

# THERE'S BEEN A CRIME!

As experts in physics, you have been recruited by the local Police Department to help solve a recent crime

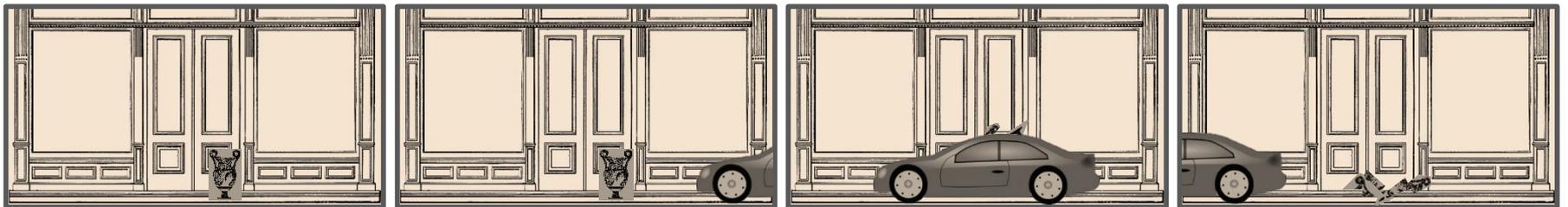
Early this morning around 6:15 am, Wilma Wilshire, was preparing to transfer an empty antique vase that once belonged to the city's first mayor, David Daisy. It was scheduled to be installed in the lobby of the Gardens Apartment Complex as part of a traveling antiques exhibit. Wilma parked around the corner of the apartment lobby's front door, unwrapped the precious antique from its packaging, and started to walk it toward the entrance. Just before she made it through the lobby doors, she remembered that she left her van running. Since the street was pretty much deserted so early in the morning, she decided to set the vase down on the sidewalk for a moment while she ran to her van around the corner to turn off the engine. While she was walking back, she saw a blue car zip by and heard a loud crash. To her horror, she returned to find her priceless historic vase destroyed beyond repair and scattered among a mess of ceramic, potting soil, and red geraniums.

The policeman that arrived first to the scene noticed a security camera outside of the ATM across the street and quickly requested the footage in hopes of catching the perpetrator in the act. Unfortunately, the camera footage seems worthless as the crash must have occurred in the exact moment that the blue car drove past. You can even see some of the debris flying through the air at this moment.

The apartment manager noted that the red geraniums scattered about the crime scene appeared to be of the exact same variety as the potted plants that the apartment provided to each resident to place on their outdoor patio. Quick to remove himself from the scenario, he further explained that there is no way that one of these plants would have toppled on its own, it would have had to have been intentionally tampered with.

