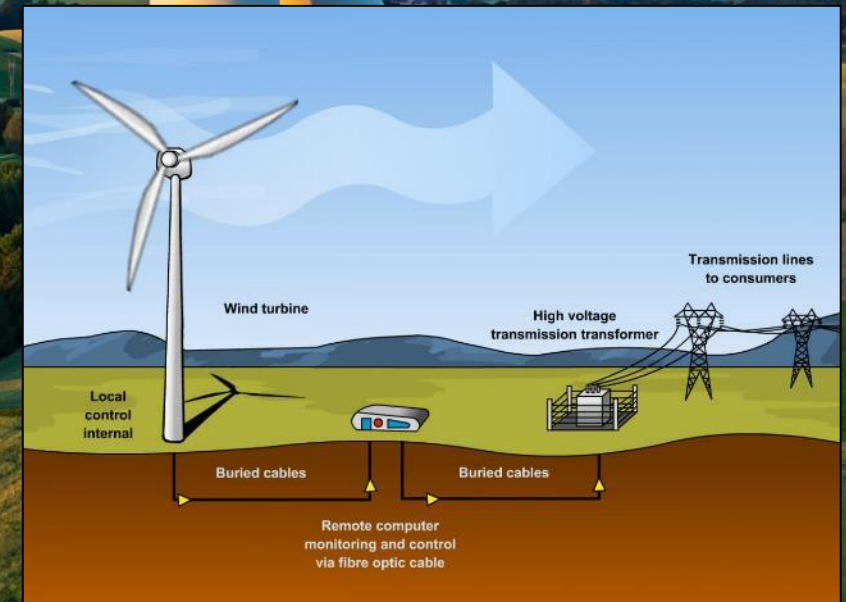
The terms wind energy or wind power describe the process by which the wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power.

Advantages to Wind Power:

- No emissions
- Can be used in really remote areas
- Freely Available

Disadvantages to Wind Power

- Expensive to set up
- Wind farms are often regarded as unsightly



WIND POWER



Answer the 9 mark question in your books using the resource sheets to help you. Remember, this is for 9 marks so you need to discuss 9 points!

Exam-style question

Evaluate the use of using a wind system for generating electricity in remote countryside. **(9 marks)**

TIDAL POWER

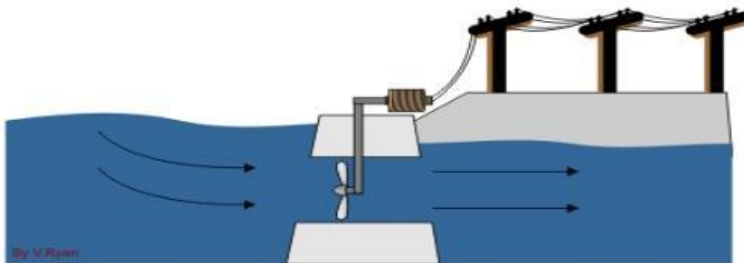
Tidal power in the UK clip



Tidal power or tidal energy is a form of hydropower that converts the energy obtained from tides into useful forms of power, mainly electricity. Although not yet widely used, tidal energy has potential for future electricity generation. Tides are more predictable than the wind and the sun.

Advantages to Tidal Power:

- No Emissions
- Powerful
- Tides are more predictable and stable
- Artificial tidal barrages which direct the flow of water can have a secondary purpose such as a bridge



TIDE COMING IN

This tidal electricity generation works as the tide comes in and again when it goes out. The turbines are driven by the power of the sea in both directions.



