

# MY SO PRACTICE TEST

DIVISION C - HIGH SCHOOL, GRADES 9-12

## PRACTICE TEST

### Instructions

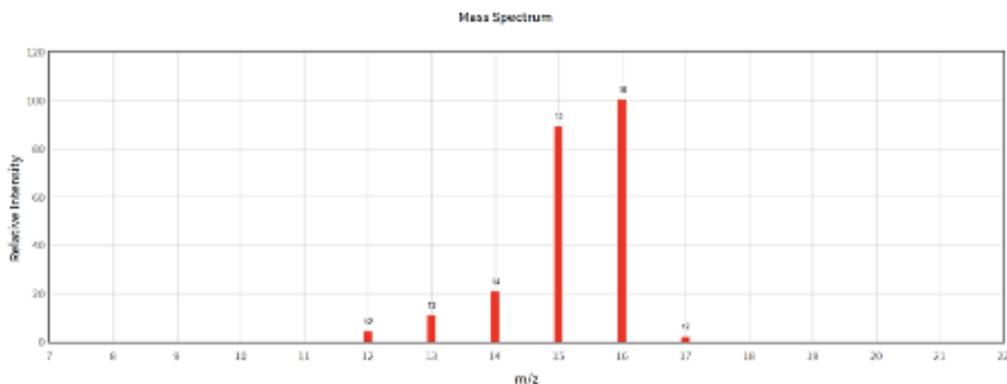
- You have 20 minutes to complete this test.
- You may write your answers directly in the test.
- You may use any notes or resources you have created or collected.
- You may use a calculator and scratch paper if necessary.
- Good Luck!

### Test Questions

1. You give your new assistant a fiber of yellow-ish hair to identify, but she has no matches and her microscope camera is broken. She brings it back to you and you decide to rule options out by measuring it. The medulla of the hair measures  $89\ \mu\text{m}$  in diameter, while the whole hair shaft measures  $142\ \mu\text{m}$  in diameter. You determine that this hair is least likely to be from a...
  - a. Dog
  - b. Cat
  - c. Human
  - d. Horse
2. Which of the following compounds would NOT light up a conductivity meter when dissolved in water?
  - a. Ammonium chloride
  - b. Glucose
  - c. Sodium bicarbonate
  - d. Boric acid
3. You perform flame tests on the following four compounds:  
Calcium sulfate, magnesium sulfate, calcium carbonate, sodium carbonate
  - a. Two give off orange-red flames when put through fire. Which two, and why?
  - b. Magnesium sulfate and calcium sulfate due to the shared sulfate anion
  - c. Calcium sulfate and calcium carbonate due to the shared calcium cation
  - d. Sodium carbonate and calcium carbonate due to the shared carbonate anion

4. Which of the following recyclable plastics polymerizes by condensation rather than addition?
  - a. Polycarbonate
  - b. Polypropylene
  - c. Polystyrene
  - d. Polymethyl methacrylate
  
5. True/false: Under a microscope, you would see more ovoid bodies along the edges of cow hairs than horse hairs.
  - a. True
  - b. False
  
6. Meredith's favorite shirt is her favorite because she loves the way the fabric feels. She wants to buy more shirts with this type of fabric. Sadly, the tag has fallen off her favorite shirt, so she needs another way to identify the fabric used. She decides to cut off a bit of the shirt and perform a burn test on it. Surprisingly, the results she finds don't match up with any of her notes for common fabrics! What is a possible explanation for these findings?
  - a. Her favorite shirt may contain a blend of fibers, making the test results unreliable or uncomparable to typical fabric burn tests.
  - b. Her favorite shirt may have chemical finishings or coatings, making the test results unreliable or uncomparable to typical fabric burn tests.
  - c. Her favorite shirt may be made of animal fibers, making the test results unreliable or uncomparable to typical fabric burn tests.
  - d. All of the above
  - e. A and B only
  - f. B and C only

