

Names: \_\_\_\_\_  
\_\_\_\_\_

Score: \_\_\_\_\_/131

School: \_\_\_\_\_

## Forensics SSSS Test

Qualitative Analysis: (36 pts)

1. Which of the following is/are basic?

sodium carbonate, calcium nitrate, sucrose, sodium acetate, calcium carbonate

\_\_\_\_\_

2. Write the chemical formulas of the above five (in order), as well as boric acid:

\_\_\_\_\_

3. Name these chemicals:  $\text{NaHCO}_3$ ,  $\text{MgSO}_4$ (common name),  $\text{CaSO}_4$ ,  $\text{NH}_4\text{Cl}$

\_\_\_\_\_

4. Write one major use for each chemical:

LiCl \_\_\_\_\_  $\text{MgSO}_4$  \_\_\_\_\_

Boric acid \_\_\_\_\_ Calcium carbonate \_\_\_\_\_

5. Which chemical (from question 4) is insoluble in water? \_\_\_\_\_

6. Fill in the blank: a) The HCl test is positive for chemicals containing \_\_\_\_\_

Name two chemicals that react with HCl: \_\_\_\_\_

b) Testing for iodine tests for chemicals containing \_\_\_\_\_

Name a compound that reacts with iodine: \_\_\_\_\_ What color does it turn? \_\_\_\_\_

Another compound that reacts with iodine?: \_\_\_\_\_ Color after reaction? \_\_\_\_\_

c) Why is testing for Benedict's solution useful? \_\_\_\_\_

What color does sucrose turn when heated with Benedict's? \_\_\_\_\_

What color does ammonium chloride turn when mixed with Benedict's? \_\_\_\_\_

7. Name the flame color:  $\text{NaHCO}_3$  \_\_\_\_\_

LiCl \_\_\_\_\_

KCl \_\_\_\_\_

Boric Acid \_\_\_\_\_

Plastics: (18 pts)

8. Name that plastic:

floats in water, floats in 40% isopropyl alcohol, sinks in vegetable oil, density  $.92 \text{ g/cm}^3$  : \_\_\_\_\_

sinks in water, floats in 10% NaCl, density  $1.05 \text{ g/cm}^3$ : \_\_\_\_\_

used in clear food packaging, shampoo, plumb, wire insulation: \_\_\_\_\_

used in Plexiglas, acrylic glass: \_\_\_\_\_

9. Draw the complete molecular structure of the following plastics

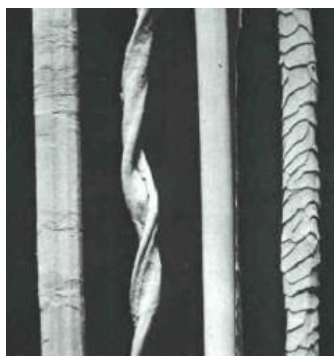
Low Density Polyethylene:

Polyvinyl Chloride:

Fibers and Hairs: (15 pts)

10. Name these fibers :

A B C D



A: \_\_\_\_\_

B: \_\_\_\_\_

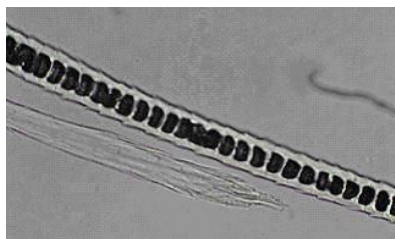
C: \_\_\_\_\_

D: \_\_\_\_\_

11. Which fibers self extinguish when burned? \_\_\_\_\_

Which fibers melt? \_\_\_\_\_

12. Name that hair:



\_\_\_\_\_

Which type of hair has an indistinct medulla? \_\_\_\_\_

What is the outer part of the hair called? \_\_\_\_\_

More Qualitative Analysis: (9 pts)

13. Name that chemical:

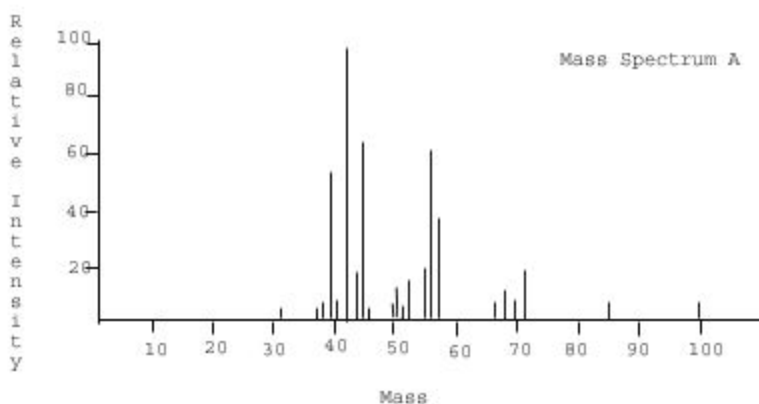
Soluble in water, nonconductive, blue litmus turns red: \_\_\_\_\_

Soluble in H<sub>2</sub>O, conductive, red litmus turns blue, turns yellow with iodine, no rxn w/  
HCl \_\_\_\_\_

Insoluble in water, conductive: \_\_\_\_\_

Mass Spectroscopy and Paper Chromatography: (9 pts)

14. Complete the equation:  $R_f =$

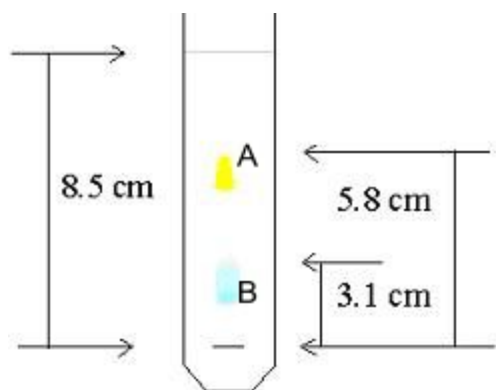


15. Refer to the above mass spectrum.

What is the base peak? LABEL it on the spectrum.

