

**C - Forensics C - Rickards Invitational Div. C - 12-05-2020**

Hello there! Welcome to the Rickards Invitational. You have 50 minutes to complete the following test, good luck!

**THERE IS ONE IMPOSTER AMONG US**

A loud buzzer sounds, catching the attention of the remaining crewmates. Everyone rushes to the central table in the cafeteria and looks around. Red, Green, Blue, Brown, and White are all here... but where's Purple? Red breaks the bad news: he found purple lying dead in electrical, adjacent to the vent. Everyone looks around, skeptical of the other crewmates. Who killed purple, and how much longer can they get away with it? Use the suspect logs below to determine the culprit. Each piece of evidence that was found at the crime scene is demoted with a letter (i.e. Powder A, etc.)

**BLUE:** Blue was feeling under the weather, so he had taken some cough medicine. He used a heating pad to deal with his sore back. He also was treating leather back in his sleeping quarters for a homemade wallet. His favorite hobby is playing with his Etch-a-sketch and his suit is made of spandex. His companion is a miniature cow.

**GREEN:** Green was in charge of pest control, so she recently used some cockroach insecticide to get rid of any roaches that came from Earth...or outer space? She loves eating salt and vinegar chips, and brought a half-eaten bag with her to the emergency meeting. In her other hand was a bar of Hershey's chocolate- you can tell Green loves junk food. She 3D-printed a security badge holder for convenience. Her suit is made of linen and her loyal companion is a squirrel

**RED:** Red's favorite task is destroying the asteroids, and he says he was using the CO2 lasers to destroy incoming asteroids when the emergency meeting was called. He has arthritis and takes medication to numb the pain. He also is using an antiseptic to manage a cut he got before the expedition began. He loves trying out new knots in his rope and his suit is made from polyester. His loyal companion is a horse.

**BROWN:** Brown is a diabetic, so she uses insulin to restore blood sugar levels. She put out a fire in storage with a fire extinguisher. She's also very health-conscious and brushes her teeth at least three times a day, using an excessive amount of toothpaste each time. She was in charge of fixing the plumbing pipes in MedBay and her suit is made of wool. Her trusty companion is a mutated alien-human hybrid.

**WHITE:** White, like most sane individuals, is a chicken nugget fanatic. However, some condiments got on the cotton suit, so they washed it with extra laundry detergent. They then made a microwave meal and made sure to wash their hands with soap after their meal, but the packaging got stuck on their glove. Their trusty companion is a bat.

Powder	Description
A	Burns green in a flame test
B	Exothermic with pH of 8
C	A coagulant that turns black in iodine

D	Burns red in a flame test
E	Bubbles when mixed in a combination of iodine and Benedict's Reagent
F	The only reducing sugar on the rules
G	Leaves a prominent smoke trail after a flame test
H	Burns purple in a flame test

1. (1.00 pts) What powder is powder A?

**Expected Answer:** Boric Acid

2. (1.00 pts) What is the chemical formula of Powder A?

3. (1.00 pts) What suspect(s), if any, is Powder A associated with?

**Expected Answer:** Red and Green

4. (2.00 pts) What detail from the suspect log allowed you to associate Powder A with the suspect? If the powder is not associated with a suspect, just write 'N/A'

**Expected Answer:** Antiseptic; Cockroach control

5. (2.00 pts) What powder is powder B?

**Expected Answer:** Sodium Acetate

6. (2.00 pts) What is the chemical formula of Powder B?

NaC2H3O2

7. (2.00 pts) What suspect(s), if any, is Powder B associated with?

Expected Answer: Blue

8. (2.00 pts) What detail from the suspect log allowed you to associate Powder B with the suspect? If the powder is not associated with a suspect, just write 'N/A'

Expected Answer: Heating Pad

9. (2.00 pts) What powder is powder C?

Expected Answer: Cornstarch

10. (2.00 pts) What suspect(s), if any, is Powder C associated with?

