WHAT DID THE TEST FIND?

STUDENT WORKSHEET

Many companies require a urine drug screen. Clinical laboratories hire chemists to run the samples through a liquid chromatograph-mass spectrometer, or LC-MS, for analysis. Today you will be given an unknown spectrum to identify.

Procedure

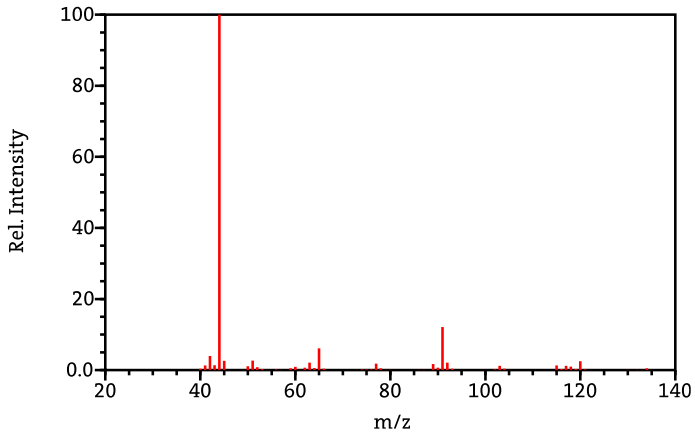
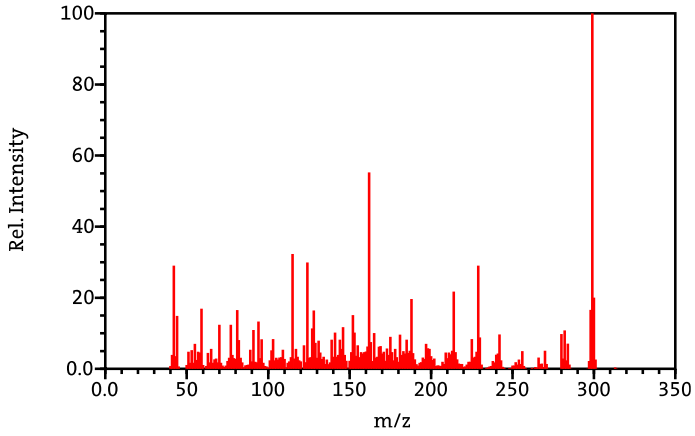
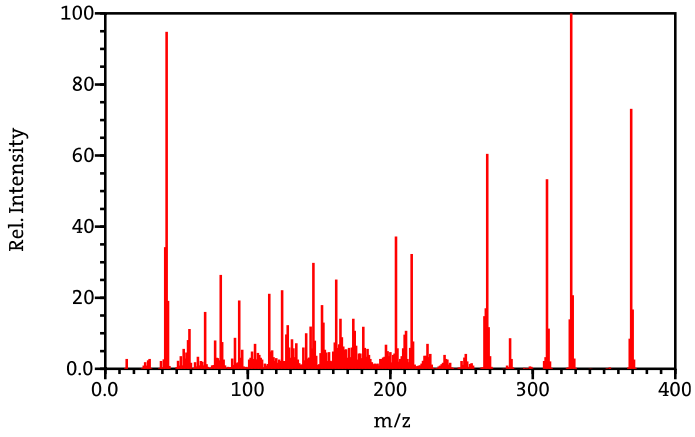
Unknown Chemical #: _____

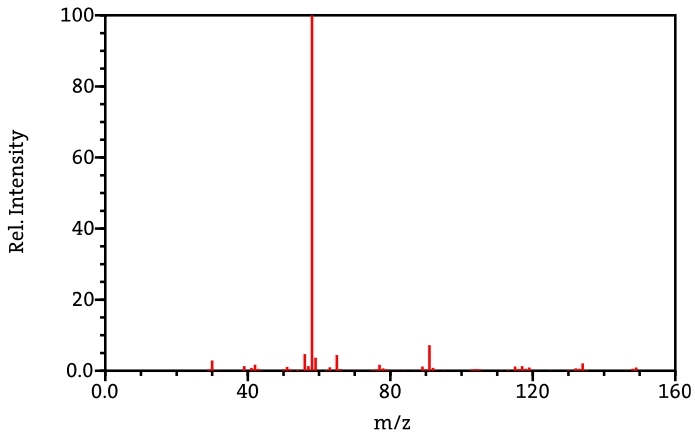
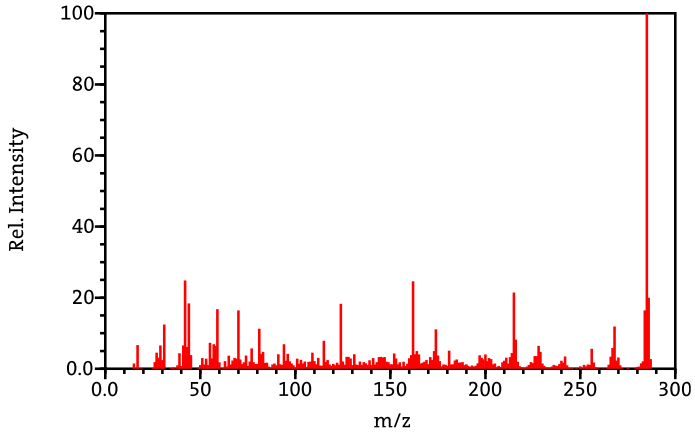
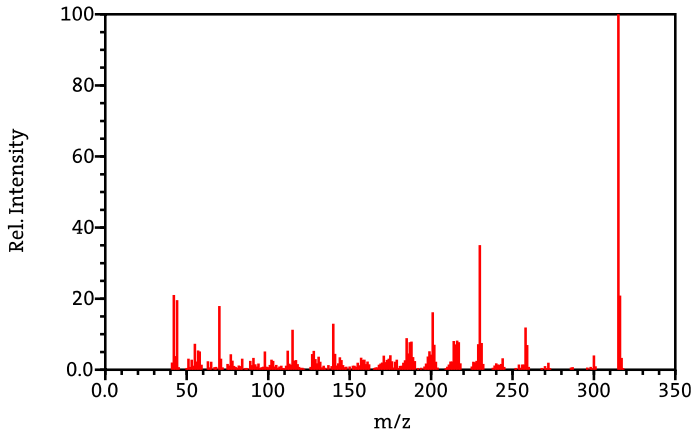
1. Which chemical do you think this is?
2. What do the numbers mean on the x-axis?
3. Why are the peaks at different heights?
4. What is the last peak on the right of the graph?