TIDE GOING OUT

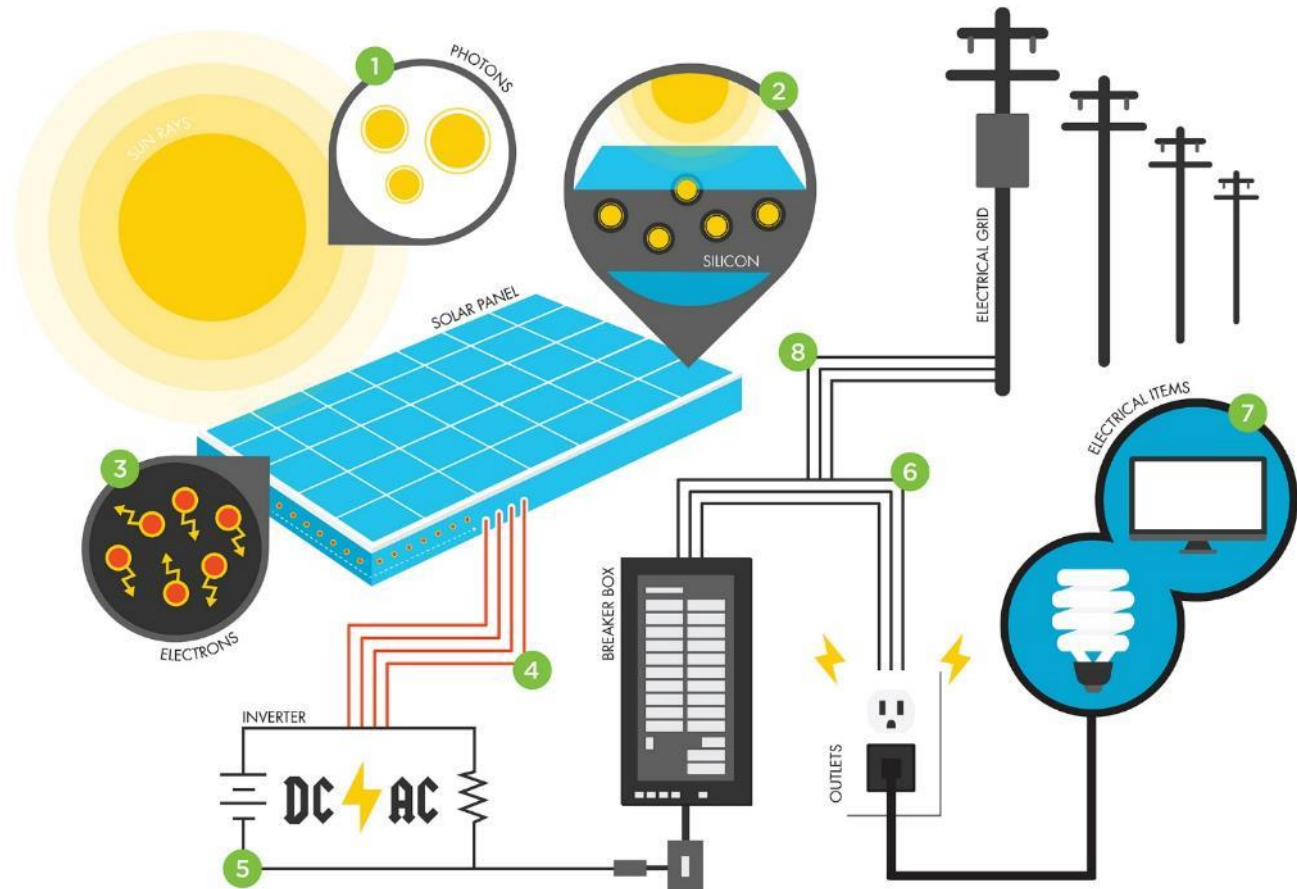
SOLAR POWER

The rise of Solar Power Clip



How Solar Energy Works...

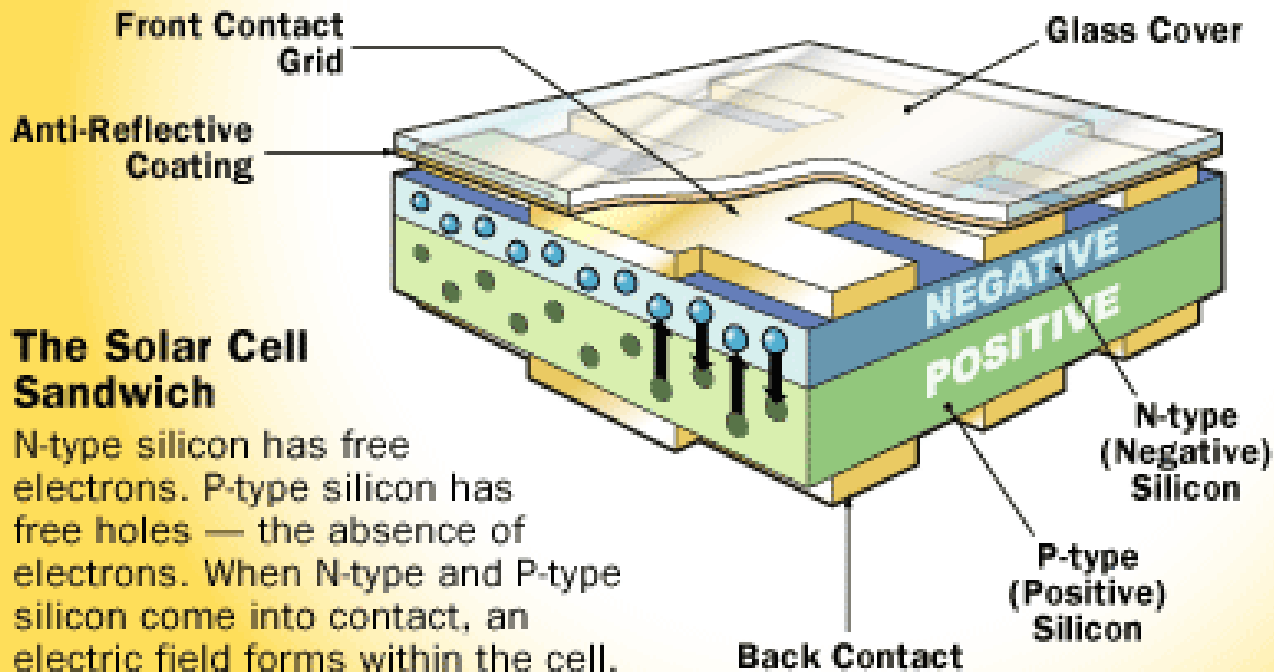
- 1 Sunlight contains tiny particles of energy called photons.
- 2 When the sun's rays hit a solar panel, material inside the panel – usually silicon – absorbs the photons.
- 3 The photons excite the electrons inside the silicon's atoms until they begin to dart around and break away, forming an electrical current.
- 4 Copper wiring inside the panel serves as a highway for the current.
- 5 This direct current (DC) travels out of the panel through a control device called an inverter, which changes it to the alternating current (AC) we use.
- 6 The electricity then passes from breaker boxes to outlets throughout the building.
- 7 Electrical items such as computers and lights can then run on this pollution-free solar energy!
- 8 Whatever isn't used goes back into the electrical grid so it can be used by someone else.



