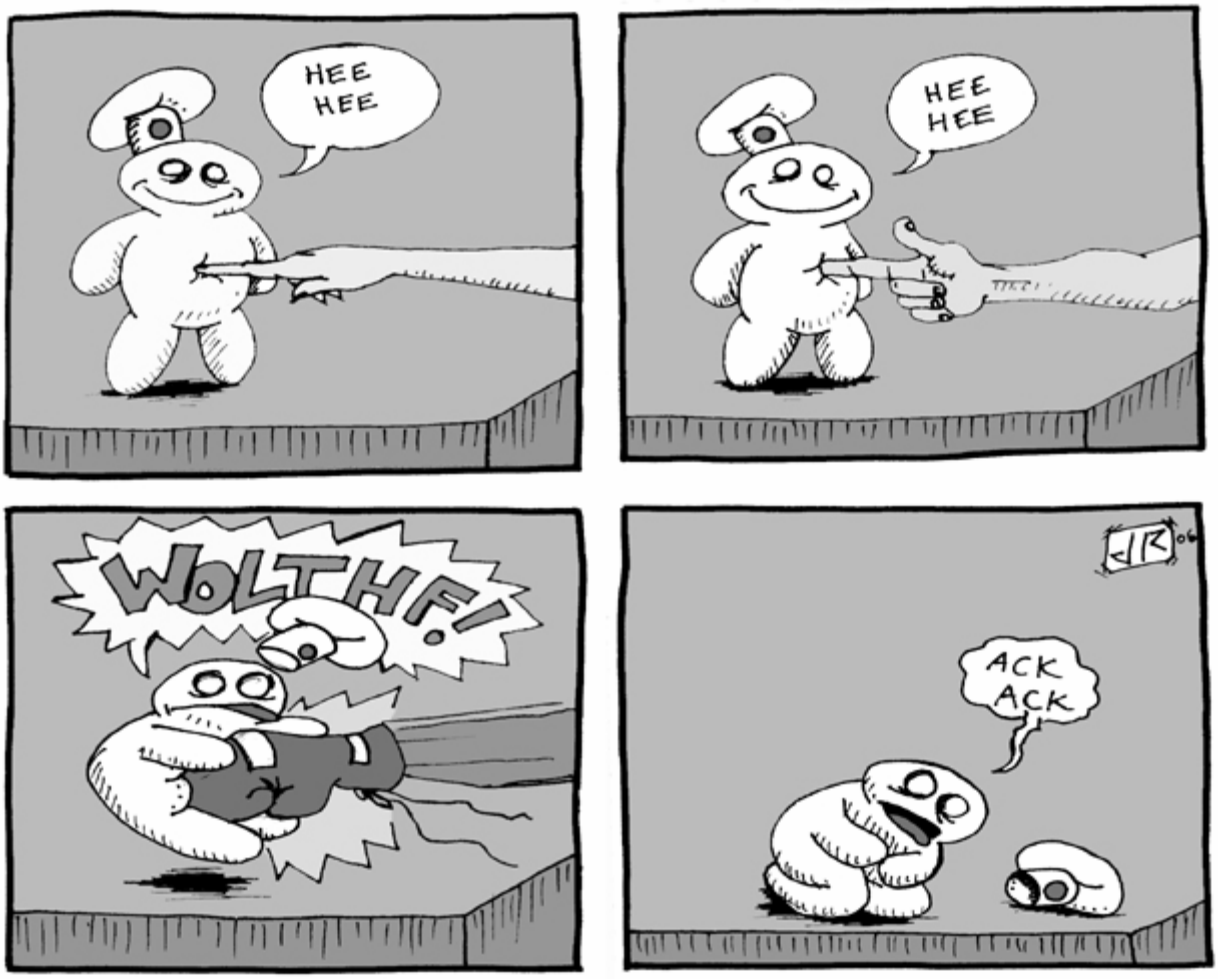



Who killed the Doughboy?