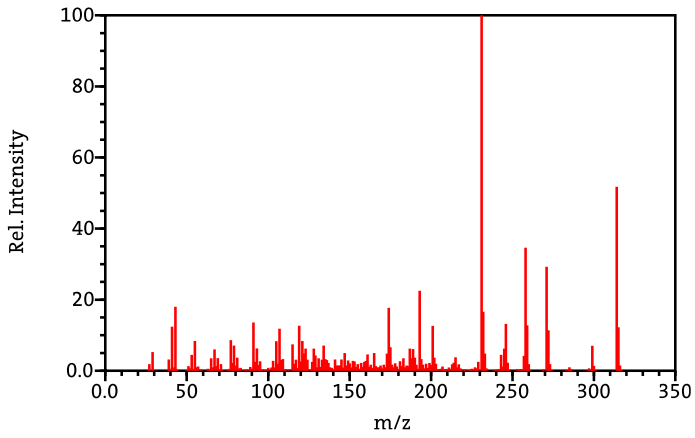
Discussion Questions

1. How do you calculate the atomic mass of the chemical you just identified?
2. What steps does a sample go through in the liquid chromatograph-mass spectrometer?

Known Chemicals

CHEMICAL NAME	CHEMICAL FORMULA	MASS SPECTRUM
Amphetamine	$C_9H_{13}N$	
Codeine	$C_{18}H_{21}NO_3$	
Diacetylmorphine (heroin)	$C_{21}H_{23}NO_5$	

Methamphetamine	$C_{10}H_{15}N$	
Morphine	$C_{17}H_{19}NO_3$	
Oxycodone	$C_{18}H_{21}NO_4$	

Tetrahydrocannabinol (marijuana)	$C_{21}H_{30}O_2$	

WHAT HAPPENS TO THE BODY?

STUDENT WORKSHEET

Once a body is discovered at a crime scene, it takes a fascinating journey before it is released for burial. Your task is to discover and report back to others what happens to the body along the way.

Procedure

Crime Scene Investigation

1. Read *A Guide to Death Scene Investigation* (*nij.gov/nij/topics/law-enforcement/investigations/crime-scene/guides/death-investigation*). Click on the links at the bottom of the page to answer the following questions:

    a. What is the first thing a death scene investigator should do upon arriving at the scene?

    b. What is the procedure for chain of custody?

    c. When evaluating the scene, what are at least 4 of the steps that should be done?

    d. What happens to the body when it is documented and evaluated?

2. Listen to *Science of Forensics* on NPR's *Talk of the Nation* (*npr.org/templates/rundowns/rundown.php?prgId=5&prgDate=9-7-2001*; click the RealPlayer icon next to the podcast title) and list 3 things forensic scientists must think of during an investigation:

    a. Thing #1:

b. Thing #2:

c. Thing #3:

Autopsy

3. Read the *Guidelines, Rules, and Statutes* of the North Carolina Office of the Chief Medical Examiner (*www.ocme.dhhs.nc.gov/rules/guidelines*) and answer the following questions:

   a. When does the state of North Carolina require an autopsy to be done on a body?

   b. Who conducts a required autopsy?

4. Read *How Autopsies Work* (*science.howstuffworks.com/autopsy4.htm*), from the external to the internal investigations of an autopsy.

   a. What happens in an external investigation?

   b. Where is the first cut on the body usually made?

   c. What happens to the internal organs?

   d. How is the head examined?

