

# TPC : Liquid - liquid extraction

## I. Miscible or immiscible liquids ?

### Experiment 1

- Pour 2 mL of ethanol into a test tube.
- Add approximately 2 mL of aqueous solution of copper sulphate.
- Seal the tube. Shake.
- Let the mixture settle for a few moments.

Make a captioned plan of the settled test tube and write down your observations.



Conclusion :

When we mix two liquids and the resulting mixture is ..... (a single phase), we say that both liquids are .....

### Experiment 2 **under the basket**

- Pour 2 mL of aqueous solution of copper sulphate into a test tube.
- **Under the extractor hood**, add approximately 2 mL of cyclohexane.
- Seal the tube. Shake.
- Let the mixture settle for a few moments.

Make a captioned plan of the settled test tube and write down your observations.



Conclusion :

When we mix two liquids and the resulting mixture is ..... (two phases), we say that both liquids are .....

## II. Notion of density

### 1. Definition

The density is noted  $\rho$  (Greek letter rhô). It is equal to the ratio of the mass of one sample by its volume.

$$\rho = \frac{m_{\text{échantillon}}}{V_{\text{échantillon}}}$$

$m$  : mass of the sample (g)     $V$  : volume of the sample ( $\text{cm}^3$  ou L)

$\rho$  : density ( $\text{g} \cdot \text{cm}^{-3}$  ou  $\text{g} \cdot \text{L}^{-1}$ )

We determine the mass of a sample of a chemical species from the density of this species and the volume occupied by the sample

$$m = \rho \times V$$

## 2. Applications

### Experiment 3

- Place the empty graduated cylinder on the balance and make the tare weight.
- Measure 50 mL of water.
- Write down its mass  $m_{\text{water}} = \dots\dots\dots$

Calculation of the water density :

### Experiment 4

- Place the empty graduated cylinder on the balance and make the tare weight.
- Measure 50 mL of oil.
- Write down its mass  $m_{\text{oil}} = \dots\dots\dots$

Calculation of the oil density :

## III. Notion of relative density

### 1. Definition

Relative density is the ratio of the density of a substance to the density of a given reference material. Specific gravity usually means relative density with respect to water.

$$d_{\text{substance}} = \frac{\rho_{\text{substance}}}{\rho_{\text{water}}}$$

Densities must be expressed with the same units. So the relative density has no unit.

Calculate the relative density of water.

Calculate the relative density of oil.

We give for the cyclohexane  $d_{\text{cyclohexane}} = 0,78$ . Calculate its density.

## 2. Applications

### Experiment 5

- Pour 4 mL of oil into a test tube then add 2 mL of water.
- Shake slightly. Let settle.

Captioned plan (after settling)



Both solutions were poured, which one possesses the biggest mass? .....  
Which substance corresponds to the the superior phase or the lower phase? .....

### Experiment 6

- Pour 2 mL of oil into a test tube then add 4 mL of water.
- Shake slightly. Let settle.

Captioned plan (after settling)



Both solutions were poured, which one possesses the biggest mass? .....  
Which substance corresponds to the superior phase or the lower phase? .....  
.....

Does the mass of a liquid play a role on its location in a mixture of two immiscible liquids? .....

**When we mix two immiscible liquids, the one with the ..... relative density corresponds to the ..... phase.**

## IV. Notion of solubility

### Experiment 7 : teacher

- Pour some crystals of diiodine  $I_2$  into a test tube.
- Add 5 mL of cyclohexane. Shake.
- Note your observations.

### Experiment 8 : teacher

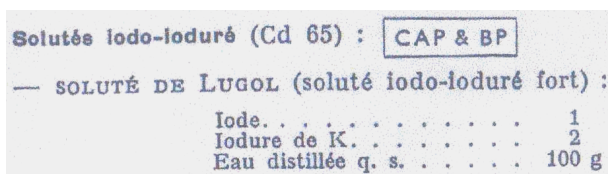
- Pour some crystals of diiodine  $I_2$  into a test tube.
- Add 5 mL of water. Shake.
- Note your observations.

Conclusion : in which solvent does the diiodine dissolve better?.....  
Is it in agreement with the reported solubility of the diiodine at  $25^\circ\text{C}$ ? .....

Solubility of diiodine at $25^\circ\text{C}$ ( $\text{g.L}^{-1}$ )	
Water	Cyclohexane
0.34	28

## V. Extraction of diode

Here is the label of a solution of Lugol sold in pharmacy.



What are the dissolved species in Lugol? What is the solvent? .....

### Experiment 9

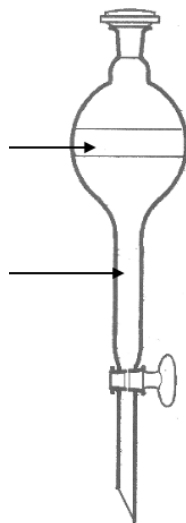
- With a graduated cylinder, take 10 mL of aqueous solution of diode. Pour them into the separatory funnel.
- Under the extractor hood : take 10 mL of cyclohexane, add them in the separatory funnel to be settled.

Seal.

- Shake the mixture, flush out the separatory funnel regularly.
- Place the separatory funnel on its support. Let settle.

Make two captioned plans of the separatory funnel : (With the name of the chemical species in each phase, as well as their color).

Before agitation



After agitation