# ANSWER KEY

There was a mysterious death in Bakersfield, California's *yeast* side yesterday. A true icon of the community died, apparently from "*a-salt*" and "*batter(y*)" from one too many pokes in his belly. He was found dead in his living room early Friday morning with a note stuffed in the doughboy's mouth that read:

## *"Your Goose is Cooked Now, Isn't it?"*

Over the last several months, Mr. Doughboy had formed an investment capital group in which each member contributed a substantial amount of *dough,* which Pillsbury invested in what he felt were quick *rising* opportunities, such as the *"bouillon"* market. Most of these turned out to be *half-baked* schemes. With the recent downturn of the stock market, the fund lost all value, leaving the investors nearly flat broke.

Over the past week, several investors were seen coming and going from his home, including Hungry Jack, Mr. Clean, Betty Crocker, Duncan Hines, and the Siamese twins – Spic and Span. None seemed very happy when they arrived, and even less happy when they left. They were all picked up and hauled down to the Station where they were *grilled* for several hours. The cops *hashed* it all over and decided not to *mince* words, they had to let them all go until you, the Crime Scene Investigators, could give them the *icing on the cake* that they *kneaded* to put the suspect on *ice*.

To further add to the Doughboy family problems, the housekeeper, Miss Scrubby Bubbles, quit last weekend, and moved back to Bath, Ohio. Dosey was so embarrassed at the dishevelment of their home when the emergency crews arrived, but with no housekeeper, no one had done any cleaning since last week..

At the funeral, Mrs. Butterworth began the eulogy, but crumbled to pieces, so Aunt Jemima finished it, describing Doughboy as a man who never knew how much he was *kneaded*. She went on to say that after World War I, where he served as a mess cook, Doughboy rose quickly in show business, but his later life was filled with turnovers. He was not considered a very smart cookie, wasting much of his dough on half-baked schemes. Despite being a little flaky at times, and considered by some to be a crusty old man, most considered him a positive *roll* model for those that really knew him. Over the years that he spent in Bakersfield, he donated over 10 gallons of blood to the Red Cross, since his blood is in such high demand, being O+.

Doughboy is survived by his wife Dosey Dough, four children: John Dough, Jane Dough, Play Dough, and Oobleck, plus they have a bun in the oven. He is also survived by his elderly father, Pop Tart. The funeral was held this afternoon at 3:50 for about 20 minutes.

**SUSPECTS:**

**Hungry Jack**, founder of "Hungry Jack's House of Pancakes" has retired from the food business and now spends all of his free time selling homeopathic remedies for burns, athlete's foot, heartburn, indigestion, gas, and monosaccharide used for hypoglycemia. He personally manufactures everything he sells, including the plastic bottles that he extrudes from a molten polymeric liquid, heated to 123 degrees. He uses this specific polymer because its structure is resistant to osmosis. He wears only "natural" fibers like linen and cotton, and has type A+ blood.

**Mr. Gene Clean** made a fortune in cleaning solutions in his younger years, in spite of his obsessive / compulsive disorder. He is now retired, and spends every morning on his farm, where he is constantly experimenting with new fertilizer blends, using the old standbys. Once a successful fertilizer mix is found, he bags it in a very flexible, translucent type bag, and sells it to the Bob Evans farm, just down the road. Being raised in the country, he has no problem wearing clothing created by animals, such as wool and silk, and has type B+ blood.

**Betty Crocker –** Many years ago, Betty came up with the idea to prepackage many of the ingredients that are in baked goods, and sell them as a kit. In recent years, she has expanded her consumables beyond her sucrose laden desserts, into snacks by baking thin slices of potatoes until crisp, then misting them with the precipitate of the vinegar and baking soda reaction, then bagging them in translucent container known to be excellent as a moisture barrier. These are obviously quite high in calories, but luckily her spandex wardrobe is very forgiving. She has type B- blood.

