



Sujets baccalauréat 2016

Langue anglaise

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Site web : <http://physique-chimie.ac-dijon.fr/spip.php?article131>

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De Broglie's Waves

“[...] If these waves represented some kind of physical reality, they should also accompany particles moving freely through space, in which case their existence or non-existence could be checked by direct experiment. In fact, if the motion of electrons is always guided by de Broglie's waves, a beam of electrons under proper conditions should show diffraction phenomena similar to those characteristic of beams of light.

Electron beams accelerated by voltages of several kilovolts (which are commonly used in laboratory experiments) should, according to de Broglie's formula, be accompanied by pilot waves of about 10^{-10} m wavelength, which is comparable to the wavelength of ordinary X-rays. This wavelength is too short to show diffraction in ordinary optical instruments and should be studied with the technique of X-ray spectroscopy. [...]

In the experiments, a characteristic diffraction pattern appeared on the screen and the diffraction bands widened or narrowed when the speed of the electrons was increased or decreased. The measured wavelength coincided exactly in all cases with that given by the de Broglie's formula. Thus the de Broglie's waves became an indisputable physical reality, although nobody understood what they were.”

taken and adapted from the book: ***Thirty Years that Shook Physics*** by George GAMOW © 1966
Dover Ed p. 82-85

Vocabulary:

beams of light : faisceaux lumineux
diffraction pattern: figure de diffraction
to widen: s'élargir
to narrow: rétrécir

Questions:

1. What is this text about? *Be clear and specific*
2. Why is it that: “This wavelength is too short to show diffraction in ordinary optical instruments”? (lines 11-12)
3. Explain: “the diffraction bands widened or narrowed when the speed of the electrons was increased or decreased”. (lines 15-16)

Hint: de Broglie's formula is: $\lambda = \frac{h}{p}$

where h = Planck's constant and p = momentum (quantité de mouvement).

4. Present other waves and their use in everyday life.

LIMONENE

Limonene, a naturally occurring hydrocarbon is commonly found in lemon and oranges. Limonene constitutes 98% of the essential oil obtained from orange peel. The main component of orange oil is limonene (A) which has a very weak smell. The fresh smell of fresh orange juice and of oil squeezed from the peel is attributed largely to aldehydes such as octanal.

- 5 Most naturally occurring chiral compounds are found as a single optical isomer only. However, limonene is an exception and both enantiomers are produced in nature; they have identical chemical properties but different biological effects. Limonene (A) is the isomer that is found in orange peels. Limonene (B) has a lemon-like aroma. Limonene has been used as a food additive for many years. Aside from the food industry limonene has a variety of uses.

- 10 At room temperature, limonene is a liquid and has proven to be a good solvent. It has an affinity for petroleum-based greases and it has been used as an industrial cleaner. One advantage is that limonene is not toxic and is replacing the use of solvents like ketones and CFCs. Limonene also has the advantage of being biodegradable and can rapidly break down into carbon dioxide and water. Another benefit of limonene is that it is obtained from a renewable resource. A by-product of the citrus juicing process is the oil found in the peel of the fruit. Limonene can be distilled from this oil.

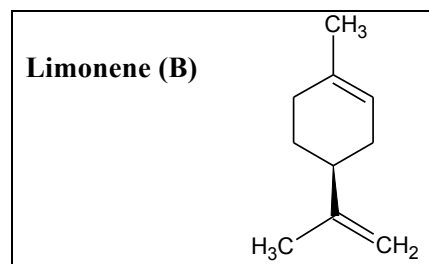
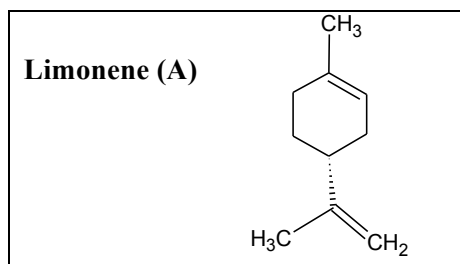
- 15 The popularity of limonene-based cleaners is growing and it can now be found in many domestic products such as Mr Muscle Orange Action. An Australian company, Orange Power, seeks to make all its products from natural, and locally-produced sources.

Adapted from <http://www.chm.bris.ac.uk/motm/limonene/limoneneh.htm> and <http://www.chm.bris.ac.uk/motm/octanal/octanalh.htm>

Vocabulary *citrus*: agrumes *peel*: écorce

by-product: sous produit, résidu

1/
and sum



Present
up the

document in your own words.

- 2/ Explain how limonene can be obtained.
- 3/ What are the two main industrial applications of limonene?
- 4/ What are enantiomers? Compare their characteristics and properties.
- 5/ Define what aldehydes and ketones are.
- 6/ Highlight the advantages of limonene over petroleum products. Do you think that limonene has a future in terms of sustainable development?

Chiral molecules

5 Just as gloves and hands come in mirror-image pairs (a left and a right), many molecules can exist in 'left-' and 'right-handed' forms. This property of handedness is called chirality, and most biological molecules are chiral. Surprisingly, all living organisms contain almost only 'left-handed' amino-acids and 'right-handed' sugars. This exclusive one-handedness has the important consequence that proteins and DNA are chiral, and that the biological and pharmaceutical activity of many molecules is often directly related to their chirality.

10 In many pharmacologically active drug molecules, chirality is crucially important. Examples of well-known chiral drugs are for instance ibuprofen, the anticoagulant warfarin, and several antibiotics, to name but a few. Often the biological activity of the drug is related to its handedness. One form may be helpful, the other may be inactive or even toxic. Examples are: only one form of dopamine is effective in the management of Parkinson's disease, the other causes granulocytopenia (reduction in white blood cells), or one form of thalidomide alleviates morning sickness*, whereas the other form may cause birth defects. Therefore it is absolutely crucial to be able to identify the correct form of the chiral molecule if it is to be used as a drug.

15 Today, most new drugs and those under development are chiral. In its 2002 cover story "*Chiral Roundup*", Chemical & Engineering News reports that in 2000 the chiral drugs market is worth \$ 133 billion. Due to new guidelines* from several agencies, the development of single enantiomer (only one of the two mirror-image forms) chiral products are a major priority. This in turn requires technological developments in the synthesis, separation and detection of chiral molecules. Our
20 research addresses all three areas. Among others, we are developing physical techniques for the synthesis and separation of single enantiomers, and we are developing new optical devices that are sensitive enough to distinguish between the two mirror-image forms of a chiral molecule.

Extract from <http://www.rowland.harvard.edu> website

Vocabulary :

to alleviate morning sickness (l.13) : soulager les nausées des femmes enceintes

guidelines (l.18) : recommandations

Questions :

1) Present the document and sum it up in your own words.

2) Explain: "*Often the biological activity of the drug is related to its handedness*" (l. 9-10).

3) Explain why butan-2-ol is a chiral molecule? Write down the two enantiomers.

4) What's your opinion on the use of chemistry in Industry?