

# Forensics SSSS Test ANSWERS Total:131

Qualitative Analysis: (36 pts)

1. Which of the following is/are basic?

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

5pts \_\_\_\_\_ **sodium acetate and sodium carbonate** \_\_\_\_\_

2. Write the chemical formulas of the above five, as well as boric acid:

5 pts: **Na<sub>2</sub>CO<sub>3</sub>, Ca(NO<sub>3</sub>)<sub>2</sub>, C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>, NaC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>, H<sub>3</sub>BO<sub>4</sub>**

3. Name these chemicals: NaHCO<sub>3</sub>, MgSO<sub>4</sub>(common name), CaSO<sub>4</sub>, NH<sub>4</sub>Cl

4pts: **Sodium Bicarbonate, Epsom salts, Calcium Sulfate, Ammonium Chloride**

4. Write one major use for each chemical: 4pts

LiCl \_\_\_\_\_ **bipolar disorder** \_\_\_\_\_ MgSO<sub>4</sub> \_\_\_\_\_ **treating sprains** \_\_\_\_\_

boric acid \_\_\_\_\_ **eye wash** \_\_\_\_\_ calcium carbonate \_\_\_\_\_ **diet supp, building** \_\_\_\_\_

5. Which substances (from above) is insoluble in water? 1 pt: \_\_\_\_\_ **CaCO<sub>3</sub>** \_\_\_\_\_

6. Fill in the blank: Testing for HCl tests for chemicals containing: 2 pt \_\_\_\_\_ **CO<sub>3</sub>, HCO<sub>3</sub>** \_\_\_\_\_

Name two chemicals that react with HCl: 2pts: **NaHCO<sub>3</sub>, Na<sub>2</sub>CO<sub>3</sub>, CaCO<sub>3</sub>**

Testing for iodine tests for chemicals containing \_\_\_\_\_ **starch** \_\_\_\_\_ 1pt

Name a compound that reacts with iodine: **cornstarch** What color does it turn? **blue-black** 2pts

Another compound that reacts with iodine?: **Na<sub>2</sub>CO<sub>3</sub>** Color after reaction? **clear** 2pts

Why is testing for Benedict's solution useful? \_\_\_\_\_ **separate glucose and sucrose** \_\_\_\_\_ 2pt

What color does sucrose turn when heated with Benedict's? \_\_\_\_\_ **red brown** \_\_\_\_\_ 1pt

What color does Ammonium Chloride turn when mixed w/ Benedict's? \_\_\_\_\_ **dark blue** \_\_\_\_\_ 1pt

7. Name the flame color: NaHCO<sub>3</sub> \_\_\_\_\_ **yellow** \_\_\_\_\_

LiCl \_\_\_\_\_ **red** \_\_\_\_\_

KCl \_\_\_\_\_ **purplish** \_\_\_\_\_

Boric Acid \_\_\_\_\_ **green** \_\_\_\_\_ 4pts total

Plastics:(18pts)

8. Name that plastic: floats in water,

floats in 40% isopropyl alcohol, sinks in vegetable oil, density .92: **LDPE** 3pts

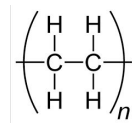
sinks in water, floats in 10% NaCl, density 1.05: **PS** 3pt

used in clear food packaging, shampoo, plumb, wire insulation: **PVC** 2pt

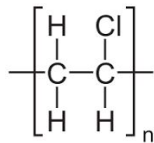
used in Plexiglas, acrylic glass: **PMMA** 2pt

9. Draw the complete molecular structure of the following plastics

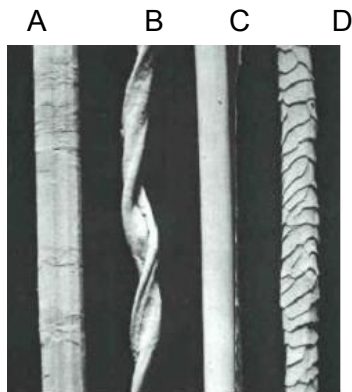
Low Density Polyethylene: 4pts



Polyvinyl Chloride: 4pts



Fibers and Hairs:(13 pts)



10. Name these fibers:

A: **linen**

B: **cotton**

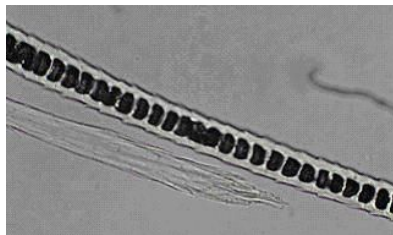
C: **polyester** (accept any man-made)\_

D: **wool** 4pts total

11. Which fibers self extinguish when burned? **Silk, wool** 2pts

Which fibers melt? **Nylon, Polyester, Spandex** 3pts

12. Name that hair:



\_\_\_CAT\_\_\_ 2 pts

Which type of hair has an indistinct medulla? \_\_\_BAT\_\_\_ 1pt

What is the outer part of the hair called? \_\_\_cuticle\_\_\_ 1pt

More Qualitative Analysis:(3pts)

