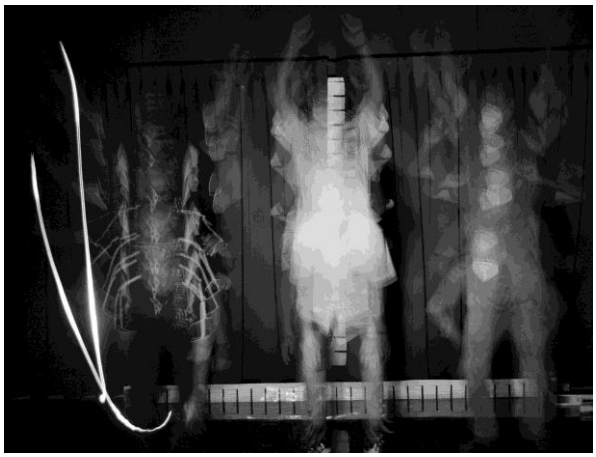
# ATAR PHYSICS
# 2021
# PROJECTILE MOTION INVESTIGATION

**NAME**: _____

**TEACHER**: **Mr Myerson**

**MARKS**: **/35**



**Instructions:**

1. Do not turn this paper over until you are told to do so
2. Answer **all** the questions in the spaces provided
3. All questions do not carry equal numbers of marks
4. Marks available for each question are shown
6. Use the appropriate number of significant figures for estimations
7. An approved scientific calculator may be used
8. **Write with a blue or black ink pen.** You may use a lead pencil to draw diagrams.