SOLAR POWER



How Solar Energy Works...



The Solar Cell Sandwich

N-type silicon has free electrons. P-type silicon has free holes — the absence of electrons. When N-type and P-type silicon come into contact, an electric field forms within the cell.



SOLAR POWERED WINDMILL



The small windmill will gather just enough power to move the windmill for a small amount of time if it is left in the sun. It just powers a small motor. It would take days for it to store enough energy to power the windmill for an hour



SOLAR POWERED WINDMILL IN ACTION

SOLAR POWERED GARDEN LIGHTS



Solar powered garden lights are the only solar products that work well in the UK. This is because they are outside all of the time. They charge up in the daytime, from what little sun light there is and during the night they then come on and are used. On a sunny day they could be on for four hours, but on an overcast cloudy day they could only last an hour! It all depends on the amount of sunlight there has been!



SOLAR POWERED BATTERY CHARGER



These small battery chargers would have to be in the sun for two days to get a full charge! As you can see below, solar powered phone chargers have to have a large amount of surface area in order for them to work properly and charge a phone.








SOLAR POWERED CHARGERS




In pairs, read the article about solar powered chargers and make your mind up about them. You need to use this article to answer the question on the worksheet so make sure you have enough to write about and you have thought about both sides to the discussion!

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Portable solar chargers – Are they worth it?

DECEMBER 3, 2014



Latest Videos



SOLAR POWER



When there is a really large surface area on the top of a roof it is easy to gather and store electricity. You will see these solar panels on the roof of the science / MFL block, and they are facing the sun.



SOLAR POWER



Many fields are now full of solar panels which are converting the sun's rays into energy for many many homes!

Sun Power have just finished creating the world's largest solar power plant in California.

SOLAR POWER



Answer the 2 mark question in your books using the resource sheet on power systems to help you. Remember, this is for 2 marks so you must explain your point!

Exam-style question

Explain **one** reason why solar cells are more environmentally friendly than rechargeable cells. **(2 marks)**

STORAGE OF ENERGY



On the national grid level the supply of electricity must be equal to demand and power companies are continually making adjustments to the supply based on predictable changes such as the timings of the working day, as well as unexpected changes from equipment overloads and storms. Any electricity not used when created must be stored so there is more flexible and reliable use. This can be in a number of forms that are then used to power systems.

nationalgrid



GCSE QUESTIONS — MINI TEST



GOOD LUCK!



SUSTAINABILITY EXAM ANSWERS

1) Using the Designer James Dyson describe how the iterative design process can result in marketable products. (2)

The process allows for the designer to test each idea fully (1)

Through product testing the product can be refined and improved (1)

As one aspect is changed and test the effects on the overall product can be judged (1)

Investors can see the product develop through each prototype (1)

Any 2 of the above to a maximum of 2 marks.

2) What is a Carbon footprint? (2)

The total amount of CO₂ burnt by a household (1)

Amount of CO₂ produced by a family by the things they use (1)

The answer must refer to the amount of CO₂ produced. No mention of CO₂ or Carbon Dioxide then no mark.

3) What effect are Greenhouse gases are having on our planet ? (2)

Greenhouse cause temperatures to rise and this then results in..... then finished with any of the following-

Melting polar ice caps, reducing area for animals to fee on

Extreme weather and flooding endangering human and animal life

Desert effect with lower rainfall, causing the failure of crops

For the 2 mark students must know the temperature rises and it causes something to happen. Without both aspects only 1 mark can be awarded.

