Europeana Learning Scenario

Title

Understanding Uniform Linear Motion with famous animated painting Gifs

Author(s)

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Summary

This is an interdisciplinary learning scenario combining the courses of physics, history and arts, for 16-17 years old students. Students conduct a historical review on different means of transport, using Europeana's Resources, followed by the research on the inventors of the first airplane, motorcycle, train and submarine as well as the design of those inventions.

In the second section they are expected to compare the speed of the latest model of the aforementioned to the first one, in order to gain a better understanding of the scales as they evolved through time. Using the previously gained data they should be able to solve physics problems, applying their knowledge on Uniform Linear Motion.

Finally, they make their own GIF illustrating an object constantly moving, by modifying a painting of their preference from Europeana's Collection. The applied teaching approach is Project Based Learning as it involves problem-solving, creativity and constructive learning.

Table of summary	
Subject	*Physics* *History*
Topic	*Motion with constant speed/ Uniform Linear motion* *Historical Review of airplanes, submarines, trains, motorcycles*
Age of students	*16-17 years old*
Preparation time	*1 h*
Teaching time	*80 min*
Online teaching material	Pixlr Editor Ezgif
Offline teaching material	*iPads*
Europeana resources used	Means of transport

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Integration into the curriculum

This lesson is part of Physics curriculum for the 10th grade (16-17 year old students)

Aim of the lesson

Students will:

- Enrich their knowledge of STREAM, using Reading and Arts,
- Develop their STEM skills: Maths & Physics,
- Apply Uniform Linear Motion,
- Practice using ICT tools.

Trends

- Project-Based Learning,
- STREAM Learning, (Science Technology Reading Engineering Arts and Mathematics),
- Visual Search & Learning,
- Collaborative Learning,
- Learning and planning with computers app,
- Combination of lecture and workshop issues,
- Open Source Learning,
- Student Centered Learning.

21st century skills

- Creativity and Innovation - Students create their own gif using ICT tools,
- Critical Thinking and Problem Solving - Students analyze information of STEM problems given,
- Collaboration - Students work in pairs to accomplish a common goal and share responsibility for collaborative work,
- ICT Literacy – Europeana's Collections are used to research and evaluate information.

Activities

Describe here in detail all the activities during the lesson and the time they require. Remember, that your learning scenario needs to use Europeana resources.

Name of activity	Procedure	Time (min)
Activity 1	Discussion on different means of transport	5
Activity 2	Students work in pairs to browse Europeana's Collection searching for different means of transport. Means of transport	10
Activity 3	Students work in pairs to investigate a mean of transportation of their preference. They may choose among Airplanes, Motorcycles, Submarines and Trains. **Airplanes** **Annex 1,** Means of transport **Motorcycles** **Annex 2,** Means of transport **Submarines** **Annex 3,** Means of transport **Trains** **Annex 4,** Means of transport	40
Activity 4	Students work in pairs in order to make a gif of a mean of transport from Europeana's Gallery by using their iPads and the following programmes: Pixlr Editor Ezgif The gif should present a mean of transport moving at a constant speed, travelling equal distances on equal time intervals.	15
Activity 5	Discussion and Conclusions	10

Assessment

The teacher evaluates according to the results of their worksheets as well as the created gif. (Annex)

Student feedback

After completing the learning scenario student prepares a report on their work, which is sent electronically to the teacher's email address.

Teacher's remarks

The learning scenario has been applied and the used methodology, Project Based Learning, has been effective and engaging, helping students to apply uniform linear motion in different contexts, combining physics, history and arts. The students were active listeners as well as co-workers sharing ideas and collaborating efficiently. According to students' feedback the learning scenario has been extremely interesting, challenging. Overall, students mentioned that they enjoyed Europeanas Gallery as well as the the Gif creation.

About the Europeana DSI-4 project

Europeana is Europe's digital platform for cultural heritage, providing free online access to over 53 million digitised items drawn from Europe's museums, archives, libraries and galleries. The Europeana DSI-4 project continues the work of the previous three Europeana Digital Service Infrastructures (DSIs). It is the fourth iteration with a proven record of accomplishment in creating access, interoperability, visibility and use of European cultural heritage in the five target markets outlined: European Citizens, Education, Research, Creative Industries and Cultural Heritage Institutions.

European Schoolnet (EUN) is the network of 34 European Ministries of Education, based in Brussels. As a not-for-profit organisation, EUN aims to bring innovation in teaching and learning to its key stakeholders: Ministries of Education, schools, teachers, researchers, and industry partners. European Schoolnet's task in the Europeana DSI-4 project is to continue and expand the Europeana Education Community.