**Duncan Hines** got his money honestly… through inheritance! His family fortune came from the Hines ketchup fame many years ago. He is a fierce competitor with Betty Crocker, and is not above stealing a recipe every chance he gets. In fact, the only difference in his ingredients is that his desserts are cornstarch based, while Betty's are flour based. He recently paid an industrial spy to steal Betty's vinegar chip recipe, and has improved on it by baking instead of deep frying. Duncan is strongly addicted to caffeine and is rarely seen without a Starbucks in their famous disposable insulated cup. Duncan is stuck in the '70's… leisure suits…, polyester shirts…, big hair… ya, man! He has type O- blood

**Spic and Span** are brothers that are "joined at the hip" (literally). You never see one without the other. Some say they are inseparable, in spite of totally different personalities. Spic is a real neatnic, that can't stand any disarray, while Span is a total slob. The messier the task, the more Span seems to enjoy it… He enjoys pounding the chalkboard erasers to clean them, and casting statuary using variations of plaster. Span has actually gotten quite good at sculpting as well, investing in a set of high density polyethylene tools. As you might expect, Spic prefers natural fibers like cotton and linen, while Span likes synthetics like spandex and polyester. They both have type AB+ blood.

**Possible Unknowns:**

- Sodium Acetate ($NaC_2H_3O_2$)
- Sodium Chloride ($NaCl$)
- Sodium Hydrogen Carbonate (Sodium BiCarb) ($NaHCO_3$)
- Sodium Carbonate ($Na_2CO_3$)
- Lithium Chloride ($LiCl$)
- Potassium Chloride ($KCl$)
- Calcium Nitrate ($Ca(NO_3)_2$)
- Calcium Sulfate ($CaSO_4$)
- Calcium Carbonate ($CaCO_3$)
- Cornstarch (Organic)
- Glucose ($C_6H_{12}O_6$)
- Sucrose ($C_{12}H_{22}O_{11}$)
- Magnesium Sulfate ($MgSO_4$)
- Boric Acid ($H_3BO_3$)
- Ammonium Chloride ($NH_4Cl$)

**Polymers:**

- PETE
- HDPE
- PS
- LDPE
- PP
- PVC
- PMMA
- PC

**Hair:**

- Human
- Dog
- Cat

**Fibers:**

- Cotton
- Wool
- Silk
- Linen
- Nylon
- Spandex
- Polyester

The following Evidence was collected from the scene of the crime.

**3a. Qualitative Analysis (3 Points Each – 54 Possible):**

| | | Chemical Name: | Chemical Formula: | Suspects Implicated: (No partial Values) |
|---|---|---|---|---|
| EVIDENCE | 1 | Sodium Chloride | $NaCl$ | Betty Crocker & Duncan Hines |
| EVIDENCE | 2 | Sodium Hydrogen Carbonate | $NaHCO_3$ | Hungry Jack, Betty Crocker & Duncan Hines |
| EVIDENCE | 3 | Sodium Acetate | $NaC_2H_3O_2$ | Betty Crocker & Duncan Hines |
| EVIDENCE | 4 | Glucose | $C_6H_{12}O_6$ | Hungry Jack |
| EVIDENCE | 5 | Magnesium Sulfate | $MgSO_4$ | Hungry Jack & Mr. Clean |
| EVIDENCE | 6 | Calcium Nitrate | $Ca(NO_3)_2$ | Mr. Clean |

