



Bueno Nacho Blues

William P. Clements High School's Forensics Test

Names: _____

School: _____

Team Number: _____

So, What's the Sitch?

Located in the town of Middleton, Bueno Nacho is known as one of the most successful Mexican restaurants in the United States. Its world-famous burritos and nachos never fail to please any customer's taste buds! But why, you ask? The key to success lies in Bueno Nacho's secret recipe, which has been safely locked away at the back of the restaurant for years... until June 3, 2015.

Kim Possible and Ron Stoppable (and Rufus) were heading towards Bueno Nacho for their daily dose of nachos. However, once they opened the door to the restaurant, all three stopped in their tracks. Bueno Nacho was a complete mess. The floor was littered with smashed glass bits and stale food crumbs. Uneaten burritos were covered with ravenous flies. The corpses of employees and customers were scattered throughout the restaurant. Under further investigation, Kim and Ron discovered traces of hairs, fibers, and blood spatters on the victims.

The teenage spy duo headed to the back of Bueno Nacho and was met with yet another horrifying discovery. The safe holding the secret recipe was empty. Someone had stolen Bueno Nacho's secret recipe!

As a forensic scientist, your job is to help Kim and Ron find the thief and save Bueno Nacho. The task may seem daunting, but anything is *possible* with your skills and intellect at hand!

Evidence Found at Bueno Nacho:

- Powder A
- Polymers J/K/L
- Hair U
- Fiber Z
- Blood Sample II
- Fingerprint NN

Suspects:

Dr. Drakken

Hobbies: Robotics, Cloning

Description: Dr. Drakken is a blue-skinned evil mad scientist and Kim's arch nemesis. He is quite obsessed with world domination and fails his evil plots most of the time, although (even Kim admits) he has recently been improving his tactics at an alarming rate. Dr. Drakken frequently experiences hypertension and suffers from hypokalemia due to overuse of diuretics. His deteriorating health condition could be due to his addiction to grape soda...

Statement: Do you think someone like ME, Dr. Drakken, would want to perform such a petty crime? Of course I love making Kim Possible's life miserable in all ways possible (including possibly causing trouble in her hometown....) but no one has time to rob Bueno Nacho! (except possibly my henchwoman Shego...) On June 2, I was too busy back in my lair perfecting my beloved BeBe robots.

Evidence:

- Powders B/ C
- Polymers M/ N
- Hair V
- Fiber AA
- Blood Sample EE
- Ink Sample JJ
- Fingerprint OO

Duff Kiligan

Hobbies: Golf, Painting golf balls, eating

Description: Duff Kiligan is an overweight Scottish golf player who attacks his opponents with exploding golf balls. After several attempts to turn the whole world into a golf course, Kiligan has been permanently banned from golf courses. (He still manages to sneak into some golf courses on some occasions.) According to rumors, Kiligan has decided to once again try to overrun the world with golf... but he still needs funding.

Statement: ... Huh? Wait, can you repeat that again? What?

(5 minutes pass while prosecutor attempts to get his question across)

Ohh, I see now. My apologies for my subpar hearing ability; I seem to be suffering from an ear infection. Please don't misunderstand me, I have been seeking treatment. Anyways, I was too busy playing miniature golf all day to

commit such a foul crime. Why would I cause so much commotion at Bueno Nacho in the first place? I absolutely adore their tacos!~ If only I could make their tacos everyday at home... wait, what did I just say?

Evidence:

- Powders D/ E
- Polymers O/ P
- Hair W
- Fiber BB
- Blood Sample FF
- Ink Sample KK
- Fingerprint PP

Monkey Fist

Hobbies: Kung fu, collecting fossil specimens and artifacts, playing Ninja

Description: Monkey Fist is an archaeologist – turned monkey fanatic. An avid practitioner of monkey kung fu, Monkey Fist is known for being able to kill a person with a single finger. Although he is no longer an archaeologist, Monkey Fist still holds a strong passion for fossils, especially brachiopods and mollusks (organisms with shells). Being part animal himself, Monkey Fist is also a vegetarian.

Statement: To think that I would bother to rob a taco shop is absolutely preposterous. I absolutely abhor Mexican food! It bothers me that even after all these years, Bueno Nacho has never offered any vegetarian options... not even any *tofu* burritos... how disappointing and discriminating.