Expected Answer: White

11. (2.00 pts) What detail from the suspect log allowed you to associate Powder C with the suspect? If the powder is not associated with a suspect, just write 'N/A'

Expected Answer: Cornstarch

12. (2.00 pts) What powder is powder D?

**Expected Answer:** Lithium Chloride

13. (2.00 pts) What is the chemical formula of Powder D?

**Expected Answer:** LiCl

14. (2.00 pts) What suspect(s), if any, is Powder D associated with?

**Expected Answer:** Red

15. (2.00 pts) What detail from the suspect log allowed you to associate Powder D with the suspect? If the powder is not associated with a suspect, just write 'N/A'

**Expected Answer:** Arthritis

16. (2.00 pts) What powder is powder E?

**Expected Answer:** Boric Acid

17. (2.00 pts) What is the chemical formula of Powder E?

Expected Answer:  $\text{H}_3\text{BO}_3$

18. (2.00 pts) What suspect(s), if any, is Powder E associated with?

Expected Answer: Red and Green

19. (2.00 pts) What detail from the suspect log allowed you to associate Powder E with the suspect? If the powder is not associated with a suspect, just write 'N/A'

Expected Answer: Antiseptic, cockroach control

20. (2.00 pts) What powder is powder F?

Expected Answer: Glucose

21. (2.00 pts) What is the chemical formula of Powder F?

Expected Answer:  $\text{C}_6\text{H}_{12}\text{O}_6$

22. (2.00 pts) What suspect(s), if any, is Powder F associated with?

Expected Answer: Brown

**23. (2.00 pts)** What detail from the suspect log allowed you to associate Powder F with the suspect? If the powder is not associated with a suspect, just write 'N/A'

**Expected Answer:** Diabetic

**24. (2.00 pts)** What powder is powder G?

**Expected Answer:** Ammonium Chloride

**25. (2.00 pts)** What is the chemical formula of Powder G?

**Expected Answer:** NH<sub>4</sub>Cl

**26. (2.00 pts)** What suspect(s), if any, is Powder G associated with?

**Expected Answer:** Blue

**27. (2.00 pts)** What detail from the suspect log allowed you to associate Powder G with the suspect? If the powder is not associated with a suspect, just write 'N/A'

**Expected Answer:** Cough Medicine

28. (2.00 pts) What powder is powder H?

Expected Answer: Potassium Chloride

29. (2.00 pts) What is the chemical formula of Powder H?

Expected Answer: KCl

30. (1.00 pts) What suspect(s), if any, is Powder H associated with?

Expected Answer: Red

31. (1.00 pts) What detail from the suspect log allowed you to associate Powder H with the suspect? If the powder is not associated with a suspect, just write 'N/A'

Expected Answer: CO2 Lasers

32. (1.00 pts) What powder turns Royal Blue in Benedict's reagent?

Expected Answer: Ammonium Chloride

33. (1.00 pts) What powder turns yellow when placed in iodine?

Expected Answer: Calcium Sulfate

- 34. (1.00 pts)** Glucose and sucrose both react with Benedict's Reagent. There is another powder that also reacts with Benedict's reagent. Identify that powder.

**Expected Answer:** Ammonium Chloride

- 35. (1.00 pts)** Write the balanced chemical equation for the powder mentioned in Question 34 with Benedict's Reagent.

**Expected Answer:**  $4\text{NH}_4\text{Cl} + \text{CuSO}_4 + 4\text{NaOH} \rightarrow [\text{Cu}(\text{NH}_3)_4]\text{SO}_4 + 4\text{H}_2\text{O} + 4\text{NaCl}$

- 36. (1.00 pts)** Which powder does not react with water?

**Expected Answer:** Cornstarch

- 37. (1.00 pts)** What compound in Benedict's reagent prevents premature color change?

