Key Stage 5

Artificial atoms

Pupil worksheet

Quantum dots

You may have heard about quantum dots as the latest technology to improve LCD screens for televisions and mobile devices.

They are tiny particles or nanocrystals of a semiconducting material with diameters in the range of 2-10 nanometres (10-50 atoms). Because of their size they act like single atoms so are also known as artificial atoms. Upon excitation, these quantum dots fluoresce and release visible light. Using them in screens produces brighter pictures.

How do they produce light? Let’s start at the basics...

When the electrons in single atoms gain energy they become excited and when the energy gain is sufficient they can move up energy levels. They will eventually fall back down and lose the energy which is released as photons.

The amount of energy an electron loses is equal to the difference in energy levels it moves between.

Electrons moving between different energy levels produce photons with different energies and therefore different frequencies (and colours). Atoms of elements produce sets of photons with different frequencies, each set being unique to one element. Therefore, every element has a unique emission spectrum.

The fluorescent property of a quantum dot is due to the same principle.

Other uses

Scientists have developed quantum dots that are capable of producing single photons of a defined wavelength. These single photon emitters have many potential uses.

Your task

Produce a 15 second video explaining what a quantum dot is.

Before you can explain something this concisely you need a good understanding. Do some research outlined on the following page. Use the weblinks or your own internet searches.

Plan what you are going to say in your video. Then record it!

http://www.oxfordsparks.ox.ac.uk/run-for-your-light
Key Stage 5

Artificial atoms

Gathering information

Weblink: goo.gl/Di7Juo
What to find out: What a band gap is

Weblink: goo.gl/bbvGau
What to find out: How a quantum dot produces light

Weblink: goo.gl/ILB24U
What to find out: How to produce different frequency photons from quantum dots

Weblink: http://goo.gl/GSSOKw
What to find out: Applications of single photons emitters

The 15 second explanation

http://www.oxfordsparks.ox.ac.uk/run-for-your-light