Evidence:

- Powders F/G
- Polymers Q/R
- Hair X
- Fiber CC
- Blood Sample GG
- Ink Sample LL
- Fingerprint QQ

Senor Senior, Sr.

Hobbies: Showering, washing hands, making money, reading

Description: If there's one thing that Senor Senior, Sr. loves in this world, it's money. Although he owns a large resort island with his son, Senor Senior, Jr., Senor Senior, Sr. is always on the lookout for more methods of "earning" dough for his own pleasure... and for ruling the world. Senor Senior, Sr. is also extremely hygienic and goes hysterical if he dirties his hands (literally... not figuratively.) His most prized possession is his limited edition Russian Amber Imperial Shampoo. Senor Senior, Sr. is commonly found carrying a bar of soap in his pocket (for emergency situations) and reading the "Book of Evil".

Statement: While the crime was taking place, I was back in my lair (located in West Europe) taking a shower. Don't look at me like that – I treasure my showers very much. I have no affiliation with Bueno Nacho whatsoever... although I do know that Bueno Nacho's market value is off the charts.

(It was later discovered that Senor Senior, Sr. had actually purchased an airplane ticket to Centerton, USA on June 2. Lowerton is 3.5 miles away from Middleton.)

Evidence:

- Powders H/I
- Polymers S/T
- Hair Y
- Fiber DD
- Blood Sample HH
- Ink Sample MM
- Fingerprint RR

I. Qualitative Analysis (112)

Complete the following table by identifying each unknown's full name, chemical symbol, and relationship with the corresponding suspect.

Powder	Full Name (5)	Chemical Symbol (3)	Relationship (5)
A			N/A
B			
C			
D			
E			
F			
G			
H			
I			

II. Polymers (72)

(Note: Provide the abbreviated version of the polymer name, not the full name.)

Identify the polymers. Physical samples will be provided. (4 pts each)

J. _____

N. _____

R. _____

K. _____

O. _____

S. _____

L. _____

P. _____

T. _____

M. _____

Q. _____

Identify the polymer based on the description. (2 pts each)

_____ Sold under the trademarks Lucite, Plexiglas and Perspex

_____ Floats in water, floats in 46% isopropyl alcohol, floats in vegetable oil

_____ Floats in water, sinks in 46% isopropyl alcohol

_____ Burn Test: Plastic chars, self-extinguishing, green flame

_____ Burn Test: plastic drips, self-extinguishing, orange flame, black smoke

_____ Used in cellophane wrap and diapers

_____ Burn Test: Does not char, shrivels, plastic drips, yellow flame

Answer the following questions. (2 pts each)

1. PP polymerizes by _____.
2. Provide the full name for PMMA.
3. What is the term describing a repeating unit in a polymer chain?
4. What is the melting point of PVC?
5. Draw the monomer unit structure of polystyrene.
6. The recycling rate for polyethylene terephthalate is about _____%.
7. Which polymer is commonly used in disk drives and swim noodles?

III. Hairs & Fibers (54)

In the space provided, identify the hair and fiber. (4 pts each)

U.



V.



W.



X.



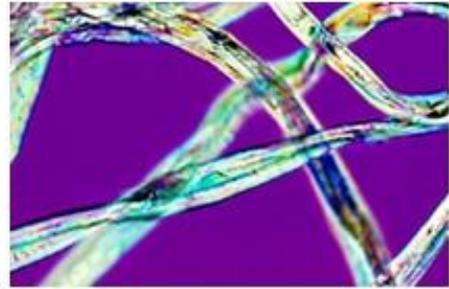
Y.



Z.



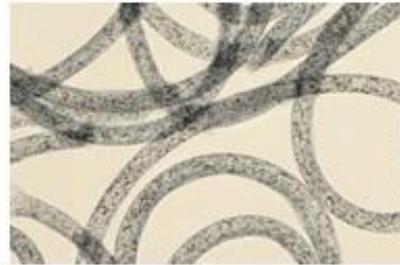
AA.



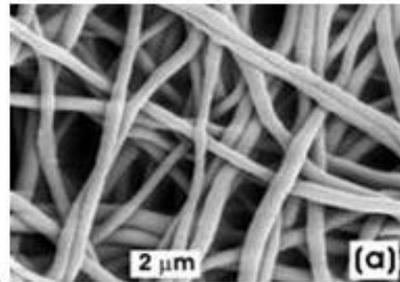
BB.