Virtual Autopsy

5. Read/watch 2 of the following articles/videos:
   - *Virtual Autopsy in Forensic Medicine* (*medical.siemens.com/siemens/it_IT/gg_ct_FBAs/files/CIP/Out_of_the_ordinary/Virtual_Autopsy_in_Forensic_Medicine.pdf*)
   - *Forensics Revolution: Virtual Autopsies Provide New Insights into Death* (*spiegel.de/international/europe/new-virtual-autopsy-procedure-is-changing-forensics-a-875657.html*)
   - *Virtual autopsy: does it spell the end of the scalpel?* (*guardian.co.uk/science/2013/feb/23/virtual-autopsy-virtopsy-forensic-science*)
   - *Die Zukunft heisst Virtopsy / The future is Virtopsy* (*www.virtopsy.com/movies*; scroll down to find the video and choose one of the English versions of the activity)

   a. What tests or scans may be conducted in a virtual autopsy?

   b. What are the benefits of virtual autopsy?

Religious & Cultural Considerations

6. Read 1 of the following articles:
   - *Religions and the Autopsy*

(*emedicine.medscape.com/article/1705993-overview#showall*)

- *Religious and Cultural Considerations for Autopsy* (*ohsu.edu/xd/health/services/doernbecher/research-education/research/pape-family-pediatric-research-institute/upload/Religious-and-Cultural-Considerations-for-Autopsy.pdf*)

a. Which religions and cultures do not favor autopsies?

b. How can a medical professional help ease concerns people might have about autopsies?

Virtual Autopsy Activity

7. Visit The Virtual Autopsy (*www.le.ac.uk/pathology/teach/va*) and choose a case. Review the data from the autopsy and try to diagnose the cause of death. Check to see if your cause of death was correct.

   a. Which case did you choose?

   b. What is your initial cause of death? (If you do not know the specific medical term, explain which part of the body causes concern.)

   c. Did you diagnose the case correctly?

   d. Which piece of information helped (or would have helped) the diagnosis?

WHAT ARE MY TEST RESULTS?

STUDENT WORKSHEET

Doctors often order medical tests to help diagnose a person's illness. The three main examinations that may be conducted for a urinalysis are physical examination, chemical examination and microscopic examination. In this activity, you will perform physical and chemical examinations of several different urine samples.

Procedure

Record all observations in the chart on the next page.

Physical Examination

1. Waft to detect if the sample has an odor.
2. Observe the color of the sample.
3. Observe the clarity of the sample.

Chemical Examination

4. Follow the instructions on the reagent strip bottle to test for common indicators.

	SAMPLE #___	SAMPLE #___	SAMPLE #___
Odor			
Color			
Clarity			
Ketones			
Glucose			
Protein			
Blood			

Discussion Questions

1. Which sample is normal? Why do the results indicate the identified sample is correct?

2. What do you think the other samples indicate?

3. Today you used the instructions for the reagent strip to test the urine samples. Please translate these instructions into common language and write a quality control checklist for the chemical reagent test strips.

4. Once the tests have been completed, it is very important for the results to be relayed to the doctor and patient. Please write the test results in an organized and concise fashion. Remember that the lab technicians relay the results but do not diagnose the illness.

Extension
Now that the results have been relayed to the doctor, pretend to be a physician. Use the medical dictionary or online sources to identify what illnesses are indicated by the test results.

WHAT IS A FALSE POSITIVE?

STUDENT WORKSHEET

Medical test results do not always provide a clear or accurate picture of a patient's medical condition. Consider this example: A patient receives a positive ELISA test, which is used to screen blood donations for HIV. For a couple weeks until her next doctor's appointment, the patient worries she is a carrier of HIV. However, once she goes back to the doctor and further tests are completed, the tests come back negative. The patient is shown to not be a carrier of HIV. Still, she wonders why and how she could have received the initial, positive test result.

Procedure

The sensitivity of the ELISA test is 97.7%. The specificity of the test is 92.6%. (Visit *amstat.org/publications/jse/v3n2/rossman.html* for more information.) Based on past data, 0.5% of the United States population carries HIV.

1. What are the terms for the 4 possible test results? Complete the following chart.

	Test result is positive	Test result is negative
Person actually has the disease		
Person does not actually have the disease		

2. What is sensitivity?

3. What does a sensitivity of 97.7% mean?

4. What is specificity?

5. What does a specificity of 92.6% mean?

6. In a sample population where 0.5% of people have HIV, how many people out of 100,000 have HIV? How many people out of 100,000 do not have HIV?

7. How many true positives will the test show?

8. How many false positives will the test show? If a person has a positive test result in this scenario, what is the chance it is a false positive?

9. How many true negatives will the test show?

10. How many false negatives will the test show?

11. In some parts of Africa, the prevalence of HIV is 10%. If the prevalence is 10%, how many people are infected? How many are not infected?

12. Calculate the number and percentage of true and false positives and negatives for a population where the prevalence is 10%.

Discussion Questions

1. What is the difference between a true positive and a false positive?

2. Explain the problem with the following statement: “A positive test result means the patient definitely has the disease.”

3. How are sensitivity and specificity different?