**3b. Polymer Testing / Fibers (2 Points Each – 48 Possible)**

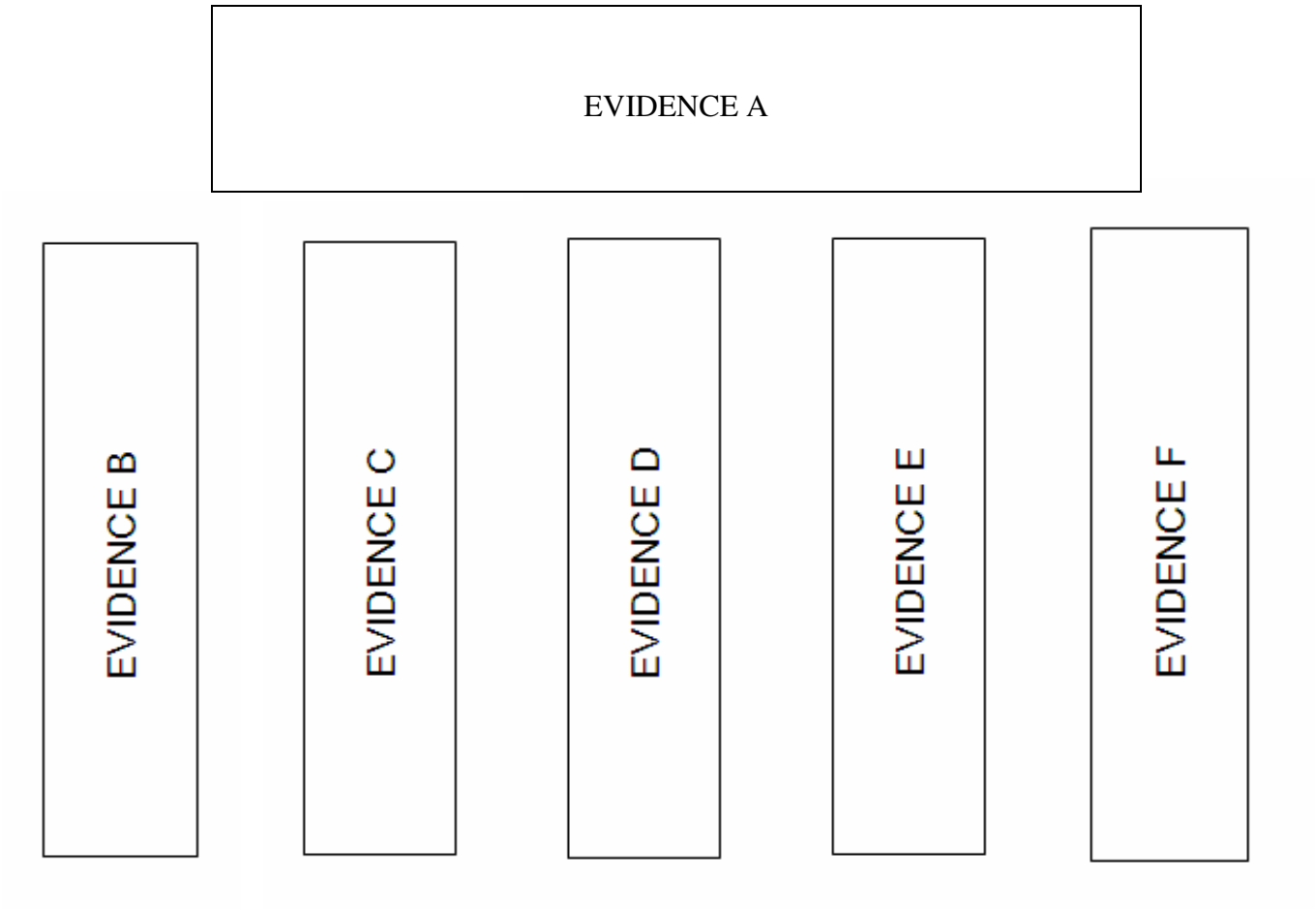
| | | Polymer Abbreviation | Recycle Code | Suspects Implicated (No Partial Values): |
|---|---|---|---|---|
| EVIDENCE | 7 | HDPE | 2 | Spic & Span |
| EVIDENCE | 8 | PS | 6 | Duncan Hines |
| EVIDENCE | 9 | LDPE | 4 | Mr. Clean |
| EVIDENCE | 10 | PP | 5 | Betty Crocker |

| | | Fiber Sample: | Origin (Animal, Vegetable, or Synthetic) | Suspects Implicated (No Partial Values): |
|---|---|---|---|---|
| EVIDENCE | 11 | Linen | Vegetable | Hungry Jack, Spic & Span |
| EVIDENCE | 12 | Cotton | Vegetable | Hungry Jack, Spic & Span |
| EVIDENCE | 13 | Polyester | Synthetic | Duncan Hines & Spic & Span |
| EVIDENCE | 14 | Spandex | Synthetic | Betty Crocker & Spic & San |