Worksheet sources:

- ✓ http://ducati.gr/site/content.php
- ✓ http://www.wright-brothers.org/History_Wing/History_of_the_Airplane/Century_Before/First_Airplanes/First_Airplanes.htm
- ✓ https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104499/f-15e-strike-eagle/
- ✓ https://en.wikipedia.org/wiki/Motorcycle
- ✓ https://www.aerotime.aero/rytis.beresnevicius/22863-top-10-fastest-aircraft-in-the-world
- ✓ https://www.alux.com/fastest-motorcycles-world/
- ✓ https://www.britannica.com/technology/submarine-naval-vessel
- ✓ https://www.dailymail.co.uk/sciencetech/article-2734072/Shaghai-San-Francisco-100-minutes-China-reveals-plans-supersonic-submarine-using-underwater-bubble-help-swim-faster.html
- ✓ https://en.wikipedia.org/wiki/Train
- ✓ https://www.cntraveler.com/stories/2016-05-18/the-10-fastest-trains-in-the-world

Annex 1.

MEASURING MOTION – AIRPLANES

UNIFORM LINEAR MOTION

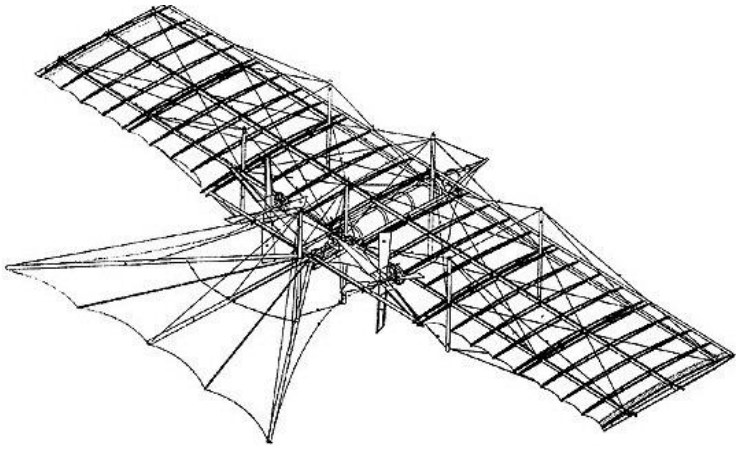
SUBJECT: Physics

GRADE: 11th

Name: _____ Date: _____

In this project you have been asked to make a research in airplanes as well as motion with constant velocity. Read instructions carefully and answer the questions given. Don't forget to include bibliography at the end of your project.

Travelling in air has been one of the most exciting things to do in this world. It is also the fastest mode of travel in the world. Planes which are used to fly from one place to another can carry people to other continents, countries and across the oceans within hours. There was a time when such long distances were travelled in days and weeks via ships on water or road trips. With the advancement in technology, there are planes that take only minutes to reach their destination.



1. Make a historical review about airplanes, including the following questions.
Who was the inventor of the first airplane? When? Where? How fast could it travel? How did it look like? How much did it weigh? How much was its height and length? How did it work? **(50 points)**

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2. The F-15E Strike Eagle is a twin-engine, all weather fighter, that is the backbone for the Air Force's air superiority. Its proven design is undefeated in air-to-air combat, with more than 100 aerial combat victories. The Eagle's twin-engine and thrust-to-weight ratio of almost 1:1 can propel the 18,000 kg aircraft to more than 2.5 times the speed of sound. The F-15 has been claimed to be one of the most successful aircraft ever built and is still in service with the US Air Force. F-15s are capable of flying at speeds greater than 2,655 km/h (1,650 mph) and are considered one of the most successful planes ever created.
Lockheed YF-12, another military aircraft, can travel up to 3661km/h and coasts somewhere between $15 and $18 million.

3. An YF-12 aircraft travels in a straight line at ***a constant speed*** of 3,600 km/h.
(35 points)

a. How can motion with constant speed be defined? Give an example.

_____

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b. How is velocity different to speed?

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c. How far does the YF-12 aircraft travel in 1 second?

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d. Calculate how many times the speed of light in vacuum ($c = 3 \times 10^8$ m/s) is faster than the abovementioned speed of the YF-12 aircraft.

_____

_____

e. Calculate how many times the speed of the YF-12 aircraft is faster than the speed of sound in air. (u= 343 m/s)

_____

_____

f. Calculate how many times the YF-12 aircraft is faster than the first invented airplane?

_____

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g. How long would it take for the YF-12 aircraft to travel the distance of the equator line?

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4. A passenger airplane travels at a constant speed of 800 km/h. While the airplane is above California the control tower informs the pilot that 1,000 km away the weather conditions are bad. An YF-12 aircraft must go there first in order to investigate the conditions. The YF-12 aircraft takes off from California and starts travelling towards that area when the passenger airplane has already travelled 680 km towards it.

(15 points)

a. How far is the passenger airplane from the dangerous area at this time?

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b. Calculate how long it will take for the passenger airplane to reach the dangerous area.

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c. How fast must the YF-12 aircraft travel if it is to reach the dangerous area before the passenger airplane?

