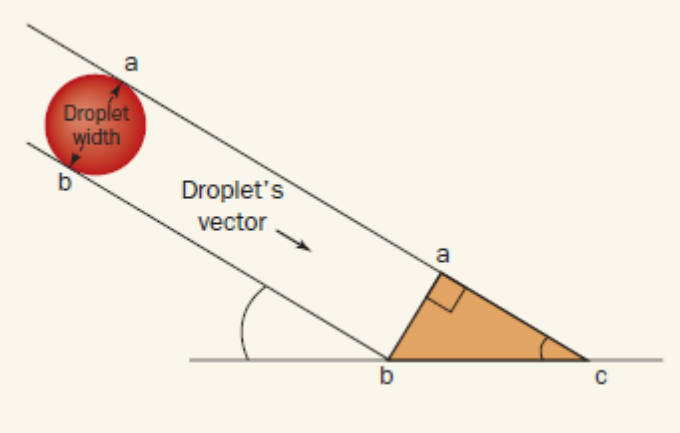
**Names** _____ **Per.** _____ **Date** _____

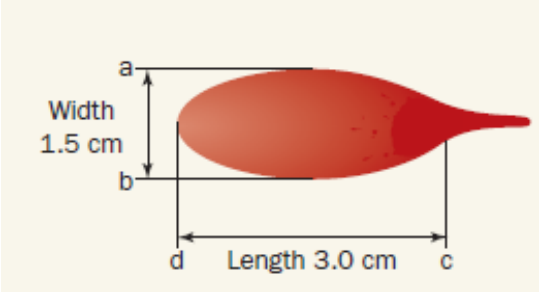
**Chapter 11- Lab #2- Blood-Spatter Impact Angle**

**Background:**
Blood-spatter analysis is a powerful forensic tool. Spatter patterns allow investigators to reconstruct what happened at a crime scene. The blood-spatter patterns "tell a story" of the crime and help the investigators determine if eyewitness accounts are consistent with the evidence. To study impact angle, you will need to use trigonometry math skills. Use trigonometric functions to determine the impact angle for any given blood droplet.




*By accurately measuring the length and width of a bloodstain, the impact angle can be calculated using the sin formula below. SOH*

(c) = opposite = width (a–b)
hypotenuse length (b–c)
(c) = 1.5 cm
3.0 cm
(c) = 0.5
Arcsine (.5) = 30°




***To determine the angle of impact, take the inverse sin (arcsine) of 0.5, which is 30 degrees.***

**Objectives:**
1. Create blood-spatter patterns from different angles of impact.
2. Examine the relationship between angle of impact and blood-spatter patterns.
3. Calculate the angle of impact from blood-spatter patterns.

**Materials:** (per group of four students)
1 dropper bottle of simulated blood
9 five-by-eight-inch index cards
2 meter sticks
Butcher paper
4 white boards
1 protractor
1 roll masking

**Safety Precautions:**
Cover the floor in the work area with newspaper. Simulated blood may stain clothing and furniture, so care should be taken to avoid spilling blood.

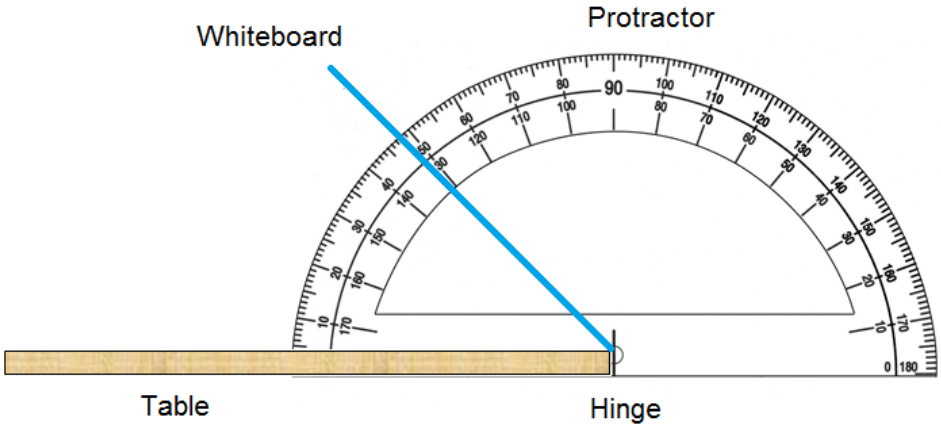
**Procedure:**
**Creating blood spatter from different angles of impact**
In this activity, you will drop blood onto 5 × 8 index cards set at various angles. You will drop the blood from 30 cm from the point of impact on the 5 × 8 card. You will observe how the angle of impact affects the size and shape of the blood spatter. You will drop simulated blood onto 5 × 8 cards that are set to represent impact angles of**: 10 degrees 20 degrees 30 degrees 40 degrees 50 degrees 60 degrees 70 degrees 80 degrees 90 degrees**