CC.



DD.



Answer the following questions. (2 pts each)

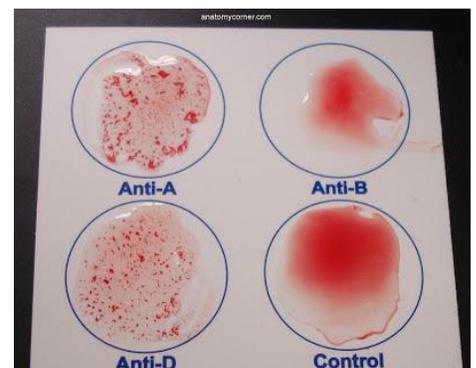
1. What characteristic of silk gives it a shimmering appearance?
2. Nylon was intended to be the synthetic replacement for which other fiber?
3. Draw cross section of cotton, not mercerized and mercerized (respectively).
4. Define mercerization. (1 pt for describing its effect on cotton; 2 pts for explaining how the process works)
5. Name the fiber that produces sparks, does not produce smoke, and burns at a constant rate in a burn test.
6. Name the fiber that does not shrink from the flame, leaves behind sticky ash, and melts quickly.
7. Name the fiber that shrinks from the flame, melts, produces black residue, and ignites only when brought to flame.

IV. Blood (22)

Identify the following blood types (including the Rh factor) based on the blood test results. (3 pts each)

	ANTI-A	ANTI-B	ANTI-D	
EE.				_____
FF.				_____
GG.				_____
HH.				_____

- II. A blood sample was taken from the scene. The results are shown to the right. Identify the blood type and the corresponding suspect.



Answer the following questions. (7)

1. A, B, and O are __ (1) __. While A and B are __ (2) __ __ (1) __, O is a __ (3) __ __ (1) __.
Hint: (1) is defined as one of many forms of the same gene. (3)

(1): _____

(2): _____

(3): _____

2. From which animal is the phrase "Rh Factor" derived from? (2)

3. Define blood borne pathogen. (2)

V. Fingerprints (24)

In the space provided, identify the fingerprint pattern. (2 pts each)



NN. _____

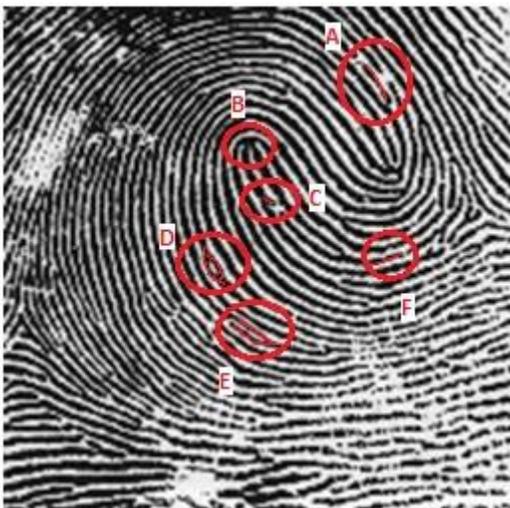
QQ. _____

OO. _____

RR. _____

PP. _____

Identify the fingerprint minutiae. (2 pts each)