**Formulas which may be of use:**

$v = s/t$ $F = ma$ $g = 9.80 ms^{-2}$

$v = u + at$ $v^2 = u^2 + 2as$

$s = ut + \frac{1}{2} at^2$

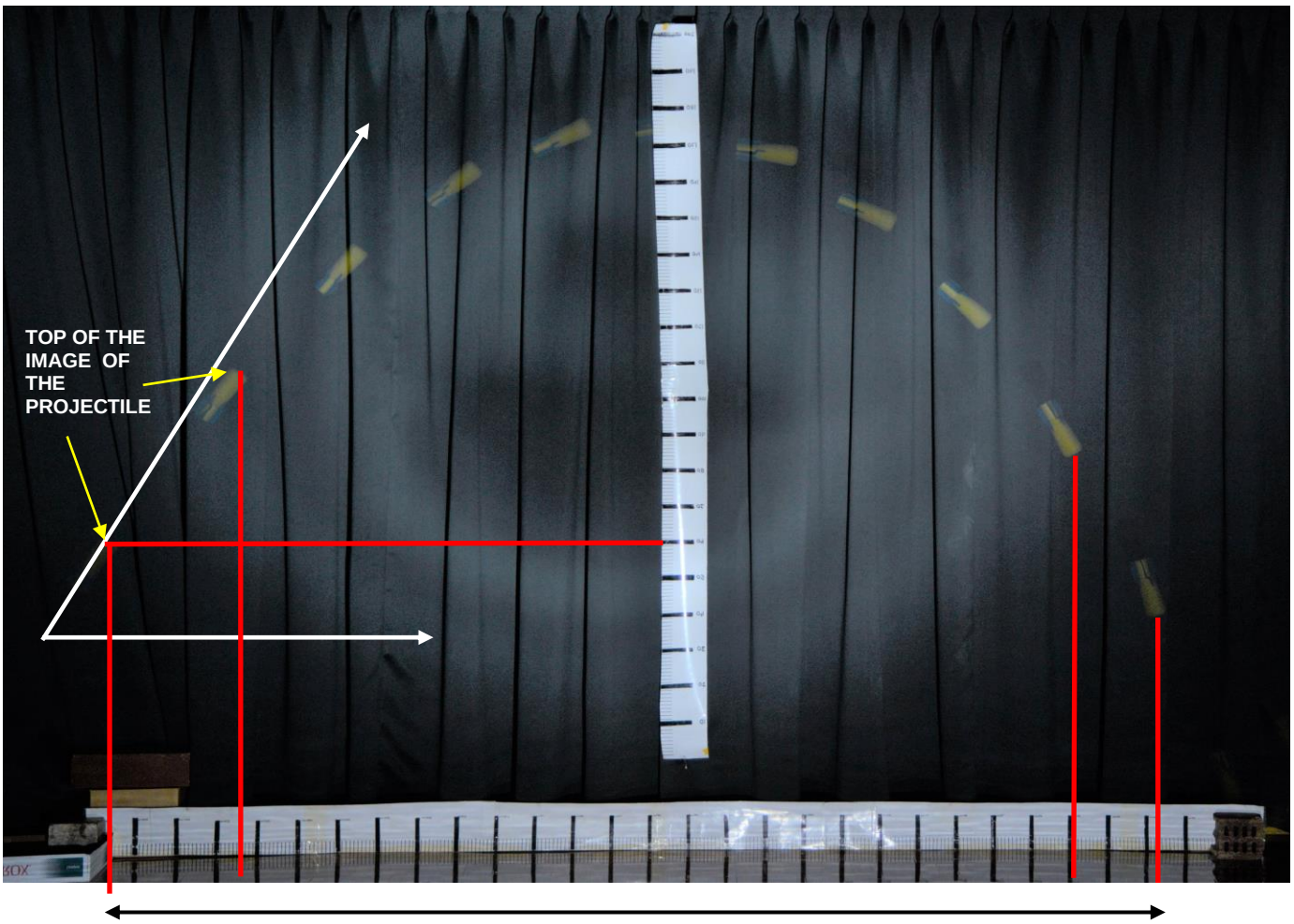
## INVESTIGATION 35 marks

AIM: To use the photographs taken to investigate the effect of resistance on the motion of a test object undergoing projectile motion.

*Clearly show how you have made your measurements from the photos and show your calculations in detail.*

Note: Mass of toy missile = **5.842 g** Distance between lines on scale: 10cm (0.10m)
Strobe setting: 10 Hz (0.1 sec between flashes.)

PHOTO: (Some lines have been drawn to help with your measurements).




Total horizontal displacement = _____

Total flight time = _____ (First to last image)

(2 marks)

1.0 Determine the initial horizontal velocity of the projectile. Use the first two images. (Lines have been drawn from the top of the first two projectile images).

(1 mark)

$u_h = s/t$ = _____ / _____ = _____

2.0 Measure the take-off angle: _____ degrees. (1 mark)

3.0 Using this value and your answer from questions 1.0 and 2.0, calculate the initial total take-off velocity (u) and hence calculate the magnitude of the initial vertical velocity ($u_v$).

(2 marks)

$u_h = u\cos\Theta$ so $u = u_h/\cos\Theta$ = _____

$u_v = u\sin\Theta$ = _____

4.0 From your answers to questions 1.0 and 3.0, determine the theoretical range and maximum height of the projectile. (4 marks)

Theoretical range = $u_h \times t_{tot}$ = _____

Theoretical vertical height:

5.0 Using your answers to 4.0, sketch the theoretical curve on top of the photograph. (2 marks)

6.0 From the photograph, determine the final horizontal velocity of the projectile. (Use the last two images on the right). (2 marks)

7.0 Using $u_h$ and your answer from 6.0, calculate the change in horizontal velocity and hence the average horizontal deceleration over the total time of the flight

(2 marks)

8.0 Using your answer to 7.0, calculate the retarding horizontal force on the projectile. **Express your answer to the appropriate number of significant figures.**

(4 marks)

9.0 From the photograph, determine the "final" vertical displacement and hence calculate the final vertical velocity of the projectile (use the last two images on the right).

(2 marks)

10.0 Using the initial vertical velocity as zero, your answer from 9.0 and the displacement from the highest point to the last image, calculate the downward acceleration on the projectile while it is falling.

