In Class Exercises (ICE) - 2/21/01

The use of morphine as an analgesic for the relief of postoperative pain is quite a recent development, although the recreational use of opiates (the family of drugs that morphine belongs to) has been traced back more than 5000 years[1].

Figure 1: Recognition guide for Roxanol™ from the Physicians' Desk Reference, 1999.

In 1834 the Scottish physician Dr. Alexander Wood perfected the technique of administering morphine via intravenous injection using a syringe. This method is still in common use today.

According to the Forensic Toxicology Drug Information Fact Sheet (2000) distributed by the Toxicology and Accident Research Laboratory of the Federal Aviation Administration, the half life of morphine in the body is approximately four hours. Morphine obeys the linear law of pharmacokinetics.

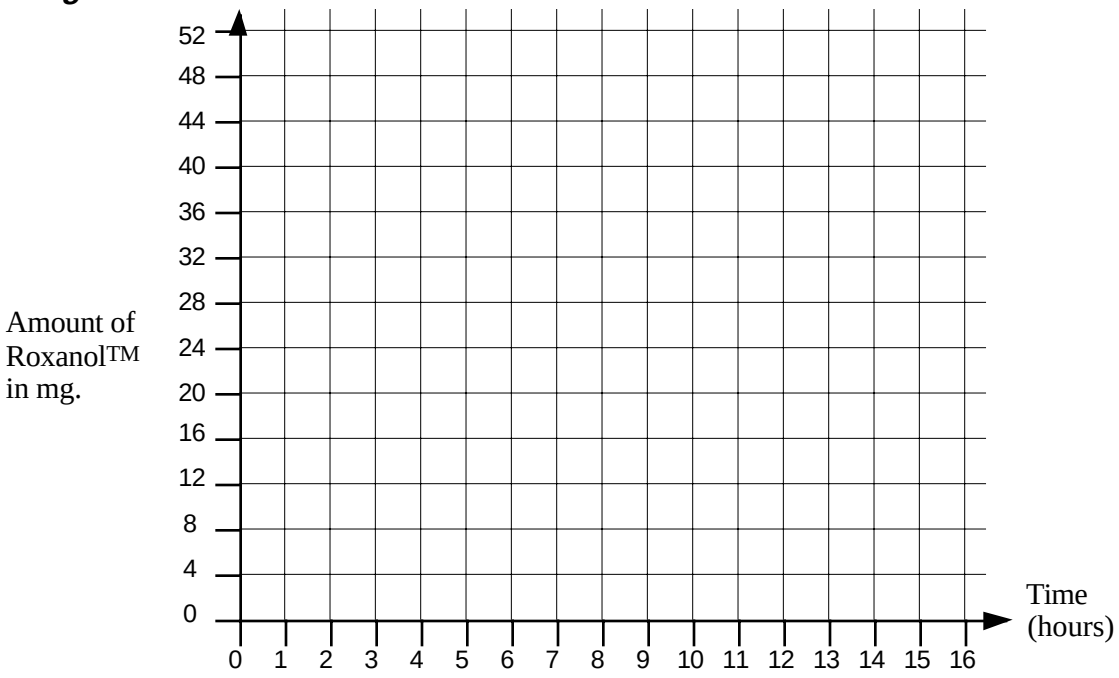
- ***Suppose that a patient is injected[2] with 1 ml of Roxanol® immediately after an operation. Find a formula for amount of Roxanol® in the patient's blood stream as a function of time.***

---

[1] Archaeological evidence suggests that the members of the Sumerian civilization deliberately cultivated opium poppies in southern Mesopotamia at around 3400 BCE (Source: www.pbs.org)

[2] According to the Roxanol® Dosage and Administration Fact Sheet, 1999, the recommended dose is 10 to 30 mg every four hours, depending on the patient's response to the drug. Source: Roxane Laboratories, Inc.

- ***Suppose that this dose is repeated every four hours. Sketch a graph showing how the amount of Roxanol® in the patient's bloodstream changes with time.***



- ***For each four-hour time period shown on your graph, find a formula that gives amount of Roxanol® as a function of time.***

- ***The minimum lethal concentration[3] of morphine in the blood is between 5mg/100ml and 40 mg/100ml. How long does it take before the levels of morphine in the patient's blood could reach dangerous levels? (Assume that the patient has 4700 ml of blood[4].)***

[3] Forensic Toxicology Drug Information Sheet (2000). Distributed by the Toxicology and Accident Research Laboratory, Federal Aviation Administration, Office of Aviation Medicine.
[4] Source: World Book Encyclopedia (1998 Edition).