IMHOTEP'S LEGACY ACADEMY

8.2 Blood Detection Using Luminol

Grade 8 Activity Plan

Reviews and Updates

8.2 Detecting Blood Using Luminol

Purpose:

1. To understand what a chemical reaction is.
2. To learn about characteristics of chemical reactions and balancing of chemical equations.
3. To understand how Luminol is used to detect blood and the chemical reaction involved

Keywords/concepts: chemical reactions, reactants, products, luminol, chemiluminescence, catalyst, haemoglobin

Curriculum outcomes: 304-9.

Take-home item: glow-sticks

Segment	Detail
African Proverb and Cultural Relevance (5 min.)	"If you burn a house can you conceal the smoke?" **Buganda, Uganda**
Pre-test (10 min.)	Assess understanding of chemical reactions; encourage students to voice their ideas of day-to-day occurrences of chemical reactions.
Background (10 min.)	More about chemical reactions; make this topic more familiar by using as many real life examples as possible. Introduce Luminol. Use glow sticks as an aid.
Activity 1 (10 min.)	Illustrate the concept of evolution of gases in a chemical reaction using vinegar and baking soda.
Activity 2 (10 min.)	Illustrate chemiluminescence using glow-sticks, bleach and Luminol.
Activity 3: CSI (25 min.)	Setup a crime scene, make students act as detectives and encourage critical thinking. A sample crime scene set up is included but could be tweaked for more excitement and learning. Arrive at target site early to set up crime scene. Mentor request that a police officer attends to make this more fun.
Follow-up (10 min.)	Re-assemble and discuss the findings.
Post-test (10 min.)	Ask probing questions to assess students' on concepts that were introduced during the session.

Suggested interpretation of proverb: Whatever is done even in secret always find its way to the open. One's secret efforts to be successful will always be revealed in good grades, while laziness and bad habits more often are disclosed in failure. As seen in this activity, every committed crime leaves trails behind for investigators.

BACKGROUNG INFORMATION

A chemical reaction is the combination of two or more reactants to form an entirely new product. Another way to define is a chemical reaction breaks materials apart and makes new materials from the original parts. The rusting of iron, the burning of gasoline, the cooking of sugar are all
examples of chemical reactions.

For a reaction to take place a chemical change must occur. A chemical change produces a new substance with different chemical properties. That is you start with one compound and turn it into another. Colour changes, solid formation, bubbles of gas formation, and colour disappearance are indicators of chemical changes. For example, a steel garbage can rusting is a chemical reaction. That rusting happens because the iron (Fe) in the metal combines with oxygen (O_2) in the atmosphere.

Catalysis is the change in rate of a chemical reaction due to the participation of a substance called a catalyst. If you put pure hydrogen gas (H_2) and pure oxygen gas in a room, they can be involved in a reaction. The slow rate of reaction will have the atoms bonding to form water very slowly. If you were to add a spark, those gases would create a reaction that would result in a huge explosion. Chemists would call that spark a catalyst.

How luminal works
The basic idea of luminol is to reveal these traces with a light-producing chemical reaction between several chemicals and haemoglobin, an oxygen-carrying protein in the blood. The molecules break down and the atoms rearrange to form different molecules. In this particular reaction, the reactants (the original molecules) have more energy than the products (the resulting molecules). The molecules get rid of the extra energy in the form of visible light photons. This process, generally known as chemiluminescence, is the same phenomenon that makes fireflies and light sticks glow.

The "central" chemical in this reaction is luminol, a powdery compound made up of nitrogen, hydrogen, oxygen and carbon. Mix the luminol powder with a liquid containing hydrogen peroxide and pour the liquid into a spray bottle. The hydrogen peroxide and the luminol are actually the principal players in the chemical reaction, but in order to produce a strong glow, they need a catalyst to accelerate the process. The mixture is actually detecting the presence of such a catalyst, in this case the iron in haemoglobin. To perform a luminol test, simply spray the mixture wherever you think blood might be. If haemoglobin and the luminol mixture come in contact, the iron in the haemoglobin accelerates a reaction between the hydrogen peroxide and the luminol. With iron accelerating the process, the light is bright enough to see in a dark room.