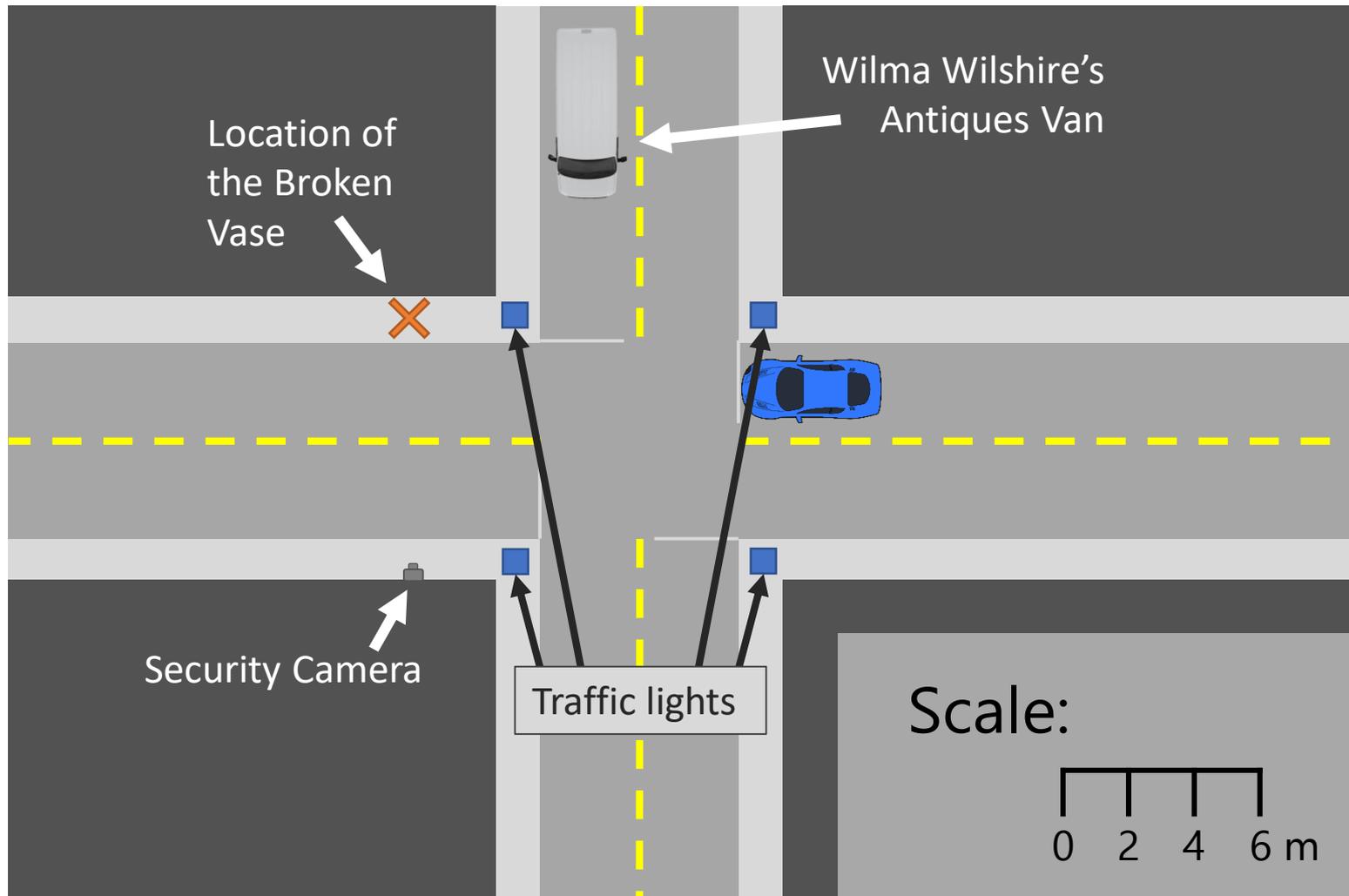
**Your task is to assemble clues and use evidence to figure out who is responsible for the destruction of this historic vase.**