**Expected Answer:** Sodium Citrate

Fiber	Description
I	Derived from Petroleum
J	Smells like burning hair and leaves grey beads when a flame test is conducted
K	The only fiber you should not burn, as it releases harmful chemicals into the air



L	A scale-like structure under a microscope, but is surprisingly fluffy
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**38. (1.00 pts)** What fiber is Fiber I?

**Expected Answer:** Polyester

**39. (1.00 pts)** Is Fiber I a plant, animal, or synthetic fiber?

- ☐ A) Plant
- ☐ B) Animal
- ☒ C) Synthetic

**40. (1.00 pts)** Which suspect(s), if any, is Fiber I associated with?

**Expected Answer:** Red

**41. (1.00 pts)** What fiber is Fiber J

**Expected Answer:** Silk

**42. (1.00 pts)** Is Fiber J a plant, animal, or synthetic fiber?

- ☐ A) Plant
- ☒ B) Animal
- ☐ C) Synthetic

**43. (1.00 pts)** Which suspect(s), if any, is Fiber J associated with?

**Expected Answer:** N/A

44. (1.00 pts) What fiber is Fiber K

**Expected Answer:** Spandex

45. (1.00 pts) Is Fiber K a plant, animal, or synthetic fiber?

- ☐ A) Plant
- ☐ B) Animal
- ☒ C) Synthetic

46. (1.00 pts) Which suspect(s), if any, is Fiber K associated with?

**Expected Answer:** Blue

47. (1.00 pts) What fiber is Fiber L

**Expected Answer:** Wool

48. (1.00 pts) Is Fiber L a plant, animal, or synthetic fiber?

- ☐ A) Plant
- ☒ B) Animal
- ☐ C) Synthetic

49. (1.00 pts) Which suspect(s), if any, is Fiber L associated with?

**Expected Answer:** Brown

50. (1.00 pts) Which fiber is the main constituent of the US Dollar bill?

Expected Answer: Cotton

51. (1.00 pts) Which fiber(s) are made from beta-glucose?

Expected Answer: Cotton and Linen

52. (1.00 pts) Which fiber is derived from coal?

Expected Answer: Nylon

53. (1.00 pts) Wool is made from amino acid monomers. What would its polymer be?

Expected Answer: Protein

**USE ABBREVIATIONS FOR PLASTICS UNLESS OTHERWISE ASKED**

Plastic	Description
M	Has a green flame when a flame test is conducted
N	Single benzene ring in the monomer; sweet, aromatic smell
O	Resin number 2
P	Non-flame retardant, smells like wood during flame test
Q	No smoke when removed from flame, smells like fruit, noisy when burned

54. (1.00 pts) What plastic is Plastic M?

Expected Answer: PVC

55. (1.00 pts) Is plastic M an addition or condensation polymer?

- ☒ A) Addition
- ☐ B) Condensation

56. (1.00 pts) What suspect(s), if any, is Plastic M associated with?

Expected Answer: Brown

57. (1.00 pts) What detail from the suspect log allowed you to associate Plastic M with the suspect? If the plastic is not associated with a suspect, just write 'N/A'

Expected Answer: Plumbing Pipes

58. (1.00 pts) What plastic is Plastic N?

Expected Answer: PETE

59. (1.00 pts) Is plastic N an addition or condensation polymer?

- ☐ A) Addition
- ☒ B) Condensation

**60. (1.00 pts)** What suspect(s), if any, is Plastic N associated with?

**Expected Answer:** White

**61. (1.00 pts)** What detail from the suspect log allowed you to associate Plastic N with the suspect? If the plastic is not associated with a suspect, just write 'N/A'

**Expected Answer:** Microwave Packaging

**62. (1.00 pts)** What plastic is Plastic O?

**Expected Answer:** HDPE

**63. (1.00 pts)** Is plastic O an addition or condensation polymer?

- ☒ A) Addition
- ☐ B) Condensation

**64. (1.00 pts)** What suspect(s), if any, is Plastic O associated with?

**Expected Answer:** Green

**65. (1.00 pts)** What detail from the suspect log allowed you to associate Plastic O with the suspect? If the plastic is not associated with a suspect, just write 'N/A'

**Expected Answer:** 3D printing

66. (1.00 pts) What plastic is Plastic P?