**Use the following image to answer questions 7-9:**



7. The above mass spectrogram was created using which of the following gases?
  - a. Methane (CH<sub>4</sub>)
  - b. Ethane (C<sub>2</sub>H<sub>6</sub>)
  - c. Propane (C<sub>3</sub>H<sub>8</sub>)
  - d. Butane (C<sub>4</sub>H<sub>10</sub>)
  
8. While the highest peak on the graph is at 16 m/z, there is a very small peak at 17 m/z. What is the reason for this miniscule peak at 17 m/z?
  - a. Isotopes of the gas with more hydrogens are common.
  - b. Isotopes of the gas with fewer hydrogens are common.
  - c. Isotopes of carbon with more neutrons are common.
  - d. Isotopes of hydrogen with more neutrons are common.

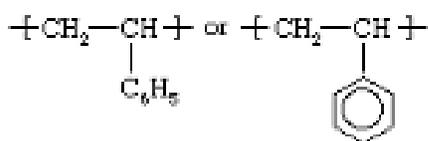
9. Which of the following compounds has a molecular weight of DOUBLE the approximate molecular weight of the gas whose mass spectrogram is above?
- $N_2$
  - $O_2$
  - $Br_2$
  - $Cl_2$

Below are steps involved in a polymerase chain reaction (PCR):

- Separation of DNA strands through denaturation
  - Annealing of a primer to a complementary strand of DNA
  - Synthesis of a new DNA strand Taq Polymerase
  - Amplification of DNA through repeated cycles of steps I-III
10. A murder occurred at a restaurant, and you are tasked with collecting and analyzing biological evidence from the scene. The detective on site believes that the cause of the murder was an escalated knife fight over the last garlic breadstick. It is theorized the fight began over the table, where multiple stabbings between both individuals occurred in the hands and arms. A waiter tried to intervene, and was stabbed in the arm while leaning over the table. Blood is splattered across the table, and there is a large pool by the victim's body. The detective asks you what blood samples you will take, and if you will perform a PCR analysis on them. How do you respond?
- The blood from the table will be analyzed using PCR because PCR alone can distinguish the DNA of the victim, the waiter, and the murderer.
  - The blood from the table will be analyzed using PCR, and also using electrophoresis, because PCR alone will not distinguish between the DNA of the victim, the waiter, and the murderer

11. The image below represents the general chemical structure of what common type of plastic?

- PS
- PP
- PVC
- PC



12. Which of the following minutiae are NOT found in the following fingerprint?



- Direction
- Ridge Ending
- Island
- Lake

13. Steven accidentally leaves his oven mitts inside the oven when baking his cake! As they burn, a smell of burning paper wafts through the air. The flame was slow burning and yellow. What were his oven mitts most likely made out of?
- Wool
  - Cotton
  - Nylon
  - None of the above

14. Which of the following is NOT a synthetic fiber?
- Rayon
  - Nylon
  - Acrylic
  - Spandex
15. While you are investigating a crime scene, you notice a bright yellow flame is roaring in the distance. From this, what can you hypothesize about the flame?
- Boric acid is being consumed by a flame
  - Sodium metal is being consumed by the flame
  - Lithium metal is being consumed by the flame
  - Calcium metal is being consumed by the flame
16. While you continue to investigate the crime scene, you notice another flame roaring in the distance, this time bright green. From this, what can you hypothesize about the flame?
- Boric acid is being consumed by a flame
  - Sodium metal is being consumed by the flame
  - Lithium metal is being consumed by the flame
  - Calcium metal is being consumed by the flame
17. You are investigating a fireplace at the scene of a crime. You notice a burnt polycarbonate magnifying lens among the ashes. From this, you deduce that the culprit has poor vision. When the lens was being burned, what would have been the color of the flame?
- Yellow
  - Green
  - Blue
  - Orange
18. There are fingerprints found in a block of clay. What type of prints are they classified as?
- Visible print
  - Impression
  - Latent
  - Dusting
19. This method is primarily used for fingerprinting when surfaces are wet. It primarily reacts with the lipids present in fingerprints.
- Iodine Fuming
  - Ninhydrin
  - Cyanoacrylate fuming
  - Small particle reagent
20. A body has been dead for less than a day. What species of insect would you most likely find on the body?
- Rove Beetles
  - Cheese Skippers
  - Blow Flies
  - Carrion Beetles

