Key

Battle at Valley Forge Invitational

January 8th, 2011

Team Name: _____ Team Number: _____

Participant Names: _____

Forensics Answer Packet

All answers should go in this packet. Answers that are recorded elsewhere (such as the Information Packet) will not be considered. Write your answers as neatly as possible. Answers that cannot be read or understood will be marked as incorrect.

Part I Qualitative Analysis (20 points)

You are given samples of five (5) white powders. Use available methods to determine their identities and record your answers here. Either chemical names or correct formulas will be accepted.

1.) ____KCl_____

2.) ____$MgSO_4$_____

3.) ____Sucrose_____

4.) ____ $MgSO_4$_____

5.) _____$CaCO_3$_____

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Part II Polymers & Fibers (20 points)

You are given five (5) samples of polymers and fibers. Use available methods to determine heir identities and record your answers here. You may record polymer names using their appropriate 2-4 letter abbreviations but **not** by resin code numbers 1-7. Fibers may be burnt but polymers may not. Anyone seen burning the polymer samples will lose all credit form this part of the exam.

6.) __PS_____

7.) __PETE_____

8.) __HDPE_____

9.) __Synthetic (Polyester)_____

10.) __Human Hair_____

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Part III Chromatography/Spectroscopy (15 points)

You are given a sample of ink found at the crime scene. Use available methods to develop a paper chromatogram of this ink and determine the R_f value of each dye in the ink. Tape your paper chromatogram below and show the measurements and calculations that led to your R_f values. After that, look at the given mass spectrum and answer the related questions.

Paper Chromatogram Analysis:

I provided a precut piece of filter paper with a dot of purple washable marker on it. I used a Cayola purple. Whatever you use, make sure the R_f values DO NOT match those listed in Mikey "the Hammer"s description.

This section was worth 10 points. Correct development of the chromatogram with markings for the start line and solvent front were worth up to 6 and correct calculation of the R_fs were worth the other 4.

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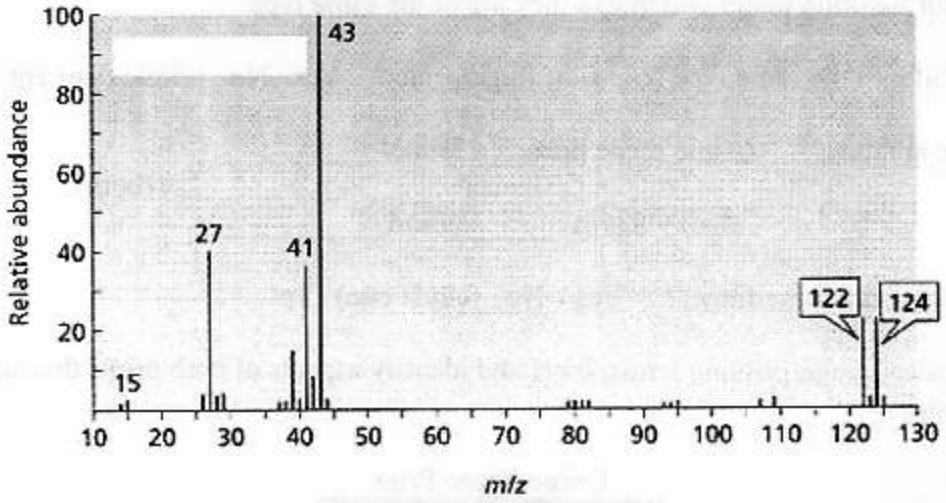
Mass Spectrum Analysis:

The mass spectrum below was taken of the liquid found at the crime scene



1.) What is the most likely molar mass of this chemical compound? ___123___(2pts)

2.) What is the m/z value of the base peak? _____43_____ (2pts)

3.)The pattern shown by the peaks at 122 and 124 point toward the presence of a specific element. What element is it? _____Br____(1pt)

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Part IV (a) Fingerprint Analysis (5 points)

Answer the questions below.