## Security Camera Footage:



# CLUE #1

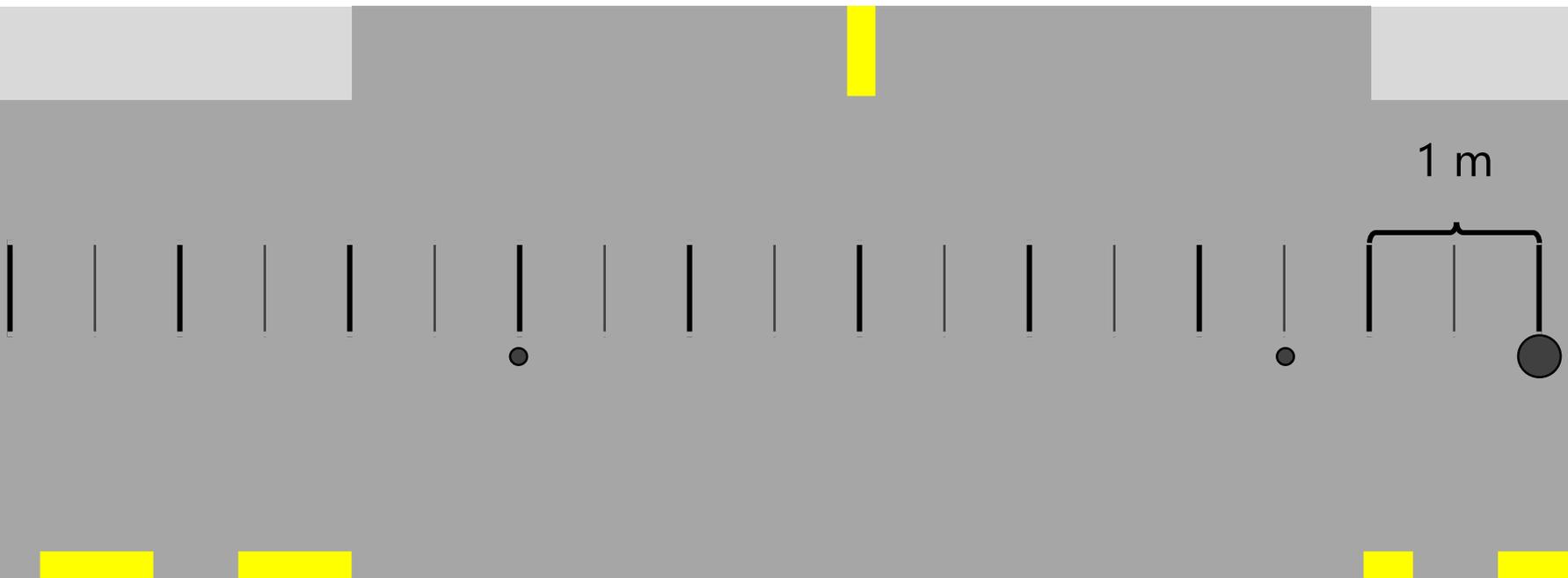
## The Scene of the Crime



# CLUE #2

## The Car Trail...

One of the investigators notices something and calls you over. It turns out that as the car captured in the security camera footage was accelerating from the traffic light, it was also dripping oil at a constant rate of exactly 1 drop per second. A measurement scale has been overlaid to help you translate this diagram into quantifiable data. If the large puddle represents the location when the car was stopped at a stoplight, **use this image of this scene to calculate the acceleration of this mystery car.**



# CLUE #3

## Apartment Balconies



16 <sup>th</sup> Floor	3 m
15 <sup>th</sup> Floor	3 m
14 <sup>th</sup> Floor	3 m
13 <sup>th</sup> Floor	3 m
12 <sup>th</sup> Floor	3 m
11 <sup>th</sup> Floor	3 m
10 <sup>th</sup> Floor	3 m
9 <sup>th</sup> Floor	3 m
8 <sup>th</sup> Floor	3 m
7 <sup>th</sup> Floor	3 m
6 <sup>th</sup> Floor	3 m
5 <sup>th</sup> Floor	3 m
4 <sup>th</sup> Floor	3 m
3 <sup>rd</sup> Floor	3 m
2 <sup>nd</sup> Floor	3 m
1 <sup>st</sup> Floor	3 m
Lobby	4.5 m

You ask the management for a blueprint and find that the lobby level is 4.5 m tall while each floor beyond that is 3 m tall.

The railing of the apartment balcony is 1 meter above the floor level.

**Develop a math equation to calculate the balcony railing height for any level.**

*Examples:*

*The 5<sup>th</sup> floor balcony railing is 17.5 meters above ground level*

*The 8<sup>th</sup> floor balcony railing is 26.5 meters above ground level*

# CLUE #4 The Suspects

After examining all of the balconies directly above the crime scene, you discover that the 8<sup>th</sup>, 12<sup>th</sup>, and 16<sup>th</sup> floor balconies are all missing their apartment provided potted plant, so you send someone to interview them. Here are their notes:

## **Suspect #1 | Room 817 – Rachel Rose**

- Very political. Tried to change the topic to the current mayor several times during the conversation
- Extremely messy apartment, had to clear a place to sit down for the interview
- Wilma Wilshire's cousin

## **Suspect #2 | Room 1217 – Don Daisy**

- Had a hushed conversation on the phone while we were checking things out
- Has lived in this apartment for 14 years
- Well known in the community as a news anchor for the local news station

## **Suspect #3 | Room 1617 – Freddy Flower**

- Works late shift at the diner down the street and doesn't get home until 3:00 am
- Recently moved in and doesn't really have any connections in town yet.
- Claims to prefer staying indoors and doesn't use the balcony so he gave his plant away