21. If six days total have passed since the time of death, at what stage of their life cycle would the blow flies found near the body be?
- Egg
  - Larva
  - Pupa
  - Adult

**Use the following descriptions of flame tests for individual fibers to answer questions 22-26:**

- Strong odor similar to burning hair; leaves brittle ash; self-extinguishing
  - Odor similar to burning wood; leaves soft ash; not self-extinguishing
  - Odor similar to celery; leaves no ash; self-extinguishing
  - Odor similar to burning paper; leaves feathery grey ash; not self-extinguishing
  - Strong fishy odor; leaves no ash; not self-extinguishing
22. Which of the above descriptions corresponds with the burning of nylon fibers?
- I
  - II
  - III
  - None of the above
23. Which of the above descriptions corresponds with the burning of rayon fibers?
- II
  - III
  - IV
  - None of the above
24. Which of the above descriptions corresponds with the burning of vegetable fibers?
- I, II, III
  - I, III
  - II, IV
  - II, IV, V
  - None of the above
25. Which of the above descriptions corresponds with the burning of silk fibers?
- I
  - III
  - V
  - None of the above
26. You decide to further inspect the fiber used to create the description labelled "IV" above. Upon looking under a microscope, what do you expect to see?
- Thin, smooth cylinders
  - Flat, twisted ribbons
  - Scaly corkscrews
  - Cylinders with dog-bone shaped ends

27. Which of the following hairs has coronal scales on the cuticle?
- Bat
  - Horse
  - Cow
  - Squirrel
28. Which of the following answers incorrectly pairs a substance with the color of its corresponding flame test?
- Potassium: light purple
  - Boric acid: faint green flame
  - Sodium: yellow flame
  - Calcium: yellow/red flame
29. True/False: A solution containing sucrose will react with Benedict's solution.
- True
  - False
30. You are attempting to dissolve a sample of sodium chloride in water. The sample is not all dissolving, even though you know sodium chloride is soluble in water. Which of the following actions would not result in a larger amount of the sodium chloride sample dissolving?
- Heating the solution gently
  - Adding more water to the solution
  - Stirring the solution gently
31. During gel electrophoresis, DNA samples migrate to the \_\_\_\_\_ electrode because DNA is \_\_\_\_\_ charged.
- Positive; Positively
  - Negative; Negatively
  - Positive; Negatively
  - Negative; Positively

# ANSWER KEY

- |     |          |     |          |     |          |
|-----|----------|-----|----------|-----|----------|
| 1.  | <b>C</b> | 15. | <b>B</b> | 29. | <b>B</b> |
| 2.  | <b>B</b> | 16. | <b>A</b> | 30. | <b>C</b> |
| 3.  | <b>B</b> | 17. | <b>D</b> | 31. | <b>C</b> |
| 4.  | <b>A</b> | 18. | <b>B</b> |     |          |
| 5.  | <b>A</b> | 19. | <b>D</b> |     |          |
| 6.  | <b>E</b> | 20. | <b>C</b> |     |          |
| 7.  | <b>A</b> | 21. | <b>D</b> |     |          |
| 8.  | <b>C</b> | 22. | <b>C</b> |     |          |
| 9.  | <b>B</b> | 23. | <b>A</b> |     |          |
| 10. | <b>B</b> | 24. | <b>C</b> |     |          |
| 11. | <b>A</b> | 25. | <b>D</b> |     |          |
| 12. | <b>C</b> | 26. | <b>B</b> |     |          |
| 13. | <b>B</b> | 27. | <b>A</b> |     |          |
| 14. | <b>A</b> | 28. | <b>B</b> |     |          |



*Practice Test Developed with Science Olympiad at Cornell*



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