**PART 3.c- Chromatography (25 Points Possible)**

eUsing the chromatography materials provided, fractionalize the provided sample "A" as shown below. Collect additional ink samples from each suspect's pen on strips provided, and label according to the table below. Using water as an eluting solution, fractionalize the suspects ink samples, and tape in designated spot below

| Note Sample | A |
|---|---|
| **Hungry Jack** | **B** |
| **Mr. Clean** | **C** |
| **Betty Crocker** | **D** |
| **Duncan Hines** | **E** |
| **Spic & Span** | **F** |




Calculate the Rf values of the above samples:

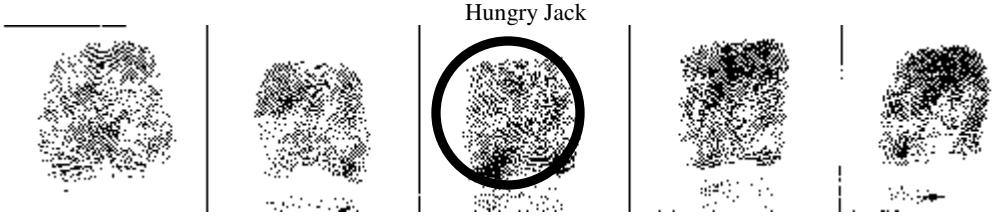
| | | | |
|---|---|---|---|
| Sample A | | Sample D | |
| Sample B | | Sample E | |
| Sample C | | Sample F | |

Which Suspect's pen was used to write the note? _____

**3.d Crime Scene Physical Evidence:**

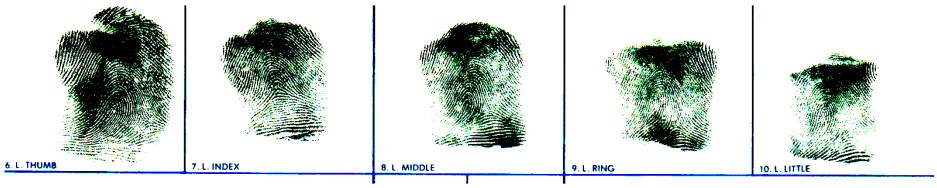
**3.d.i Fingerprints (6 Points Possible)**

Hungry Jack

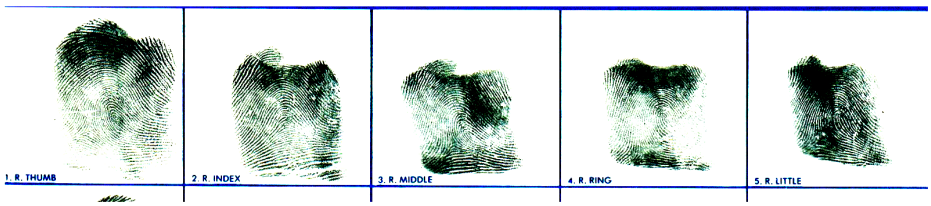


Mr. Clean

Betty Crocker

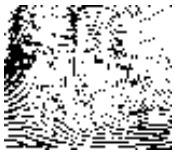



Duncan Hines




Spic & Span

EVIDENCE 13



A

Partial Print recovered from the note

B

Bloody Print taken from the fatal poke location on the belly of Pillsbury Doughboy

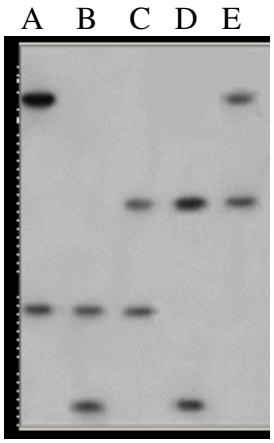
Which Suspect(s) match(es) the partial prints?

A: Mr. Clean

B: Hungry Jack

**3d.ii DNA Evidence (6 Points Possible):**

The following autoradiograph shows 5 columns; one for Dosey Dough, and one for each of her 4 children. Assuming that every child shares one marker with each parent, which column must belong to Dosey?