# CLUE #5

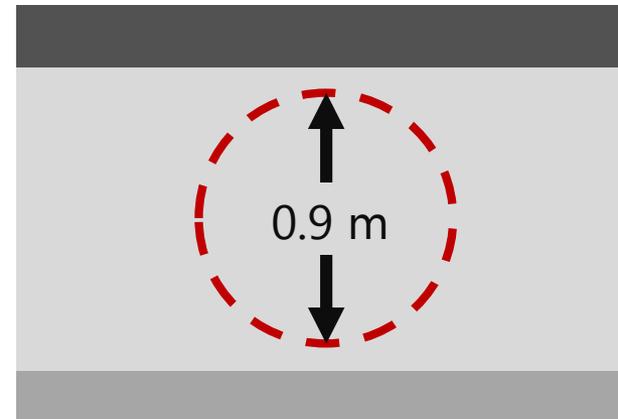
## The Man in the Car

After a little time, police were able to ID and track down the man in the car and bring him in for questioning. His name is Peter Petunia, and works as an Uber driver in the city so he is usually driving around early in the morning. According to Peter, he had received a phone call from an unknown number the day before. This mystery caller had a series of detailed instructions for Peter to follow on his morning driving that day. The caller was very clear that after waiting at the stoplight outside of Gardens Apartments, Peter was supposed to accelerate constantly. He didn't really know why but he seemed to remember hearing the caller say something about dropping something at the same time as the light turned green in order for the timing to work...



*You check out the car and in addition to the oil leak in the engine compartment, you notice that the middle of the passenger door is covered with dirt, ceramic pieces, and flower petals.*

*This same type of debris was found on the sidewalk in the shape shown below:*

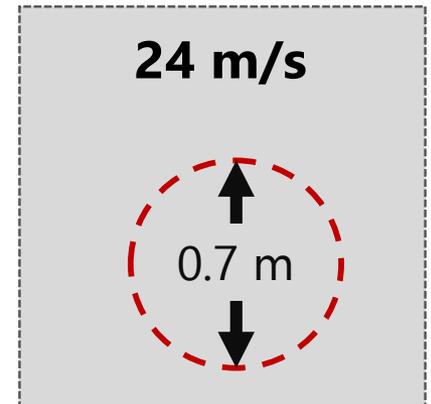
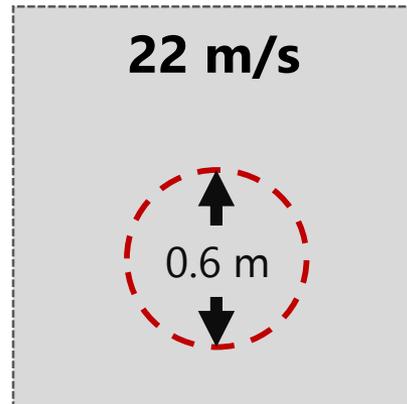
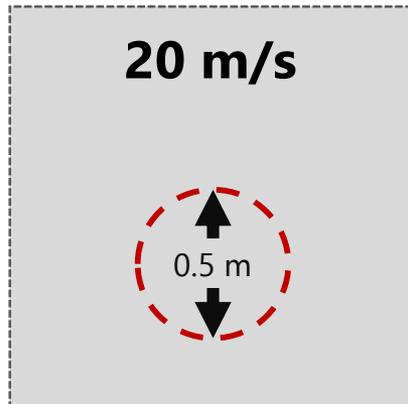
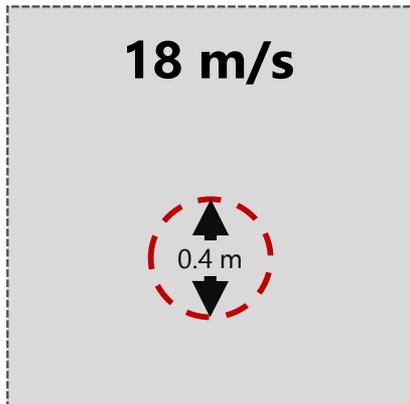


# CLUE #6

## Drop Test

You hear from the crew on the scene that there is a significant amount of debris left from the impact of the plant. They believe that this debris pattern could be used to help describe the events of the crime. You decide to do a little test to figure out if a debris pattern can tell you more information about the impact speed. You simulate the impact by launching the same brand of potted plant towards the concrete at different impact velocities. Not knowing the exact nature of the debris pattern observed by your team, **you decide to develop an equation to relate debris diameter to impact speed.**

Data below taken from the lab testing at different impact velocities:



# EVIDENCE SHEET

What does the evidence tell you? What do you know?

How might this evidence help solve the mystery?

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# CONCLUSION

It is our professional opinion that the police should arrest Suspect #\_\_\_\_ because