Simulation: *oPhysics: Interactive Physics Simulations*
Access:[*https://ophysics.com/index.html*](https://ophysics.com/index.html)

Description: The oPhysics is a collection of interactive physics simulations that can be used effectively to teach students about the concepts of force and motion. The content on this website was created by Tom Walsh, who is a retired high school physics teacher that taught for 27 years, with 25 years of experience teaching AP Physics (ophysics, N.D). All of the interactive simulations were created using the GeoGebra software (ophysics, N.D).

I was introduced to this set of simulations by one of my senior students who graduated this past June. She used it to complete her Internal Assessment. The internal assessment task is one scientific investigation taking about 10 hours, which is a requirement for IBDP students writing the biology, chemistry and physics examinations (International, 2013). It is worth 20% of the final assessment for students writing the biology, chemistry and physics examinations (International, 2013).

Below I show how these interactive physics simulations connect to physics content that is a part of the IBDP physics course. However, these simulations are also useful for teaching physics content at about a middle school level and above.

oPhysics: Interactive Physics Simulations for IB DP Physics (Standard Level & Higher Level)

Topic	Sub- topic with Understandings/Skills and Applications	oPhysics simulations
Mechanics	2.1 Motion **Understandings** ● Distance and displacement ● Speed and velocity ● Acceleration ● Graphs describing motion **Skills and Applications**	Uniform Acceleration in One Dimension: Motion Graphs Description This simulation aims at helping students to get a better understanding of the relationships between various quantities involved in uniformly accelerated motion.

	• Sketching and interpreting motion graphs	
Mechanics	2.1 Motion **Understandings** • Distance and displacement • Speed and velocity • Acceleration • Graphs describing motion **Skills and Applications** • Sketching and interpreting motion graphs	Kinematics in 1D: Velocity vs. Time Graphs Description This simulation shows students the velocity vs. time graph for an object moving along a straight line.
Mechanics	2.1 Motion **Understandings** • Distance and displacement • Speed and velocity • Acceleration • Graphs describing motion **Skills and Applications** • Sketching and interpreting motion graphs	Uniform Acceleration in One Dimension Description This is a simulation of the motion of a car undergoing uniform acceleration. The initial position, initial velocity, and acceleration of the car can be adjusted. This simulation is also useful for students to gain an understanding of how to apply the following equation: $s = ut + \frac{1}{2}at^2$ Reference: International Baccalaureate Organization (2014). *Diploma Programme Physics data booklet*, pg 4.

Mechanics	2.1 Motion **Understandings** ● Projectile motion **Skills and Applications** ● Analysing projectile motion, including the resolution of vertical and horizontal components of acceleration, velocity and displacement	Projectile Motion Description: This simulation allows students to explore projectile motion by changing the initial conditions and watching the resulting changes in the projectile's motion.
Mechanics	2.2 – Forces **Understandings:** ● Solid friction **Skills and Applications** Describing solid friction (static and dynamic) by coefficients of friction	Friction: Pulling a Box on a Horizontal Surface This simulation can be used to explore the effects of static and kinetic friction and their relationship to the normal force of the surface. This simulation is also useful for students to gain an understanding of how to apply the following equations: $F_f \leq \mu_s R$ $F_f = \mu_d R$ Static and Kinetic Friction on an Inclined Plane Description

		This is a simulation of the motion of an object on an inclined plane. The forces acting on the object: gravity, normal force of the incline, and friction are represented as vectors.

Pros of using this simulation

- Very helpful in illustrating the vector breakdown of projectiles.
- Useful for testing new ideas quickly as they emerge
- Supports independent learners who may wish to design experiments for their internal assessments.

Cons of using this simulation

- Might be a bit intimidating for new users as the appearance is not as aesthetically pleasing as other simulations. Thus, in my opinion, initially students might need a bit more guidance when first using this simulation.

How the simulation would be used in the learning sequence and student interaction

This set of simulations is effective when used during interactive lecture demonstrations. During these sessions my students are given a prediction sheet in which they write down their ideas, predictions, and observations of all the demonstrations that will be presented in a class that day. Using this set of simulations this way allows my students to practice other skills, such as writing scientific ideas, or the use of diagrams and drawings to represent models, among others.

Possible student insights based on their interactions with these simulations

- Simulations are easy to use and a lot of data can be collected in a relatively short period of time
- It is easier to conceptualize what is being taught by using the simulations
- It is easier to make connections between scientific phenomena and everyday life

References

International Baccalaureate Organization (2014). *Diploma Programme Physics data booklet*, pg 4.International Baccalaureate Organization (2013). *Physics Guide, pg 142.* *https://ophysics.com/index.html*

OPhysics: Interactive Physics Simulations. (n.d.). Retrieved November 15, 2021, from https://ophysics.com/index.html