What is the molecular weight of the molecule? \_\_\_\_\_

What is the molecular weight of the most abundant piece(s)?: \_\_\_\_\_



16. Calculate the R<sub>f</sub> of ink B: \_\_\_\_\_

calculate the R<sub>f</sub> of the ink A: \_\_\_\_\_

17. What does TLC stand for?

More hairs: (3pts)

18. Label the following hairs:



A

B

C

A: \_\_\_\_\_ B: \_\_\_\_\_ C: \_\_\_\_\_

Fingerprints: (10 pts) Label the following:



19. \_\_\_\_\_

20. What does AFIS stand for? \_\_\_\_\_

21. List FOUR ways to develop fingerprints:

\_\_\_\_\_

22. How many ridges does the average adult have on one finger? \_\_\_\_\_

Entomology: (4 pts)

23. Typically the first type of insect to arrive at a death scene would be:

A. Beetle      B. Fly      C. Moth      D. Maggot

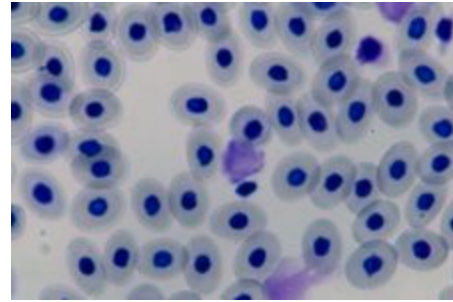
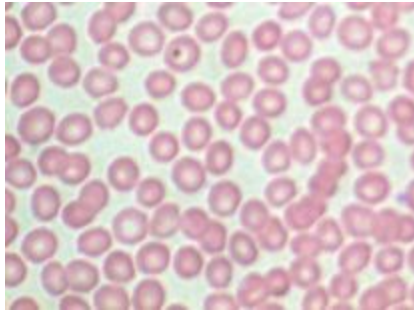
24. What does PMI stand for? \_\_\_\_\_

Blood: (10 pts)

25. Regarding Blood Type AB individuals, which of the following statements are TRUE? (Circle all that apply.)

- A. Possess both A and B Antigens
- B. Possess neither A or B Antigens
- C. Possess both A and B Antibodies
- D. Possess neither A nor B Antibodies

Identify the following as the blood of a human, avian, reptilian/amphibian, or another mammal




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Crime Scene Analysis: (17 pts)

Crime has struck the Science Olympiad! Last night, after the event supervisors had finished setting up their events for today, a break-in occurred. The crime was discovered early this morning when the tournament director arrived to open the building. It is your task to determine who committed this heinous crime before the competition begins. The evidence has already been collected and is provided as follows.

**Hand N. Cookijar**, the school cook, is bored with preparing meals for the Science Olympiad contestants, specially since it requires working on his day off. He especially dislikes baking the cakes for the Award Ceremonies because of the extra time required to scour his pots and pans.

**Robyn U. Blind**, the groundskeeper, is tired of cleaning up after the Science Olympiad contestants who tend to leave litter scattered about her well-fertilized, green lawn. The litter nearly fills the dumpster, leaving little space for the regular trash. She'd much prefer using her extra time sharpening lawn tools than cleaning up after students she believes should spend their Saturdays at home.

**A. Way Withit**, the team bus driver, is irritated that she must earn her extra income escorting the SO team to their Saturday competitions. She much prefers driving teams to athletic events where she sometimes volunteers to assist in timing events and also acts as medic for minor scratches and sore muscles. The early morning moisture condensing on windows encourages participants to scrawl messages on the bus windows requiring her to clean the windows with foul-smelling chemicals. To her, these adolescents are simply too loud, too rude and much too messy. Her irritability often results in severe cases of heartburn.

**Am I. Gilltie**, the school custodian, is tired of cleaning up after the Science Olympiad team. This extra-curricular activity always generates extra trash requiring him to make numerous trips to the dumpster. This extra effort frequently irritates his back. He is often upset at having to share his workspace with the groundskeeper, although both share a similar obsession for maintaining sharp tools.

The following evidence was found:

a) For each suspect, I have given every type of substance that was found both at the scene of the crime and on that person during an inspection.

Withit: Alka Seltzer for heartburn, Iron, Household Ammonia

Blind: Calcium Carbonate, Alka Seltzer, Iron, Aluminum

Cookijar: Iron, Household Ammonia

Gilltie: Aluminum, Household Ammonia, Rubbing Alcohol for back pain

b) Several drops of blood were discovered on a broken bottle at the scene of the crime:

Dna Evidence from blood point to: Blind

Fingerprints on bottle points to: Gilltie

c) A note was found expressing frustration over the extra effort resulting from Science Olympiad activities. Chromatogram analysis points to the pens used by Gilltie and Withit.

26. Instructions: Use the knowledge you have to explain who you think the suspect is and more importantly, make excuses for the three other suspects by explaining why the evidence against them was found at the scene (why a particular substance from evidence A, part of evidence B, or evidence C does not actually implicate a suspect because of something that is true for that particular suspect). Make sure to be specific.

Use bullets. Points will be awarded mostly for logical points, as opposed to guessing the criminal correctly. Use the back for extra space.

Also on back--BONUS (5 pts): write out your plan for identifying the chemicals (can be flowchart, paragraph, etc.)