A _____

B _____

C _____

D _____

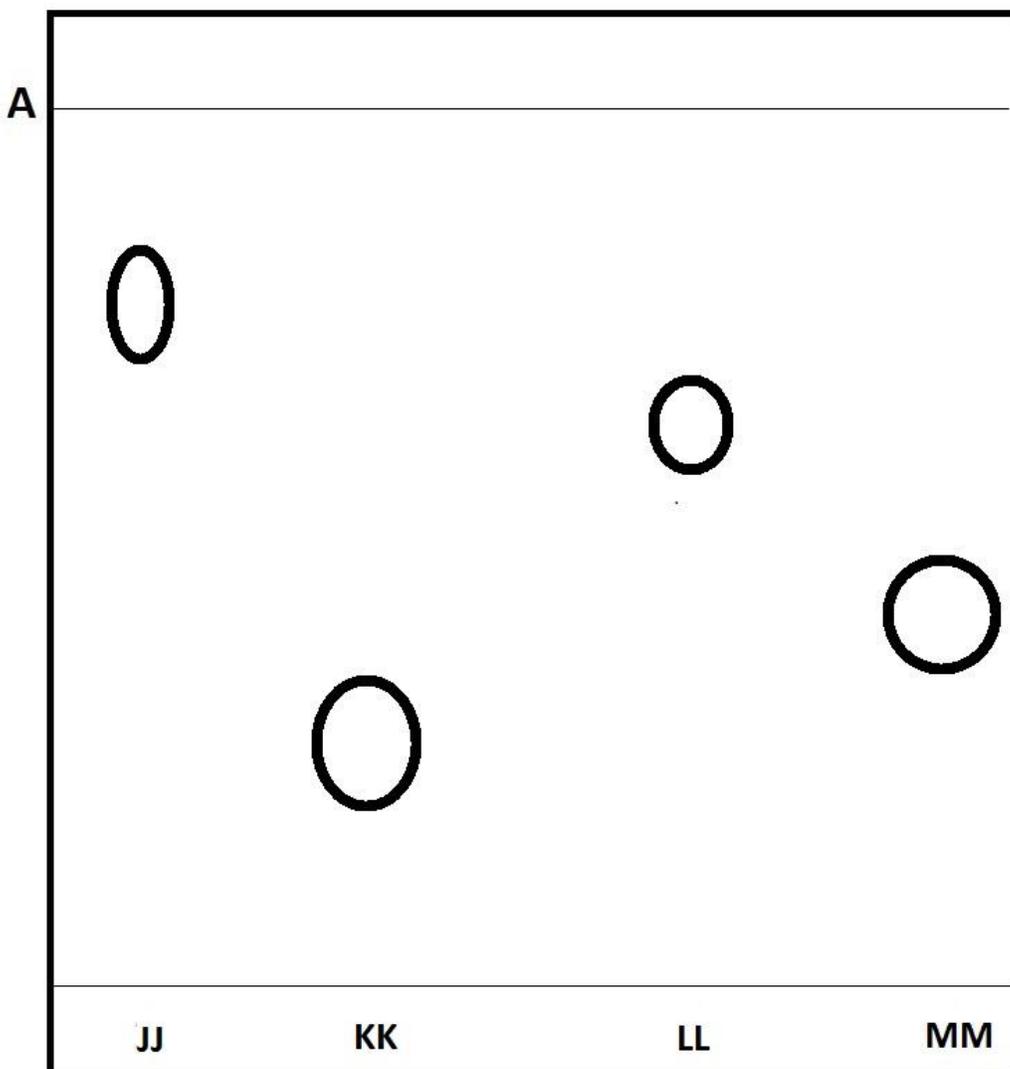
E _____

F _____

Identify the fingerprint pattern.

VI. Chromatography (15)

Line A represents the stopping point of the solvent. Find the Rf factors of each pen. (3 pts each)



JJ: _____

KK: _____

LL: _____

MM: _____

The Rf factor of the ink from the pen discovered at the crime scene is 0.64. Whose pen was found at the crime scene? (3)

VII. Entomology and Decomposition (12)

The following picture depicts one of the larvae that were found in the wounds of various corpses at Bueno Nacho. The larva has already passed the first instar. (2 pts each)

1. Give the common name for 'larvae'.
2. Identify the order.
3. Give the common name of the specimen's order.
4. Which two families (from the same order) are usually the first to arrive at a crime scene within minutes?
5. The corpse has begun to swell and produce odors. Based on the information given, identify the stage of decomposition that the corpse has reached.
6. Approximately how many days ago was the crime committed?



VIII. Glass (9)

Light travels from air into a shattered glass piece with an angle of incidence of 33° . The angle of refraction on the end of the glass piece is 20.997° .

1. Sketch a picture of the path of light as it travels through the two mediums. The angles do not have to be drawn to scale. (5)
2. Calculate the index of refraction of the glass. Show all work. Round to the nearest two decimal places. (2)
3. The glass piece is which type of optical glass? (2)

Analysis (100)

After weeks of thorough investigation and examination, the question still comes down to this:

Who is responsible for wreaking havoc at Bueno Nacho? Be sure to support your answer with evidence and reasoning.