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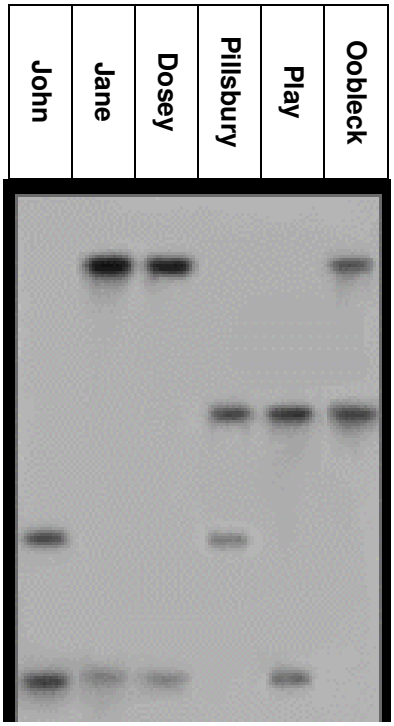
Answer:_____C_____

Based on the following autoradiograph, one of the children must be a step-sibling Again, assuming that each child inherits one marker from each parent, which of the following has a different Father?




Answer:_____Jane_____

**3.d.viii Serology (6 Points Possible)**

Using the Serology plate included in your Evidence pack, collect 3 drops of blood extracted from the bloody fingerprint found on the belly of Pillsbury Doughboy, from the Evidence Clerk located at the communal table (1 drop in each dimple. Using the Antigens provided at the table, add one drop of antigen A to the A dimple, one drop of antigen B to the B dimple, and one drop of the Rh antigen in the Rh dimple. Mix and analyze the results:

| | |
|---|---|
| **Determined Blood Type:** | O |
| **Rh Factor:** | + |
| **Individual Implicated:** | Pillsbury Doughboy |

**3e. Analysis of the Crime (80 Points Possible):**
Based on the facts and evidence presented, provide a written analysis identifying the primary suspect, and document all evidence.

***Several chemicals, polymers, and fibers were collected at the crime scene, but none of these provide conclusive proof, since each of the suspects that they may implicate, were seen entering and exiting the house over the past week, and readily admit to having been in the Dough home during the past week. Since the Housekeeper quit, the various pieces of evidence could have been left anytime since the last cleaning over a week ago.***

***The fingerprints however, were taken from the fatal poke to the belly, and the actual note taken from Doughboy's mouth.***

***The print found on the note belonged to Mr. Clean, but the ink used to write the note belonged to Hungry Jack, indicating that either someone else used his pen or that Jack is involved in the crime. Since Mr. Cleans print was found at the site of the fatal poke, he must have committed the crime, with Jack being an accessory to the fact.***

***The blood found at the scene was O+, and belonged to the Victim, Mr. Pillsbury Doughboy***

***This is a "Bonus" Section that you can use as a Study Guide for Future Competitions- 1 Point Each***

# *DIGGING DEEPER! A FORENSIC STUDY GUIDE ON FINGERPRINTS*

1. What is the name given to the 10 to 16 points of a fingerprint used to compare to a database?
   A. Bifurcations
   B. Minutiae
   C. Dots
   D. Improvisations
   ANSWER:___B___

2. The unpredictable array of fine detail found on pads of the hands and feet are called what?
   A. Friction Ridges
   B. Bifurcations
   C. Trifurcations
   D. Undulations
   ANSWER:___A___

3. The first person to classify and document fingerprints in 1892 was:
   A. Rollie Fingers
   B. The Fresh Prints of Bellaire
   C. Sir Francis Galton
   D. Sir Walter Raleigh
   ANSWER:___C___

4. A single ridge splitting into two ridges is call a:
   A. Fork
   B. Bifurcation
   C. Twinning
   D. Convergance
   ANSWER:___B___

5. Fingerprints not visible to the naked eye are called:
   A. Latex
   B. Latent
   C. Lament
   D. Invisible
   ANSWER: __B___

6. Prints on a porous surface such as paper were treated by turning them purple. The process used was probably:
   A. Cyano Acrylate Fuming
   B. Silver Nitrate Misting
   C. Iodine Fuming
   D. Ninhydrin Saturation
   ANSWER:___D___

