



Chemistry and Industry for Teachers in European Schools

FORENSIC CHEMISTRY

Scenario of a lesson

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Education and Culture

Socrates
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CITIES (*Chemistry and Industry for Teachers in European Schools*) is a COMENIUS project that produces educational materials to help teachers to make their chemistry lessons more appealing by seeing the subject in the context of the chemical industry and their daily lives.

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- Czech Chemical Society, Prague, Czech Republic, <http://www.csch.cz/>
- Jagiellonian University, Kraków, Poland, http://www.chemia.uj.edu.pl/index_en.html
- Hochschule Fresenius, Idstein, Germany, <http://www.fh-fresenius.de>
- European Chemical Employers Group (ECEG), Brussels, Belgium, <http://www.eceg.org>
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- Newcastle-under-Lyme School, Staffordshire, United Kingdom
- Masaryk Secondary School of Chemistry, Prague, Czech Republic
- Astyle linguistic competence, Vienna, Austria
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This project has been funded with support from the European Commission. The present publication reflects the views only of the author/s, and the Commission cannot be held responsible for any use which may be made of the information contained therein. The CITIES team advises that everybody using the experimental material of CITIES is familiar and does comply with the appropriate safety rules that are part of a proper professional conduct and of the respective national and institutional regulations. CITIES cannot be held responsible for any damage resulting from inappropriate use of the procedures.



INTRODUCTION

This paper presents a class scenario of a lesson showing the application of chemistry in criminology. We propose using the active teaching/learning method known as "jigsaw". This material contains:

- the description of the "jigsaw" method,
- the lesson concerning forensic chemistry,
- worksheets and instructions for students.

“JIGSAW” - DESCRIPTION OF A METHOD

The “jigsaw” method, also known as the class-puzzle method, the expert group method or the peer teaching method, requires participation of all pupils and cooperation of all the participants.

In the “jigsaw” method, the pupils perform a double role: one as learner and the other as teacher. They have to be informed about it before the work begins.

Preparation

It is necessary to divide the teaching material into five or six sub-sections for the pupils. The class must be divided into the same number of expert groups.

Stage 1

Each group receives a different theoretical or practical task to perform. The tasks of individual groups constitute elements of a certain entirety determined by the topic of the class. By performing a task (experimental, related with literature), each pupil has to internalise a new portion of knowledge in order to transfer it to another group of pupils. Making notes is helpful in this process.

Stage 2

The pupils form new groups according to the outline below; each new group has a representative from each of the previous expert groups. They present the previously acquired “portion of knowledge” to their friends. The pupils complement and put the new information in order. The teacher encourages them to put questions to the experts.

Division outline

	Group1	Group 2	Group 3	Group 4	Group 5	Group 6
Stage 1,3	1a,1b,1c, 1d,1e,1f	2a,2b,2c, 2d,2e,2f	3a,3b,3c, 3d,3e,3f	4a,4b,4c, 4d,4e,4f	5a,5b,5c, 5d,5e,5f	6a,6b,6c, 6d,6e,6f
Stage 2	1a,2a,3a, 4a,5a,6a	1b,2b,3b, 4b,5b,6b	1c,2c,3c, 4c,5c,6c	1d,2d,3d, 4d,5d,6d	1e,2e,3e, 4e,5e,6e	1f,2f,3f, 4f,5f,6f

Stage 3

The pupils return to their original groups and compare the complete knowledge acquired at the previous stage. The teacher may stimulate this type of activity by preparing a new problem which can be solved with the use of full information, e.g. preparation of a conceptual map on the subject under discussion.

Each pupil is an expert in his/ her "portion of knowledge"; in order to find out more, he / she has to enlist the help of others.

The success of this method is determined mainly by the teacher's work. The classes must be prepared in a precise manner.

USE OF "JIGSAW" METHOD IN THE FORENSIC CHEMISTRY LESSON

Stage 1

Tasks for the groups:

- (a) Theoretical task - electrophoresis
- (b) Experimental task - Making blood visible - using luminol
- (c) Experimental task - Making fingerprints visible - using powders for detection
- (d) Experimental task - Making fingerprints visible - using iodine or silver nitrate
- (e) Experimental task - Making fingerprints visible - using cyanoacrylate
- (f) Experimental task - Securing and reproducing shoe-, foot- and vehicle traces

Stage 3

Tasks for the groups - the information obtained in the first stages should be put on the poster scheme (plan of a house with garden) by adjusting a method to the examined trace and describing it (experiment scheme).

Homework

Write a short crime story in which one of above-listed methods will be used to detect an offender.

Comments

A teacher will decide which experiments from the given list she/he prefers to offer to particular group of students (experimental tasks b-f). Instructions for the experiments can be found in the file "Forensic Chemistry - Chase the Criminals with Chemistry - Simple Experiments for Chemistry Lessons" (on the CITIES project website) It depends on: laboratory conditions, timescale, students' skills and knowledge etc. According to these, the story/poster scheme should be changed by a teacher.

Instruction for pupils/students

You attend a course for detectives. You have to get to know as many methods as possible so as to be able to analyze the traces left at the crime scene. You will work together using the "jigsaw" method. In the last stage (3) you have to decide which method of detection is the best to examine particular traces at the crime scene and describe them in a table.

THEORETICAL TASK - ELECTROPHORESIS

Introduction

Electrophoresis is a well known technique for the separation and isolation of particles. Molecules of different compounds migrate at different speeds in an electric field. This feature, called the electrophoretic mobility is approximately direct proportional to a molecule's charge of and inversely proportional to its size. Notice that the shape of a molecule may also influence its electrophoretic mobility.

