Demonstrator # 4

Ski Jump

TEACHER NOTES

Activity title: SKI JUMP

Subject: Physics, Mathematics

Student age: Between 10 and 14

Estimated duration:

Science content

Basic laws of mechanics: gravitational force, centripetal force, friction forces; inclined plane; Horizontal throw, dynamic buoyancy, energy conservation

Learning objectives

Newtons Laws will be used with illustrative experiments and interpreted in the classroom.
The experiments will include, sensors in a ball ("axion ball"), bracelets, pulse and temperature gauges on the body and will transmit data wirelessly to laptop or PC. Students will be required to develop a clear interpretation of the physical relations.
The students will then apply the laws of physics and mathematical models at the ski jump and then perform the data analysis on a PC and Internet research at the ski center.

Inquiry-based character

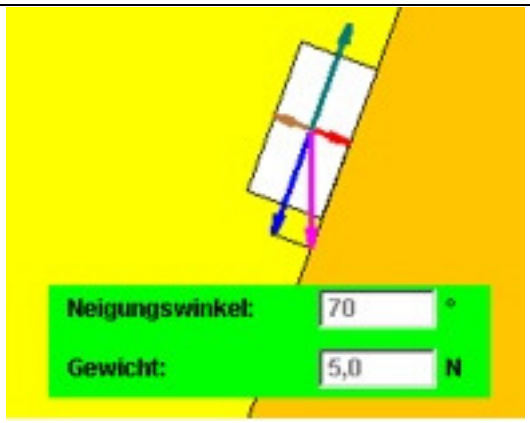
highlights the IBSE character of the activity, specifies a type of inquiry and lists inquiry-based skills (for details, definitions and terminology to use see 'Short guide for designing inquiry-based teaching materials')

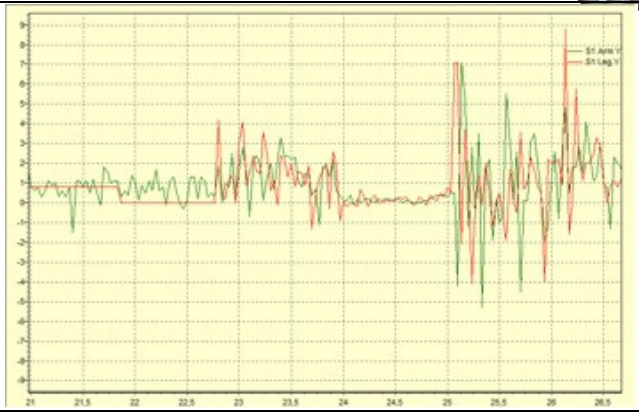
Applied technology (if any)

Materials needed

Discussion guide

Learning Phase 1: Interpreting the dynamics of a vertical Jump • **Using the KLIC sets, take the speed and time of a vertical jump and illustrate the result with a graph.** • **Indicate on the graph the different phases**	

of the jump • **Using the diagram, calculate the average jump, the average height and the average landing speed** **For this activity students can be in small groups and develop their collective responses in a table for each group. There should be some discussion generated as to why there are similar or different findings from the various groups.**	
Learning Phase 2: Forces on an Inclined Plane Go to the following page and answer the questions: http://schulen.eduhi.at/riedgym/Physik/9/schiefe_ebene/start_schief.htm a) What is a downhill force and a normal force? b) What force is necessary to prevent the downward roll of the truck? c) Go to the website of Walter Fendt and change angle and weight, and interpret the results!	
Learning Phase 3: skier on an inclined plane Following from the previous learning phase students work in discussion groups and post their answers in the appropriate file that is beamed on to the board. Students can see the responses of all groups and comment. Go to the following page and answer the questions: http://www.austromath.at/medienvielfalt/materialien/Vektoren1/lernpfad/MV_Vektor1/sites/SchiefeEbene.htm a) shifting the skier with the point C on the inclined plane! Change by the forces? b) the slope CHANGE by moving the points A and B! How to change this and the two forces? c) alters the weight (gravitational force) of a ski racer! How to change this and the two forces? d) the location from the coordinates of the points A and B, the linear equation of ski slopes in the form of parameters!	

Learning Phase 4: Interpretation of a jump on the K30 in Ramsau In groups the students are to research and prepare a presentation to the following questions; a) Is the jump with both feet hitting the ground equally? b) How long does it take to jump? c) What are the accelerations at impact?	

Assessment:

There will be two (2) assessment tasks;

Assessment 1 (take home individual task): Physics and ski jumping
Click on the link below and answer the questions:
http://www.virtuelleschule.at/lot/ramsau_2005/Physik_Schispringen.ppt

a) In which sections was the ski jump divided?
b) How can we estimate the take-off speed?
c) What is the maximum centripetal force on takeoff?
d) What is meant by a horizontal throw and why can you compare a ski jump with it?
e) What conditions are necessary to maximize the lift?

Assessment 2 (group task): Creating a Mathematical Model for the ramp profile with a flight path

a) Find the data from the hills of Innsbruck and Mitterndorf, Schattenberg K120 ski jump on the Internet
b) Adjust the hill profile with a 5th with a very rational function Level of!
c) place the trajectory depending on take-off speed and the jump angle is! (calculated with the program Derive, interactive presentation of the results with the program Geogebra)

Groups are to present their answers and each group is to comment on the responses of the rest of the class.

provides suggestions how to asses the activity, preferable with concrete questions and expected student answers

STUDENT WORKSHEET

Activity title:

Introduction

states a driving (research) question and outlines objectives

Thinking about the question

if needed provides information about the science addressed

Materials needed

if needed provides list of materials

Safety

If needed lists warnings and cautions concerning the investigation

Investigation

Depending on the type of inquiry involved provides guidance on how to carry out the investigation

Analysis

If needed suggests analysis that can help interpret data

Further investigation

If needed provides suggestions for a next possible investigation or additional, deeper investigations

Assessment

If needed includes student assessment