Expected Answer: PP

67. (1.00 pts) Is plastic P an addition or condensation polymer?

- ☒ A) Addition  
☐ B) Condensation

68. (1.00 pts) What suspect(s), if any, is Plastic P associated with?

Expected Answer: Red

69. (1.00 pts) What detail from the suspect log allowed you to associate Plastic P with the suspect? If the plastic is not associated with a suspect, just write 'N/A'

Expected Answer: Rope

70. (1.00 pts) What plastic is Plastic Q?

Expected Answer: PMMA

71. (1.00 pts) Is plastic Q an addition or condensation polymer?

- ☒ A) Addition
- ☐ B) Condensation

**72. (1.00 pts)** What suspect(s), if any, is Plastic Q associated with?

**Expected Answer:** N/A

**73. (1.00 pts)** What detail from the suspect log allowed you to associate Plastic Q with the suspect? If the plastic is not associated with a suspect, just write 'N/A'

**Expected Answer:** N/A

**74. (1.00 pts)** There is only one plastic that floats in vegetable oil. Identify that plastic.

**Expected Answer:** PP

**75. (1.00 pts)** What is the only plastic to have two benzene rings in its monomer structure?

**Expected Answer:** PC

**76. (1.00 pts)** What is the only plastic to have a halogen in its monomer structure?

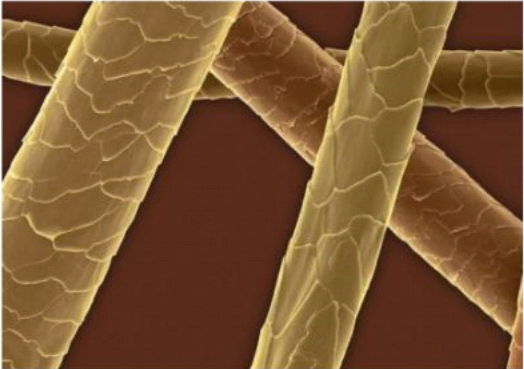
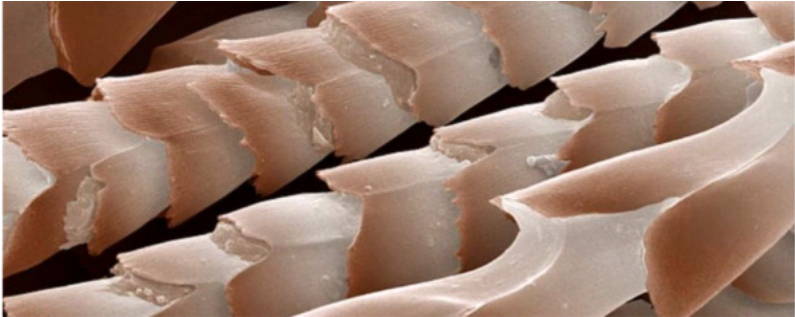
**Expected Answer:** PVC

**77. (1.00 pts)** What makes HDPE denser than LDPE?

**Expected Answer:** It is linear instead of branched as a polymer

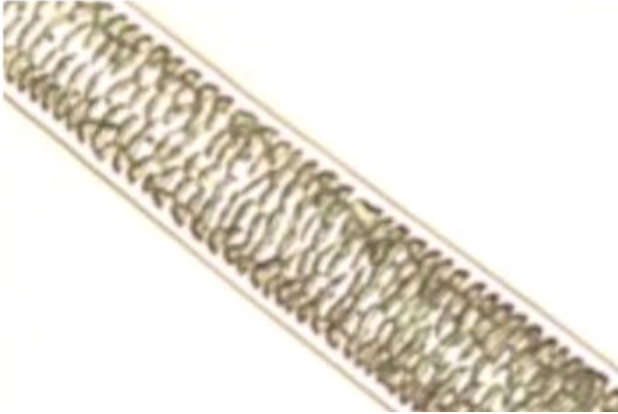
**78. (1.00 pts)** What plastic has the resin code of 5? Write the abbreviation and full name.

