Student's Worksheet

Lesson 3

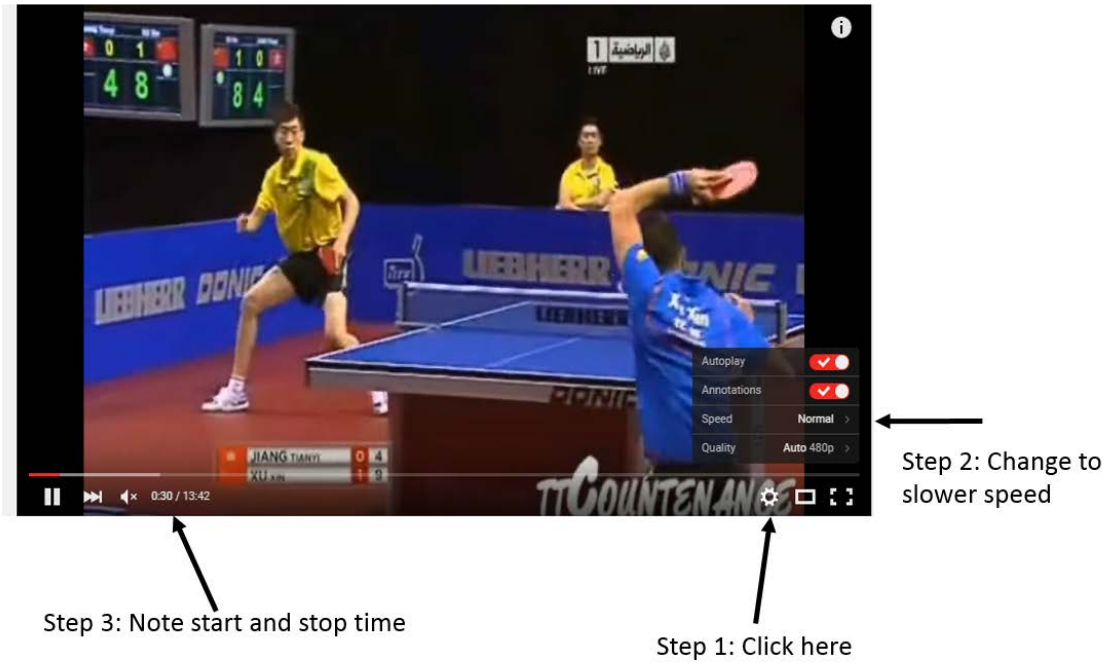
Lesson Topic: Quality Assurance in Table Tennis (Ball and Table)

Objectives:

- To use simple measurement devices to measure or estimate physical quantities known as kinematic variables.
- To compare them to the real speeds in an actual sport and compare values.

Work:

See the video https://www.youtube.com/watch?v=46OahVA7GNc at a slow speed. Here is a screen shot of how you can slow down a YouTube video:



Watch the ball going from one end of the table to the other and estimate the amount of time it takes using the time on the lower bar of the video as shown above.

Data Collection

You now know the length of the table and the amount of time it takes for the ball to travel that distance. Estimate the speed of the ball. Make at least 5 observations of DIFFERENT shots in the above video or elsewhere to calculate the average speed. Complete the following table:

Attempt	Distance travelled (m)	Time taken (sec)	Speed (m/s) (Divide second column with the third)
1			
2			
3			
4			
5			

Average speed = _____ m/s

General Discussion and Sources of Error:

1. What are the main sources of error in the measurement of distance in this case?

_____

_____

_____

_____

2. What are the main sources of error in the measurement of time in this case?

_____

_____

_____

_____

3. The cross-sectional area of the ball facing air resistance can be taken as the area of the circle with the diameter of the ball. Let r1 = 3.8cm (the old standard) and r2 = 4.0 cm (the new ball diameter).

   Area of ball with r1

   The change in the area will then be given by

$$\text{Change in Area} = 4\pi(\text{Larger radius})^2 - 4\pi(\text{Smaller radius})^2$$
$$= \pi(\text{Larger diameter})^2 - \pi(\text{Smaller diameter})^2$$

$$\approx 3[(\text{Larger diameter})^2 - (\text{Smaller diameter})^2]$$
$$= 3[\ (\quad)\quad - \quad(\quad)\ ]$$

$$= \_\_\_\_\_$$

- Hence the percentage change can be calculated as:

$$\text{Percentage change in Area} = \frac{\text{Change in Area}}{\text{Area of 3.8 cm ball}} = \_\_\_\_\_$$