4) In order to understand the effect products have the environment designers consider the cradle to grave effect a product can have. What is this process more commonly called? (2)

LCA or Life Cycle Analysis (2)



SUSTAINABILITY EXAM ANSWERS

5) List 3 Alternative sources of energy (2)

Wind
Tidal
Wave
Solar
Hydro-electric

Any 3 of the above for a maximum of 2 mark. Students must not receive credit for the term water/water power.

6) Describe how electricity is generated from fossil fuels (2)

Fuel is burnt to produce heat (1)
Heat is used to produce steam (1)
Steam drives turbines that generate power (1)

Any of the above for a maximum of 2 marks. 1 mark can be awarded for recognition of burning the fuel.

7) On average a mobile phone has to be charged everyday by the owner. Explain why in the UK the use of Solar powered chargers is not always practical. (2)

Lack of sun light (1)
Carrying around a large solar panel to be able to charge (1)

8) Portable electronic products ranging from musical greeting cards to power tools are battery powered. Describe the benefits and drawbacks of using battery power (2)

Benefits of battery power should include some of the following points:

- Variety of voltages available
- Standard physical sizes used globally
- Batteries can be rechargeable
- Safer when using power tools in damp conditions
- Tools / equipment can be used anywhere, is portable
- Low voltages safer to use.

Drawbacks of battery power should include:

- Toxic metals are still found in some batteries
- Recycling and prevention of disposal in normal waste can be difficult
- Ni Cad cells have memory which can prevent full charging
- Power source needed for recharging

- Cannot provide continuous use for power tools
- Lithium ion batteries are expensive
- Regular replacement / recharging of batteries required
- Increased weight of product.





SUSTAINABILITY EXAM ANSWERS

9) Nuclear power is seen by many European Governments as the power source of the future. Can you describe the disadvantages of using Nuclear to generate the UK's power needs? (4)

Deposal of uranium, remains active for thousands of years, it needs to be stored safely (1)

Uranium leaking this can be a general term about the chemical being dangerous (1)

Danger to the environment when something goes wrong (1)

Mention the dangers to life if something leaks into the atmosphere (1)

Discussion on how this can effect large areas if water source is contaminated (1)

Two aspects to the question. 2 marks for each. Do not award 2 marks for environment impact if something goes wrong.



HOW DID YOU DO?



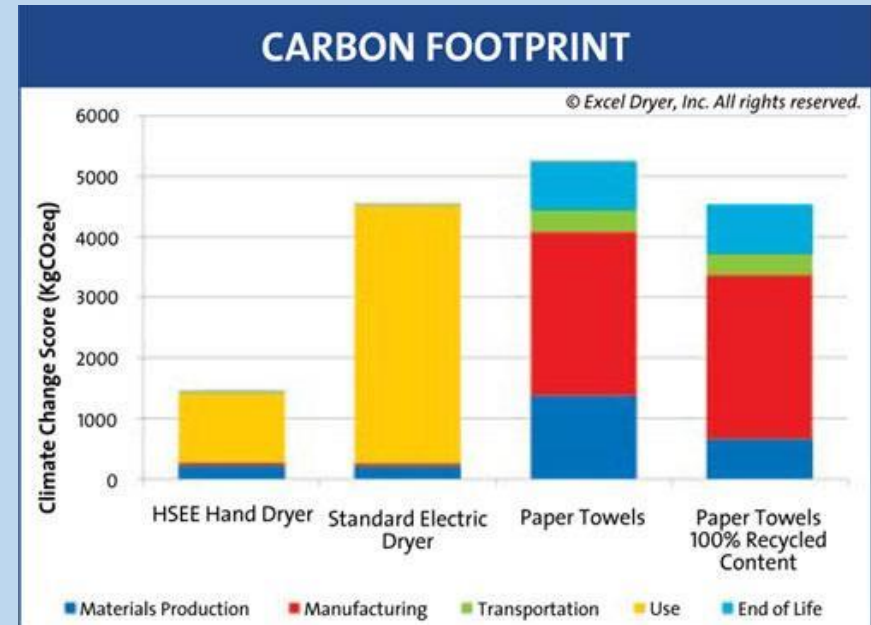
THE MARK IS OUT OF 20!



MINI KNOWLEDGE CHECK



- 1) The graph shows the carbon emissions based on a life cycle based on different hand drying options.
- a) Can you explain the difference between paper towels and electric hand dryers? Why is there more use for the hand dryers and more manufacturing for the hand towels dispenser?
- b) Explain why the paper towels option has additional carbon emissions after it has been manufactured **(2 Marks)**



- 2) Evaluate the use of solar panel fields as an alternative to fossil-fuelled power stations **(9 Marks)**
- 3) Other than solar power, give two more examples of renewable energy sources **(2 Marks)**