7. Which of the following tests require heat to develop the print?
   A. Cyano Acrylate Fuming
   B. Silver Nitrate Misting
   C. Iodine Fuming
   D. Ninhydrin Saturation
   E. A & B
   F. B & C
   G. A & C
   H. A & D
   ANSWER:___H___

8. Which of the following is NOT a recognized fingerprint pattern?
   A. Loop
   B. Whorl
   C. Delta
   D. Arch
   ANSWER:___C___

9. TRUE or FALSE: It is impossible for an individual to have more than two different types of fingerprints. ANSWER:___F___

10. The common database used throughout the United States to identify fingerprints is called:
    A. CODIS
    B. AFIS
    C. APIS
    D. COFIS
    ANSWER:___B___

11. The 10-print card system developed in the early 1900s to classify fingerprints is called:
    A. The Henry System
    B. The George System
    C. The Alexander System
    D. The Fingerprint Classification System
    ANSWER: ___A___

12. A fingerprint pattern that opens to the inside of the arm is called:
    A. Radial
    B. Posterior
    C. Anterior
    D. Ulnar
    ANSWER:___A___

13. Rigor Mortise is the temporary stiffening of the joints. The typical duration of the process is:
    A: 12 hours to 24 hors after death
    B. 6 hours to 36 hours after death
    C. 3 hours to 72 hours after death
    D. 1 hour to 96 hours after death
    ANSWER:___C___

14. The science of Fingerprint Identification is also known as:
    A. Filangescopy
    B. Digitology
    C. Minutiaology
    D. Dactyloscopy
    ANSWER:___D___

15. 3-D Fingerprints left in soft material such as wax or certain greases that identify ridge depths as well as width and length are called:
    A. Dimensional
    B. Plastic
    C. Latent
    D. Basal
    ANSWER:___B___

# *DIGGING DEEPER! A FORENSIC STUDY GUIDE ON CHROMATOGRAPHY*

16. Liquid used in the chromatography process is called the:
    A. Effluent
    B. Affluent
    C. Eluent
    D. Solvent
    ANSWER:__C

17. Highly volatile liquids with low boiling points are usually separated with which type of Chromatography?
    A. Thin Layer Chromatography
    B. Paper Chromatography
    C. Column Chromatography
    D. Gas Chromatography
    ANSWER:__D__

18. TRUE or FALSE: The liquid used will carry a high molecular weight component further than a low molecular weight component which is what causes the fractionalization of various colors seen on the paper
    ANSWER: __F__

19. TRUE or FALSE: Nonpolar compounds will generally be carried further than polar compounds
    ANSWER: __T__

20. The ratio of the fractionalized compound to the liquid is called the:
    A. Rf
    B. Rh
    C. Fr
    D. Fa
    ANSWER:__A__

21. If this ratio is greater than 1, which of the following must be true?
    A. The compound is polar
    B. The compound is nonpolar
    C. The liquid is polar
    D. The liquid is nonpolar
    E. The compound is insoluble
    F. You screwed up!
    ANSWER:__F__

22. TRUE or FALSE: One way to speed up the chromatography process is to swirl the liquid in the beaker while it is wicking up the paper
    ANSWER:__F__

23. Allowing the paper strip to touch or lay against the side of the beaker will result in inaccurate results due to:
    A. Adhesion between the glass and the liquid
    B. Cohesion between the glass and the paper
    C. Surface Tension between the glass and the liquid
    D. Gravity
    ANSWER:__A__

24. The process having the liquid move up vertically through the paper is best described as:
    A. Surface Tension
    B. Capillary Action
    C. Cohesion between dissimilar materials
    D. Antigravity
    ANSWER:__B__

25. The reason that soluble compounds fractionalize on chromatography paper is:
    A. Polarity variations between compound components
    B. Reactivity variations between compound components
    C. Molecular weight differences between compound components
    D. Solubility rate differences between compound components
    E. All of the above
    F. None of the above
    G. A & C
    H. B & D
    I. A & D
    J. B & C
    ANSWER:__G__