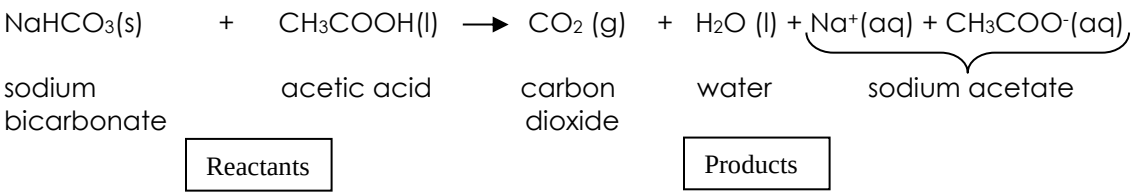
Activity1: Inflating a Balloon Without Blowing It

Purpose: To learn about characteristics of chemical reactions and balancing of chemical equations.

Suggested format: mentor should carry out this experiment, encouraging students to observe the setup and note their observations.

Items	**Quantity (1 mentor only)**
Baking soda	2 tablespoons
Vinegar	100ml
200ml Conical flask or Recycled bottle	1
Balloon	1
Spoon	1
Small Funnel	1

Consider the reaction between baking soda and vinegar. The overall reaction is displayed below:



Procedure:

1. Using a funnel, put 2 tablespoons of vinegar into the balloon.
2. Fill the conical flask to the 100ml mark with vinegar.
3. Taking care not to pour out the baking soda, pull the opening of the balloon over the top of the conical flask.
4. While holding the mouth of the balloon against the flask, tilt the balloon upright such that the baking soda is emptied into the flask. Continue to hold the balloon against the flask.
5. Ask the students to tell you what they observe and what they think is happening. Go back to the equation and discuss how the gas is been produced and that is what is blowing up the balloon.

Activity 2: Glowing Tornadoes

Purpose: To know understand how Luminol is used to detect blood and the chemical reaction involved.

Suggested format: mentor should perform experiment and encourage student participation.

Items	**Quantity (for mentor)**
Glow sticks	10
Luminol kit	1
250ml Beaker	1
Magnetic stirring plate	1
Magnetic stir rod	1
Bleach	100ml

Procedure:

Part A:

1. Break-up glow sticks to illuminate them.
2. Describe what needs to occr for the stick to glow

Part B:

1. Pour about 150ml of Luminol solution into a 250ml beaker.
2. Setup magnetic stirrer, drop the stir bar into the Luminol solution and turn the stirrer on.
3. Slowly add bleach directly into the vortex of the Luminol being stirred, as the Luminol is being oxidized, watch for chemiluminescence.
4. Discuss what has occurred with the students

Additional resource:

http://science.howstuffworks.com/luminol.htm

Activity 3: CRIME SCENE INVESTIGATION

Purpose: to use luminal in a crime scene setting.

Items	**Quantity**
Luminol kit	1
250ml Beaker	1
Magnetic stirring plate	1
Magnetic stir rod	1
Bleach	100ml
Crime scene props	By discretion
Gloves	10 pairs
Spray bottles	2

Procedure:

1. **Set up the scenario before the lesson begins**. Use at least 1 item from each suspect such as a shoe or piece of clothing to act as evidence. Put simulated blood (bleach) on at least one item that belongs to the perpetrator. Prepare two spray bottles with luminol solution.
2. Outline the story/crime to the students. Let them discuss the scenario and try to figure out who did the crime.
3. Let the students spray each item with luminal to find the perpetrator. Students should be wearing gloves.

NOTE TO MENTOR: The crime scene story line below can be changed, this is just a sample! Use your imagination and make it as exciting as possible. See poster inside the bin, which can also be changed as well.

SUGGESTED CRIME SCENE STORY LINE: NBA ALL STAR'S SAGA

The 2011 NBA finals between the L.A Lakers and Miami Heat was an event the fans were anxiously anticipating. People all over the world were placing bets on who would take the title this year. The question on everybody's mind was if Kobe would be able to lead his team to victory yet again, or would the newly formed trio, Lebron James, Chris Bosh, and Dwayne Wade be too much for him to handle?