There are many variants of this technique. Depending on the medium in which the separation is performed, the electrophoresis may be divided into paper, gel and capillary electrophoresis.

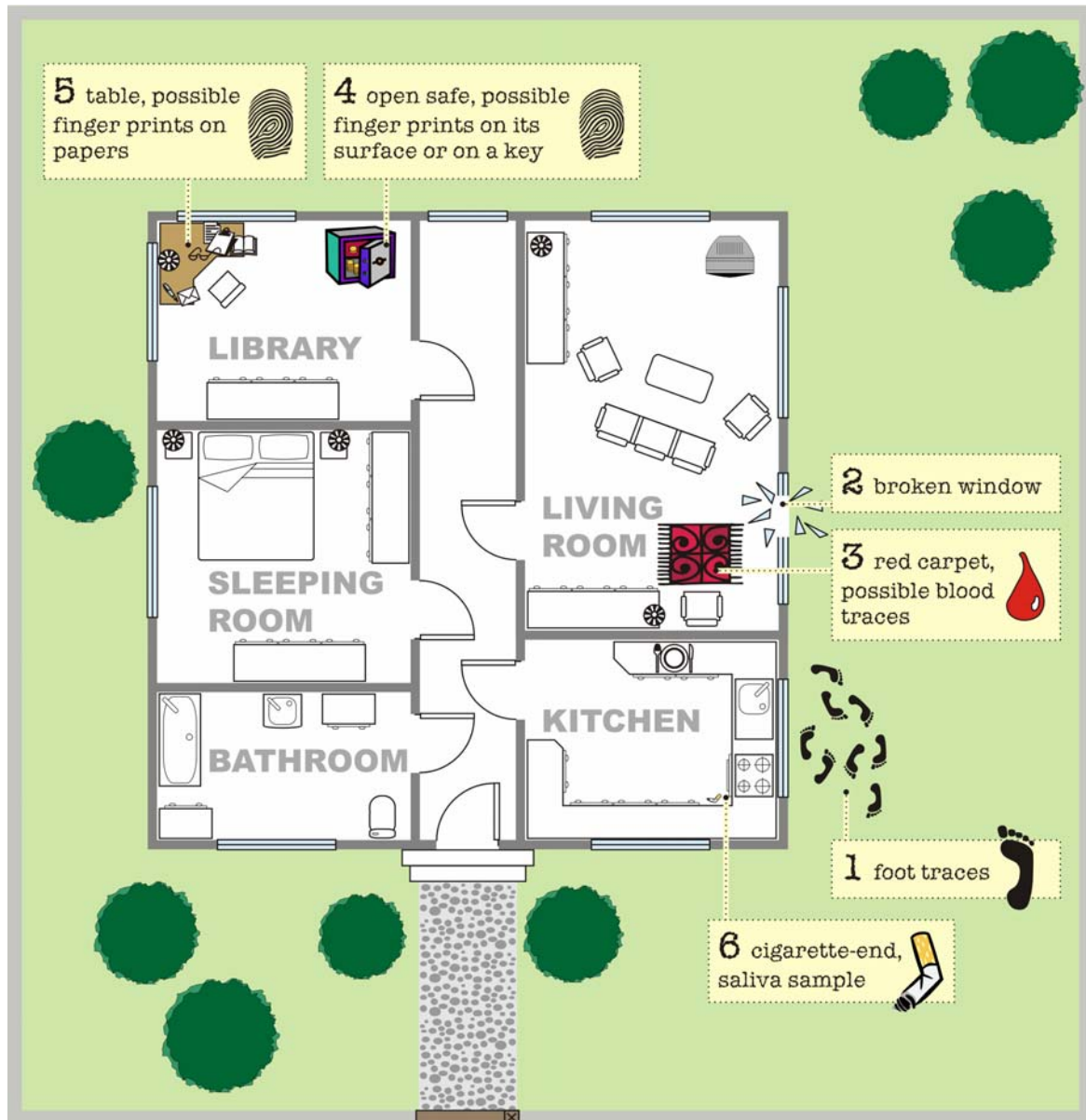
The DNA sequence identifying a person (his/her genetic code) may be analyzed by means of electrophoresis. The DNA sample is put on a glass plate covered with a thin layer of gel, close to an edge. The negative pole is connected to the sampling edge and the positive pole to the opposite one. A low DC voltage is then switched on. The DNA particles migrate in the starch gel (or silica) to the positive pole at different speeds. It is possible to perform the comparative research when two or more samples of biological material (such as blood, sweat, saliva etc.) discovered at the crime scene and collected from a suspect (or some other involved person) are analyzed simultaneously.

Animation 1 – principle of electrophoretic separation

Animation 2 – electrophoretic interaction

These animations can be downloaded from the CITIES project website. They are a part of MSc thesis of Artur Strzelecki & Magdalena Słoboda, Analytical Chemistry Department, Faculty of Chemistry, Jagiellonian University (2005).

WORKSHEET - CRIME SCENE



Graphical work by Agnieszka Węgrzyn.

WORKSHEET – METHODS OF INVESTIGATION

Kind of traces	Method of investigation	Description of a method (scheme, chemical equation)
Food traces	Gypsum (plaster)	
Blood	Luminol	
Saliva	Electrophoresis (DNA identification)	
Fingerprints on large surface	Powder	
Fingerprints on small objects	Cyanoacrylate	
Fingerprints on paper	Iodine	
	Silver nitrate	



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