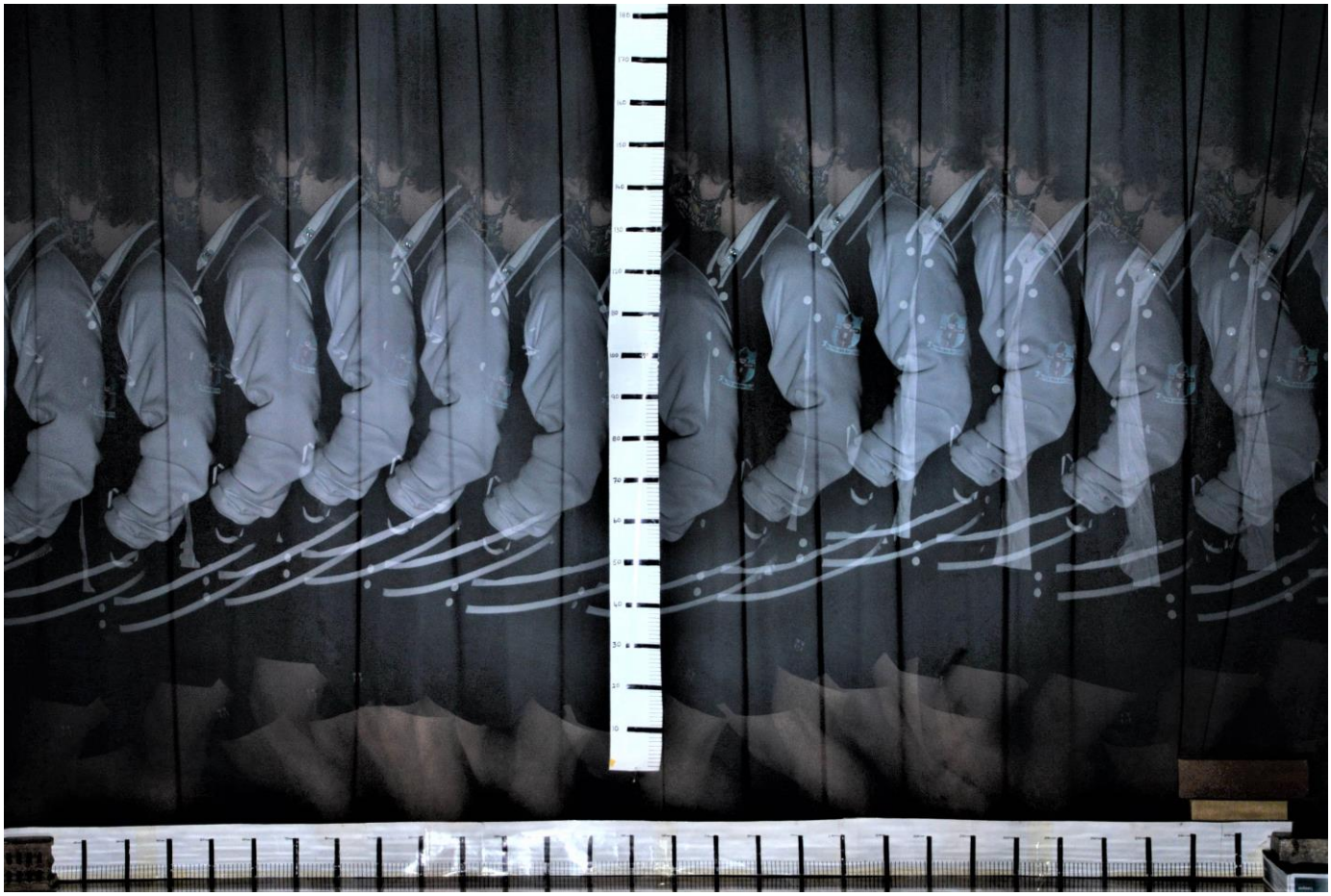
(3 marks)

11.0 Knowing that the downward acceleration should be 9.8 $ms^{-2}$, from your answer to 10.0, calculate the upward force on the projectile due to air friction
**Express your answer to the appropriate number of significant figures**

(4 marks)

12.0 Using the photo below, determine Max's average speed. (4 marks)

*Show on the photo from where you have taken your measurements.*



S= _____ t = _____ V = _____

13.0 The above calculation may be in error due to a systematic error in the design of the experiment. What is the problem and what effect would it have on your answer?

_____

_____

_____

_____

(2 marks)

END OF ASSESSMENT