You will be working in groups. Each group will prepare blood spatter from two different angles of impact. Divide the work as follows:
***Person 1: 10 degrees and 50 degrees***
***Person 2: 20 degrees and 60 degrees***
***Person 3: 30 degrees and 70 degrees***
***Person 4: 40 degrees and 80 degrees and 90 degrees***

**To simulate blood being cast off during bleeding, the following process is used.**

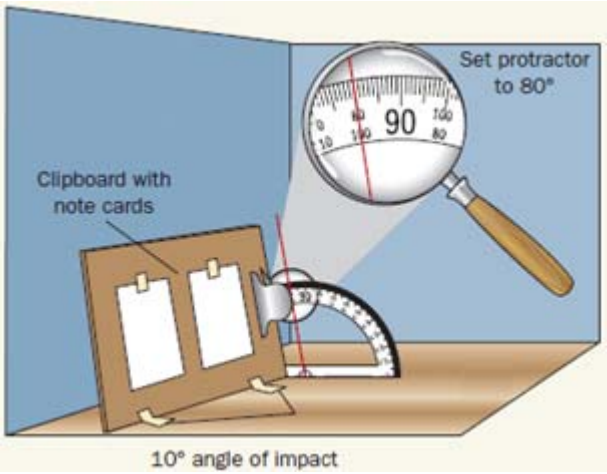
1. Turn a 5 × 8 index card over so that no lines are visible.
2. Tape two 5 × 8 index cards to the whiteboard as instructed by the teacher.
3. Label the cards with your initials on the top right corner, along with the angle of impact that you will be using.
4. Tape the edge of the whiteboard to the edge of the table to create a hinge.

Impact Angle Apparatus




5. Set the zero mark of your protractor at the hinge between the whiteboard and the table.

**Note:**
To calculate the desired impact angle, set the protractor reading for 90° minus the desired angle. For example, if the desired angle of impact is 10°, then you will subtract 10° from 90° and set your whiteboard at 80° (90° - 10° = 80°)



6. Start with the first angle of 10°. Calculate the protractor setting.
7. From a height of 30 cm, carefully, drop two drops of blood (Trial 1 and Trial 2) side by side on the index card labeled 10°.
7. While the first card is drying, reset the angle of impact of the whiteboard to 50° and repeat Step 7.
8. Allow cards to dry completely. While the cards are drying, carefully measure the widths and lengths of each trial for each of your given angles.
9. Record your measurements on the Data Table provided. You will need to calculate the average widths and heights based on your trials. Next, you will divide the average width by the average length to get the ratio. Finally, you will take the arcsine of the ratio to calculate the actual angle of impact. Be sure that you have set your calculator to RAD (radians).
10. Each person remaining repeat Steps 6-9 for their given angles.

## Data Table

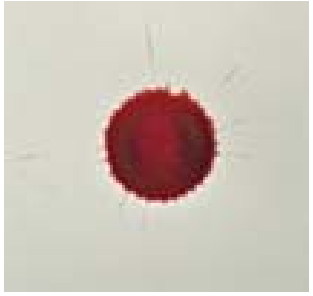
| Expected Impact Angle | Length (mm) | | | Width (mm) | | | Ratio = W/L | Actual Impact Angle |
|---|---|---|---|---|---|---|---|---|
| | 1st Trial | 2nd Trial | Avg. Length | 1st Trial | 2nd Trial | Avg. Width | Avg. W/L | |
| 10° | | | | | | | | |
| 20° | | | | | | | | |
| 30° | | | | | | | | |
| 40° | | | | | | | | |
| 50° | | | | | | | | |
| 60° | | | | | | | | |
| 70° | | | | | | | | |
| 80° | | | | | | | | |
| 90° | | | | | | | | |

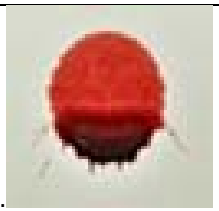
## Analysis Questions

Directions: The following blood spatters were collected at a crime scene. It is your challenge to determine the impact angle of each blood spatter pattern.

Procedure:

1. Measure length in cm (remember, length is longer than width).
2. Measure width in cm (the shorter direction if there is one).
3. Calculate Ratio by diving width/length (your answer should be equal to 1 or **less than 1**).
4. Calculate the impact angle by taking the inverse sine of R ($\sin^{-1}R$) or arcsine(R).

| **Blood Spatter** | **Length (cm)** | **Width (cm)** | **Ratio = W/L** | **Calculated Impact Angle ($\sin^{-1}$Ratio)** |
|---|---|---|---|---|
| 1.  | | | | |
| 2.  | | | | |
| 3.  | | | | |
| 4.  | | | | |

| Blood Spatter | Length (cm) | Width (cm) | R = W/L | Calculated Impact Angle ($\sin^{-1}R$) |
|---|---|---|---|---|
| 5.  | | | | |
| 6.  | | | | |
| 7.  | | | | |
| 8.  | | | | |