The first fingerprint below was found at the crime scene and the second was taken from the suspect Sharky. They have been brought to your attention because a young investigator working under you thinks they are of the same type.

Do they fall into the same type (class) of fingerprints? Yes No (circle one) 1pt

What type are they? Crime scene print: ___Whorl_____ 1pt (both)

Sharky's print: _____Whorl_____

Are they from the same finger? Yes No (circle one) 1pt

Using standard fingerprinting terms, label and identify aspects of both prints that support your decision.

Crime Scene Print

Sharky's Print

Up to two points for identifying and labeling differences between the prints such as differing islands, bifurcations, ridge endings, etc. Do not accept "lack of delta" in the second print because there is not enough of the print there to even see the delta.

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Part IV (b) Blood Spatter Analysis (10 points)

Two bloodstains were found at the crime scene in good shape. The map below depicts their relative positions. Enlargements of the stains are also included. From these pictures, determine the following:

1.) The point of convergence. Clearly label this on the map below and explain in the margin how you came to this conclusion.
2.) The angle of impact for each bloodstain. Calculate this in the space below the map and show all of your work. Circle your answers.
3.) The point of origin. Using bloodstain "A", calculate the height above the point of convergence from where the blood originated. Calculate this in the space below the map and show all of your work. Circle your answer.

I don't have a scanner or a good enough drawing program so I'm just going to explain it and you can recreate it however you'd like. The only thing is, the point (height) of origin must be about 50cm so that Sharky is implicated from the cut on his knee.

Each bloodstain should be a nice oval. I used two different stains so it would be as simple as possible. Lines drawn along the long axis of the stain should converge at a spot in the room that will be the POC or point of convergence.

The angle of impact is found by measuring the width and length of the oval and then solving for the angle.

$$AOI = \sin^{-1}(W/L)$$

The point of origin can then be found from either bloodstain. Where d = distance from the center of the stain to the point of convergence…

$$P \text{ of } O = \tan(AOI) \times (d)$$

Make sure bloodstain "A" gives the correct point of origin of around 50cm. I gave them a diagram of the room with the two bloodstains drawn in with a scale so they could calculate actual distances to the POC and then below an enlargement of each stain in order to measure their width and length for the AOI.

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Part V Analysis of the Crime (30 points)

Using data both from the Information Packet and analysis of the physical evidence provided, determine which suspects should be retained and which ones you can let go. For each suspect, justify your decision with a discussion of the crime scene and/or the physical evidence available.

Louie-

Calcium nitrate found on him was not found at the crime scene
PMMA found on him not found at the crime scene

RELEASE

Sharky-

Fingerprint found at the crime scene is not a match but....

Blood stain analysis shows that someone may have been wounded in the knee at the scene which implicates him

HOLD FOR QUESTIONING

Jimmy-

$MgSO_4$ found on him is a match to a powder found at the crime scene.

(award points for stating that cat hair was not found at the scene)

HOLD FOR QUESTIONING

Key

Mikey "the Hammer"-

Fiber found on him does not match the cotton material of the bathrobe.

Polycarbonate not found at the crime scene

Shoulder gash does not match the point of origin (height) of the bloodstain

Marker found in his pocket does not have the same R_fs as the note (chrom. Sample)

RELEASE (although he is a very popular choice)

Charlene-

HDPE found on her does not match any plastics found at the scene

$CaCO_3$ found on her may be from heartburn medication

Dog hair not found at the scene

RELEASE

List here any additional investigations you would undertake based on the evidence presented to you. In other words, what evidence has left some loose ends that need attention?

There are plenty of things that could be mentioned here. Blood typing Sharky to see if the bloodstain is from him, checking shoes for the liquid found in the shoeprint outside the door, fingerprinting the other suspects to see if someone matches the print found at the scene, taking hair samples to try and match to the one found at the scene, etc. Anything plausible that would actually accomplish something.