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KÉMIA IDEGEN NYELVEN

Kémia angolul

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Kedves Diákok!

Valószínűleg mindenki, aki érdeklődik a kémia és általában a természettudományok iránt, elképzelte már, hogy egy bűnügyi laborban tevékenykedik. A következő szöveg egy kémiai CSI – igaz, műszerek nélkül. A szöveg egy amerikai diákoknak készült könyvből származik, ezért egyes jelölések, anyagok furcsának tűnhetnek. Jó munkát kívánok!

A lefordított anyagokat 2019. január 14-ig küldjétek be a **http://kokel.mke.org.hu** weblapon keresztül!

Metals: Product Liability

… a lawyer calls you with a problem. He has a client who baked a loaf of whole-wheat bread. As the family was eating it for supper, they complained of hard bits and pieces in it; the client even broke her tooth biting down on one of the pieces. Examining the bread and flour, they found a number of what appeared to be metallic particles. Already, family members had swallowed some of these particles, and now they were worried more about poisoning than about the broken tooth.

The client called the lawyer intending to sue Happy Miller, the company that made and sold what seemed to be contaminated flour. The lawyer wants you to analyze these particles. If indeed they are metallic, could they have come from the machinery used to produce the flour? If so, shouldn't Happy Miller recall all its whole-wheat flour

packages? Or did the client purposely add some contaminant to the flour to extort money from Happy Miller.

A few quick phone calls find that the grinding, separating, mixing, and filling equipment at the flour mill is made of high chrome stainless steel and brass.

The family seems ordinary enough. The client has had problems with her teeth – lots of fillings, with not all costs covered by dental insurance. Her husband is a welder at a local construction plant and is partially blind in his left eye.

Your task is to analyze the contaminating particles, determine what they are, and give an opinion as to where they come from and how they got into the flour.

Materials:	
metal standard samples: copper, magnesium, aluminum, lead, zinc, iron, nickel, chromium test tubes hand magnifier or stereoscope 10 ml beaker with 5ml bromofrom (keep under hood) magnet forceps 6 M sodium hydroxide (NaOH) 6 M nitric acid (HNO_3) 6 M hydrochloric acid (HCl) 6 M ammonium hydroxide (NH_4OH) 6 M acetic acid	0.1 M sodium sulfide (Na_2S) 0.1 M potassium chromate (K_2CrO_4) 0.1 M potassium thiocyanate (KSCN) 3% hydrogen peroxide S & O reagent aluminon reagent dimethyl glyoxime solution unkown samples of contaminating particles test tube rack safety goggles lab apron disposable gloves small beaker of alcohol
SAFETY ALERT! CHEMICALS USED	

Physical Tests

You must first determine the **physical properties** of these eight metals: copper (brass contains copper), magnesium, aluminum, lead, zinc (galvanized iron contains zinc), iron, nickel, and chromium (stainless steel contains iron and chromium). These test are the easiest and are non-destructive. Make sure to record your observations.

1. Observe a sample of each metal under magnification. Note their size, shape, color, and any other characteristics that may aid in the identification.
2. Test the metals to identify which are magnetic.

   Of these eight metal aluminum and magnesium are very light; there density is 2.70 and 1.74 g/cc. All the other metals are heavier,
   with densities greater than 7.00 g/cc. The density of liquid bromoform is 2.89 g/cc.
3. Test the density of your samples, using the bromoform under the hood. Use your forceps to retrieve the samples, then swish them around in the beaker of alcohol next to the bromoform to clean them of so that you can use them for further tests. Caution! Bromoform is toxic. Use it I well-ventilated place.
4. Lead is soft and malleable. Can you scratch it? Bend it?
5. Observe the physical properties of the unknowns.

Chemical Tests

6. Set up 16 test tubes in two rows in a test tube rack. Place one test tube in the third row. Add one piece of each known metals to the eight test tube s in the first row and one piece to each other of the test tubes in the second row. These will be your standards.
7. Add 1 ml of HNO_3 to one of each of the test tubes I the first row; note any reaction. Be patient; sometimes it takes longer for certain reactions to occur.
8. Add 1 ml of NaOH to the set of test tubes in row 2.

9. Add a sample of chromium and 1 ml HCl to the test tube in the third row.
10. If there appears to be different metal particles in your unknown sample, separate them and drop each into clean test tubes.
11. Repeat the tests performed on the standards on your unknowns. You may be pretty sure of what your samples are by now, but it is important, especially in forensic science, to be as sure as you can possibly be. After all, someone's life may depend upon it.

The confirmatory test listed in steps 12 through 19 are used to verify, or disprove, results. After you have narrowed the possibilities, pick the appropriate tests to identify the contaminating particles. Run a known standard if you are unsure of any outcome.

12. **In case of aluminium:** confirm it by adding 2 drops of aluminon reagent to the test tube containing your unknown sample in the NaOH, Mix and et it set for a while. Pink gel-like layer at the bottom of the test tube confirms the presence of aluminum.
13. **In case of copper:** add NH_4OH to the HNO_3 solution until you get a deep blue solution.
14. **In case of magnesium**: add one or two drops of S & O reagent to the sample in the HNO_3; then slowly add NaOH until you see the fluffy, blue precipitate or gel.
15. **In case of zinc:** add a few drops of sodium sulfide solution (Na_2S) to the metal in the HNO_3 and look for the yellowish or white precipitate.
16. **In case of iron:** dilute your acid solution 10 or more times with water until it is almost clear. Add a drop of potassium thiocyanate (KSCN) and note a brown-red or red color.
17. **In case of lead:** add an equal amount of acetic acid (HAc) to the nitric acid (HNO_3) solution. Do it in the hood, because HAc smells pretty bad – like very strong vinegar. Mix and add a few drops of bright yellow potassium chromate solution (K_2CrO_4) to get an orange precipitate.

18. **In case of nickel:** add twice the amount of NH_4OH to the acid solution and mix it, and add a few drops of dimethyl glyoxime reagent to form a red-violet precipitate.
19. **In case of chromium**: confirm it by noting what happened when you added the HCl to the chromium. Look for the same reaction and add several drops of H_2O_2. A momentary yellow color should appear.

Készült: Barbara Deslich – John Funkhouser: Forensic Sceince for High School, Kendall/ Hunt Publishing Company 2006 című könyvének (ISBN 0-7575-1825-7), Chapter 9 Trace Evidence fejezetének 197-201. oldalai alapján