TEACHER REFERENCE PAGES—CAFFEINE DISCOVERY LAB

PRELAB SCENARIO

The following scenario can be used to introduce the laboratory experience to the class one or two days prior to the visitation:

It was a cold and stormy night. Linda Lipton, heiress to the Lipton millions, was discovered dead in the library of her Bel-Aire mansion. Police went to the mansion after neighbors alerted them to the fact that Ms. Lipton's Persian cat was meowing mournfully, in spite of their continuing attempts to quiet her. The police entered the mansion through the first floor atrium door which was ajar. They found the deceased on the floor of the library. She appeared to have collapsed just as she was removing a Merck Index from the library shelf. A teapot containing just a spot of tea was left on a tray on the desk along with an empty tea cup. Beside the cup was the book she had apparently been reading, Chemistry by Chang. Police suspect foul play since numerous family members stand to profit from her demise.

The autopsy showed the cause of death to be an overdose of caffeine. The family insists that the deceased had a penchant for strong tea and that she died of an accidental overdose—too many tea bags for her own good.

The D.A.'s office is tired of trying cases it cannot win, so as forensic chemists your buns are on the line. You must determine if it is feasible that she could have accidentally overdosed on tea. That is, just how many tea bags would it take to do her in? You must use the information on the accompanying MSDS sheet to help you come to your conclusion, as well as a technique you will learn to extract caffeine from tea. You could be called as an expert witness in the upcoming coroner's inquest, so be sure to justify your conclusions.

The teacher will need to explain the use of an MSDS sheet and the information it provides, particularly what LD₅₀ means. Students should discuss within their lab groups how they could come up with an LD₅₀ for humans given the available information. They will also need to determine if the tea bags could deliver the lethal dose and find the amount of caffeine in one tea bag. Allow the students time to come up with the questions they need to answer before they will be able to reach a conclusion.

The teacher should then explain the laboratory procedure for the caffeine lab from a qualitative prospective, asking the students to decide what measurements they will have to make to reach their conclusion. In other words, the students construct their own data sheets.
POST LAB QUESTIONS / EXTENSION ACTIVITIES

1. Prepare a report addressing the feasibility of whether Ms. Lipton could have died from an overdose from the caffeine contained in the tea bags found in her pantry.

2. The bark of a certain species of yew tree contains a chemical which has been found effective in the treatment of uterine cancer. Outline the chemical processes that would need to be carried out to obtain the pure chemical from the bark. Explain which physical properties of substances in the bark would need to be considered in devising your reaction scheme.

3. Design an experiment to extract pure nicotine from a cigarette based on the knowledge you gained by doing the caffeine lab.

4. Using information obtained from your local pharmacy decide which of the following would be a better "waker-upper", No-Doz or two Excedrin. Explain your answer.

ADDITIONAL TEACHER INFORMATION

LD$_{50}$ for nicotine is 230 mg/kg orally for a mouse.
LD$_{50}$ for caffeine is 192 mg/kg orally for a rat.

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