It was three hours before the game and the janitor, Timmy Doe, was on the court sweeping the floor. Final touches were being made to ensure that everything ran as smoothly as possible and the seats were ready for when the fans started arriving. The concession stands were preparing the food and snacks for the game and the workers were beginning to arrive. At this time, the preparation for the game was going was going smoothly as planned. Two hours before the game, however, was when everything took a turn for the worst.

Timmy Doe was walking back out onto the floor to do his final checks on the floor before the fans began arriving when he couldn't believe what he saw. In front of him, lying at his feet, were hundreds of tiny pieces of shattered glass. After further examination of the scene, Timmy saw little spots of blood scattered along with the glass and the basketball net had been bent at an awkward angle and was in no way fit to hold a final game in less than two hours. Then it started to hit him how much trouble he could get in for letting this happen. Not only was he to ensure the floors were clean, but he was responsible to watch and make sure that no intruders stepped onto the floor until the game began. Technically, he was the only person allowed on the floor during this time period. Poor Timmy Doe was beginning to rethink the idea of calling for help. There was only one thing he could do. He had to solve the mystery for himself and do it fast, before anybody else saw the disaster and blamed him for the crime.

It is your job to help Timmy solve this mystery before he gets into trouble and gets blamed for this disaster. The fate of Timmy's job, game, the basketball players, and the fans lies in your hands now. It is time to use your detective skills and knowledge about luminal to help you solve this mystery!

Suspects:

Lebron James - A former star player on the Cleveland Cavaliers is now forced to share the spotlight with two other star players Chris Bosh and Dwayne Wade. Rumours have it that Lebron is still stuck in his role of being the "boss" of his team and having to share rank is not coming easy to him. What started off as a little bit of healthy competition is slowly turning into a sickly battle of jealousy and an ugly fight for honour and praise. Is the pressure becoming too much for Lebron to handle?

Chris Bosh – Although Chris doesn't get as much publicity as Lebron, he is undoubtedly a talented player. Chris has become quite annoyed with Lebron's childish attitude lately and is secretly looking for a way to put him back in his place. Could sabotaging tonight's final game be the way to do that?

Dwayne Wade – As one of the original stars on his team, it has been a little strange adapting to his new team members. It has hurt his ego a little bit now that the fuss is not all about him, and it has also caused him to change his style of play a little bit. It would be a lie to say that Wade hasn't had any arguments or disagreements with Bosh or James, but for the most part they all seem to have one common goal; to beat Kobe. Would he really go as far as breaking the net before the final game just to reach that goal though?

Kobe Bryant – L.A Laker's star, loved by many, hated by just as much feels a ton of pressure going into the game tonight against Miami. Yes, he is a star player, but tonight he is facing three star players and he does not want to let his team down. Plus, wining against a team of arguably three of the best players in the

league will make him look like a basketball genius. Would Bryant stoop that low and ruin the net just because the pressure got to be too much for him?

Psycho Fan "Rosay Donaldson" - Psychotic Rosay has been stalking Kobe Bryant since he first started playing for the Lakers. The thought of Kobe's team losing and him being devastated is a nightmare for her and she would do anything in her power to ensure that it does not happen. Would she go as far and sabotaging the final game just so her crush can have an extra day to prepare for his game?

Answer: Dwayne Wade. He was only practicing for the game and when he went to dunk, he must have used too much power and the next thing he knew, he was sprawled on the floor with flying, shattered pieces of glass surrounding him. He had cuts on his hands and knees, but for the most part he was okay. He left the gym to find somebody to clean up the damage and tend to his wounds. Timmy Doe just happened to walk into the gym minutes after Dwayne had made the mistake. About fifteen minutes Wade returned with some help and Timmy Doe was relieved that it was only an accident. The net was fixed and the game was able to start as scheduled.

Sample Pictures for Whodunit Mystery……


HEAT
1
HEAT
3
HEAT
6


SOLE
COLLECTOR
UNDER ARMOUR