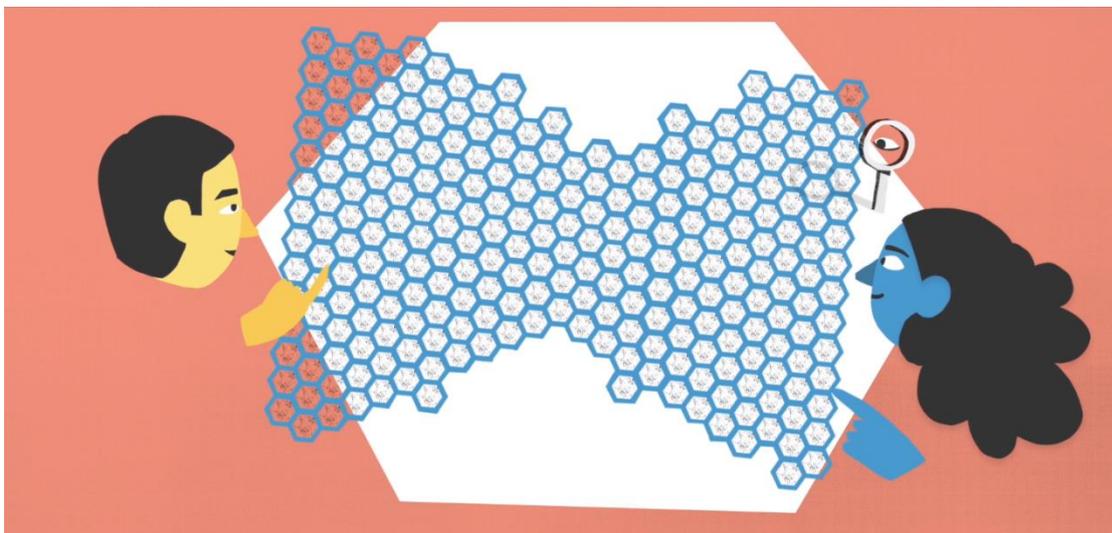




Key Stage 4 – Carbon Copy

Notes for teachers

At a glance



Scientists at the University of Oxford are researching the way that electricity flows in very small, molecular sized, components. In order to achieve this they are making use of graphene, an allotrope of carbon. In this lesson students find out more about the allotropes and, in particular, the allotropes of carbon.

Learning Outcomes

- Students will recognize that the way that the atoms or molecules in a substance are organised can have an effect on the properties of the substance.
- Students will be able to describe the arrangement of the atoms in different allotropes of carbon (such as diamond and graphite).

Each student will need

- Scrap A4 paper for starter activity
- Student worksheet
- Building materials to make models
- Paper/pens for Wanted Poster [OPTIONAL activity]

Lesson Activities

1. Starter activity

- Give the students (in pairs or small groups) 4 sheets of A4 paper each and give them 5-10 minutes to create something that will hold the weight of, say, a stapler at least 10cm above the table (they can fold/cut/change the shape of the paper as much as they like).
- Test their creations. All being well most groups will be able to do this. There are a variety of possible solutions (not least, just scrunching each sheet up in a pile) but a more elegant solution is to fold a single sheet into pleats as below:

<https://www.oxfordsparks.ox.ac.uk/content/how-does-electricity-flow-through-small-objects>



- Ask the students to reflect on the fact that although they started with flat sheets of paper that wouldn't be able to hold up the test object, by rearranging the paper in various different ways they have been able to make the paper strong enough to cope with its weight.
- Explain that just as with the sheets of paper, the way that atoms and molecules are arranged in a substance have a huge effect on the properties of that substance.
- Let them know that although in this lesson you are going to be concentrating on carbon, this applies to lots of different substances too.

2. Main activity: Comparing Properties

- Hand out the student worksheets.
- Ask the students in pairs or small groups to do task one (list differences between diamond and graphite).
- Explain that many of the differences are due to fact that the carbon atoms in diamond and graphite are arranged differently.
- [Optional] Ask the students to read the rest of the worksheet and then create a “Wanted” poster for carbon (Master of Disguise) that shows at least two of the different forms it can take.

3. Main activity: Building Models

- Using a commercial molecular modelling set or an improvised system (e.g., cocktail sticks and plasticine balls for diamond, rolled chicken wire for nanotubes, etc.) ask small groups of students to each create a different allotrope of carbon.

4. Plenary

- Watch the Oxford Sparks animation. This shows a way scientists are using graphene to perform cutting edge research.

Weblinks

- <https://isotropic.org/polyhedra/>
A page of different paper nets to make polyherdra, includes the truncated icosahedron or C₆₀ shape.
- Oxford Sparks ‘How does electricity flow through small objects’ animation
<https://youtu.be/wF13tGlrzA8>