**Expected Answer:** PP, Polypropylene

Hair	Photograph
R	
S	



T



79. (1.00 pts) What hair is Hair R?

Expected Answer: Horse

80. (1.00 pts) What suspect(s), if any, are implicated by Hair R?

Expected Answer: Red

81. (1.00 pts) What hair is Hair S?

Expected Answer: Bat

82. (1.00 pts) What suspect(s), if any, are implicated by Hair S?

Expected Answer: White

83. (1.00 pts) What hair is Hair T?

Expected Answer: Squirrel

84. (1.00 pts) What suspect(s), if any, are implicated by Hair T?

Expected Answer: Green

85. (1.00 pts) Where would one find tactile hairs on an animal?

Expected Answer: The face

86. (1.00 pts) You look at a cross-section of human hair under the microscope and find it to be triangular in shape. Is this hair from the scalp, pubic area, or beard?

Expected Answer: Beard

87. (1.00 pts) What is sebum secreted by, in humans?

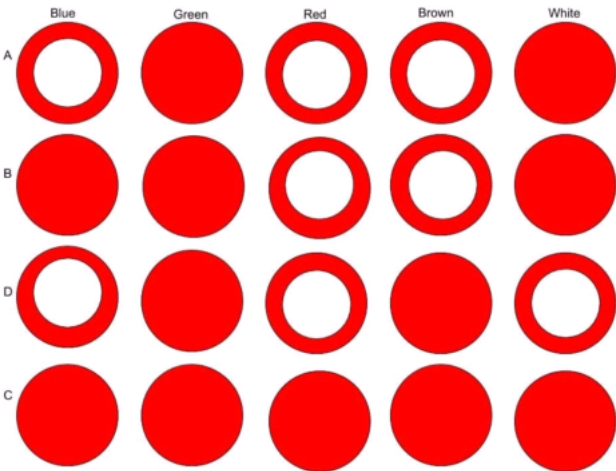
Expected Answer: The sebaceous gland

88. (1.00 pts) What are the three main components of sebum?

Expected Answer: Triglycerides, wax esters, squalene.

89. (1.00 pts) What is the primary protein in hair?

Expected Answer: Keratin



90. (1.00 pts) What blood type is Blue?

Expected Answer: A+

91. (1.00 pts) What blood type is Green?

Expected Answer: O-

92. (1.00 pts) What blood type is Red?

**Expected Answer:** AB-

Expected Answer: O+

**Expected Answer:** N/A

Blue	Green	Red	Brown	White	Crime Scene
_____				_____	_____
_____	_____	_____			
_____	_____	_____	_____		_____
	_____	_____	_____		_____
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		_____	_____		_____

96. (1.00 pts) Which suspect(s), if any, are implicated by the gel electrophoresis above?

Expected Answer: N/A

97. (1.00 pts) What does 'kp' stand for in gel electrophoresis?

Expected Answer: Kilopairs

98. (1.00 pts)



98. Use the blood splatter above to calculate the angle of impact to one decimal place, in degrees.

Expected Answer: 37.5

Suspect	Blue	Green	Red	Brown	White
Fingerprint	Central Pocket Loop	Double Loop Whorl	Accidental Whorl	Plain Arch	Plain Whorl

99. (1.00 pts) The fingerprints of the suspect's right thumbs are shown above. The crime scene data suggests that the fingerprint found at the crime scene only has one delta. Which suspect(s), if any, have only one delta on their right thumb?

Expected Answer: Red

100. (1.00 pts) Which crewmate is the Imposter?

Expected Answer: Red

Congratulations on finishing! Don't forget to check your answers. Once you do, feel free to submit. Good luck on your other events!