13. Name that chemical: 1 pt each

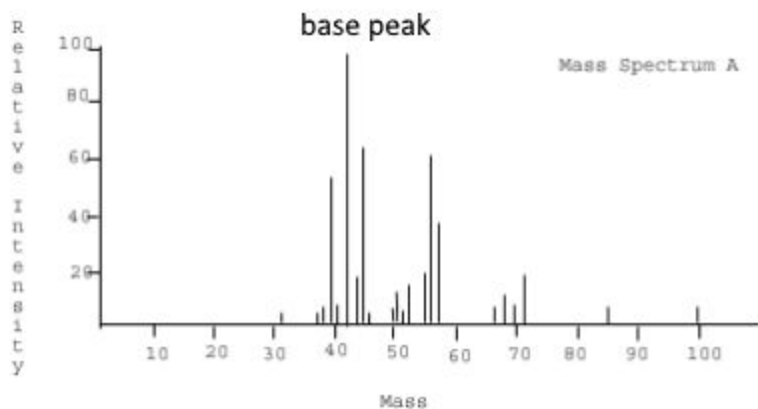
Soluble in water, nonconductive, blue litmus turns red: \_\_\_H3BO4\_\_\_

Soluble in H2O, conductive, red litmus turns blue, turns yellow with iodine, no rxn with HCl: **NaC2H3O2**

Insoluble in water, conductive: \_\_\_CaSO4\_\_\_

Mass Spectroscopy and Paper Chromatography: (9pts)

14. Complete the equation: **Rf = dist traveled by compound / dist traveled by solvent** 1pt

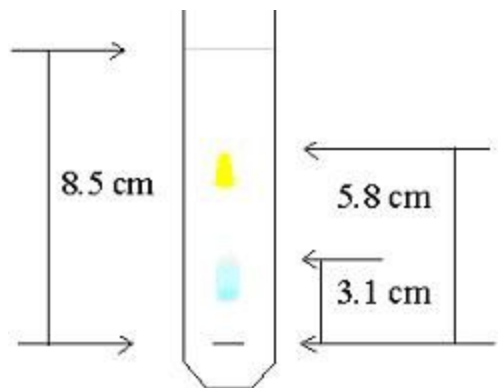


15. Refer to the above mass spectrum.

What is the base peak? LABEL it on the spectrum. 1pt

What is the molecular weight of the molecule? \_\_\_100\_\_\_ 2pts

What is the molecular weight of the most abundant piece(s)?: \_\_\_42 or 43\_\_\_ 2pt



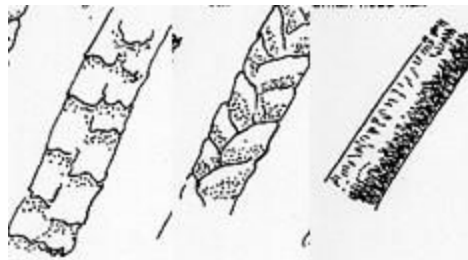
16. Calculate the Rf of the blue ink: .365 1pt

calculate the Rf of the yellow ink .682 1pt

17. What does TLC stand for? Thin Layer Chromatography 1pt

More hairs: (3 pt)

17. Label the following hairs:



A B C

A: dog B: cat C: human 3pts

Fingerprints (10 pts): Label the following N 4PTS



Accidental Tented Arch Double Loop Ulnar Loop

What does AFIS stand for? **Automated Fingerprint ID System** 1pt

List FOUR ways to develop fingerprints: **Dusting, Iodine Fuming, Ninhydrin, Cyanoacrylate fuming** 4pts

How many ridges does the average adult have on one finger? **150** 1pts

**Entomology (4 pts)**

1) Typically the first type of insect to arrive at a death scene would be: CIRCLE ONE 2pt

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

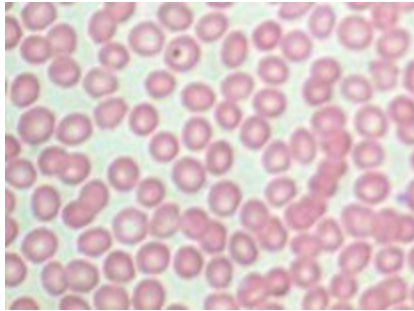
2) What does PMI stand for? **Post Mortem Interval** 2pt

Blood:(10 pt)

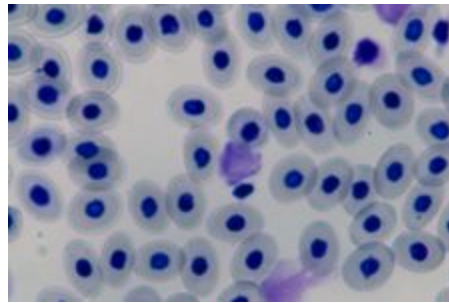
Regarding Blood Type AB individuals, which of the following statements are TRUE ? (4pts)

- 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 3pts each



\_\_\_\_\_ **human** \_\_\_\_\_



\_\_\_\_\_ **reptilian/amphibian** \_\_\_\_\_

Crime Scene Analysis:

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 Seltzar 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.

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. I will be awarding points mostly for logical points, as opposed to guessing the criminal correctly.

BONUS: write out your plan for identifying the chemicals (can be flowchart, paragraph)

- Withit: Alka Seltzar was for his heartburn (1), Iron was from the bus (1), Ammonia was to clean the bus(1)
- Blind: Calcium Carbonate-why? (1), Alka Seltzer-doesnt have heartburn (1), Iron-tools(1), Aluminum?(1)
  - blood points to Blind, cut himself(1)
  - fingerprints are Gilltie's cause he picks up trash (1)
- Cookijar: Iron from pots and pans(1), Household Ammonia-to clean up (1)
- Gilltie: Aluminum-dumpster (1), Ammonia-cleaning(1), Rubbing Alcohol for back pain (1), note? normal complaint (1)
- 2 pts for correct criminal