26. Gas Chromatography results are based on which of the following:
    A. The deflection differential between lighter and heavier ions created by a magnetic field
    B. The light spectrum reflected by the different ions being analyzed
    C. The amount of energy released when bombarded with specific wavelengths
    D. The speed differential of an electron passing through an electric field.
    E. A & D above
    F. B & C above
    ANSWER:__E__

27. TRUE or FALSE: All Mass spectroscopy results are based on similar units of measure allowing data to be easily shared between researchers
    ANSWER:__F__

28. Thin layer chromatography uses which of the following as a medium?
    A. Silica Gel
    B. Cellulose
    C. Sand
    D. Paper
    ANSWER:__A__

***This is a "Bonus" Section that you can use as a Study Guide for Future Competitions- 1 Point Each***

# *DIGGING DEEPER! A FORENSIC STUDY GUIDE ON DNA TESTING*

29. DNA is an acronym for what?

A. DEOXYNUCLEIC ACID
B. DERIBONUCLEIC ACID
C. DEOXYRIBONUCLEIC ACID
D. DEOXYRIBONUCLEIC ACTION

ANSWER: __C____

30. Occasionally, DNA is shown as a matrix of 4 letters: A, C, G, and T. These are abbreviations for the 4 basic building blocks that make up DNA. What is the "A" an abbreviation for?

A. ADENINE
B. AGLUTININE
C. ASPARTAME
D. ASCORBIC ACID

ANSWER___A___

31. What is the "C" an abbreviation for?

A. CYTOPLASM
B. CHLOROFORM
C. CYTOSINE
D. CORTIZONE

ANSWER: __C___

32. What is the "G" an abbreviation for?

A. GLIBUROL
B. GLOBURINE
C. GUANINE
D. GATANNA

ANSWER: __C___

33. What is the "T" an abbreviation for?

A THIAMINE
B. THIAZINE
C. THYMINE
D. THIGH

ANSWER: __C___

34. Repeating units within the DNA strand are called what?

A. Similar Duplicate Strands (SDS)
B. Variable Number Tandem Repeats (VNTR)
C. Redundant Unit Number Strands (RUNS)
D. Partial Chain Characteristic Similarities (PCCS)

ANSWER:___B___

35. Forensic DNA profiling was first developed in what year?

A. 1974
B. 1984
C. 1994
D. 2004

ANSWER:___B___

36. Who first developed Forensic DNA profiling?

A. Sir Walter Raleigh
B. Sir William Love
C. Sir Thomas Moore
D. Sir Alec Jeffreys

ANSWER:___D___

37. Individual markers used to distinguish between various samples are called what?

A. Alleles
B. Chromosomes
C. Genes
D. X-Factors

ANSWER:___A___

38. The United States' DNA Database is known as what:

A. AFIS
B. NRA
C. CODIS
D. DNABase

ANSWER: ___C___

39. What does the Acronym selected in 10 stand for?

COMBINED DNA INDEX SYSTEM

---

40. In the United States, how many core loci are used to distinguish genetic differences?

A. 10
B. 13
C. 16
D. 21

ANSWER:___B___

41. According to the FBI, what are the approximate odds of 2 random people having the same DNA?

A: 1 in 3 Million
B: 1 in 3 Billion
C: 1 in 3 Trillion
D: 1 in 3 Quadrillion

ANSWER ___C___

42. Which of the following are NOT acronyms for various types of DNA testing:

A. RFLP
B. PCR
C. Y-STR
D. X-STR
E. AmpFLP
F. mtDNA

ANSWER ___D___

43. What method of DNA testing is used for extremely degraded samples?

A: Ninhydrin
B: Mitochodrial
C. Metformin
D: Amslar Grid Analysis

ANSWER: ___B___

44. Individuals with 2 complete sets of genes may provide false exclusion in Forensic DNA profiling. These types of people are known as:

A. Albinos
B. Chimeras
C. Mutants
D. Dwarfs

ANSWER:___B___