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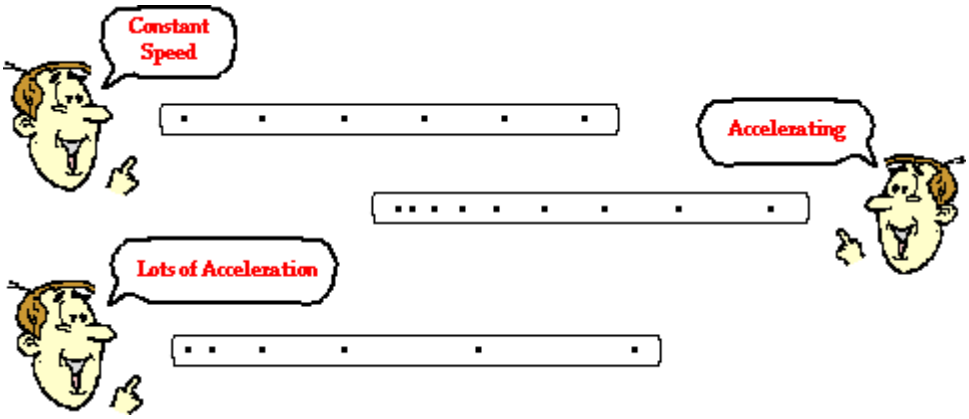

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Annex 2.

MEASURING MOTION – MOTORCYCLES

UNIFORM LINEAR MOTION

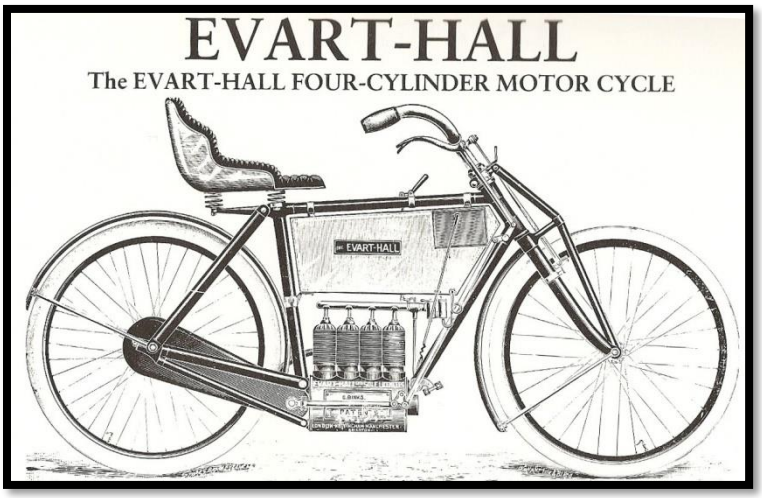
SUBJECT: Physics

GRADE: 11th

Name: _____ Date: _____

In this project you have been asked to make a research in motorcycles as well as motion with constant velocity. Read instructions carefully and answer the questions given. Don't forget to include bibliography at the end of your project.

A motorcycle is also called a motorbike, a bike or a cycle and is a two - or three - wheeled motor vehicle. Motorcycle design varies greatly to suit a range of different purposes: long distance travel, commuting, cruising and off-road riding. In regards to the safety of riding a motorcycle compared to riding in a car, there is quite a bit of publicly available data that suggests that riding a motorcycle is more dangerous. They might become really dangerous when operated by the wrong users!



1. Make a historical review about motorcycles, including the following questions.

Who was the inventor of the first motorcycle? When? Where? How fast could it travel? How did it look like? How did it work? **(40 points)**

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2. How dangerous are motorcycles? Which are the most likely causes of motorcycle accidents? **(10 points)**

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3. Usually when you have *"fast"* and *"motorcycle"* in the same sentence you usually get *"expensive"*.
The fastest motorcycle in the world is the Ducati 1098 s!
This vehicle can reach 60 mph in less than 3.0 seconds thanks to its 180 horsepower.
The Ducati 1098 s is classified as a sportbike.
Now, the thing about sportbikes is that they should be lighter in order to improve handling – This Ducati only weighs 173 kg (381 lbs). Due to its highly efficient four valves per cylinder engine the motorcycle can reach up to 169 mph or 271 km/h.
A Ducati motorcycle travels in a straight line at ***a constant speed*** of 200 km/h.
(35 points)

   a. How can motion with constant speed be defined? Give an example.

_____

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b. How is velocity different to speed?

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c. How far does the motorcycle travel in 1 second?

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d. Calculate how many times the speed of light in vacuum ($c = 3 \times 10^8$ m/s) is faster than the abovementioned speed of the Ducati motorcycle.

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e. Calculate how many times the speed of sound in air (u= 343 m/s) is faster than the abovementioned speed of the Ducati motorcycle.

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f. Calculate how many times the Ducati motorcycle is faster than the first invented motorcycle?

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g. How long would it take for the Ducati motorcycle to travel the distance of the equator line?

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4. A robber is in a fast motorcycle, hurrying away from the scene of his crime. His motorcycle can go at 80km/h. He will be safe if he can reach the border, 100 km away. A police car arrives at the scene of the crime. The police are late! The robber has already travelled 60 km towards the border. The police motorcycle sets off in hot pursuit!
(15 points)

a. How far is the robber from the border?

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b. Calculate how long it will take for the robber to reach border.

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c. How fast must the police motorcycle travel if it is to catch the robber before he reaches the border?

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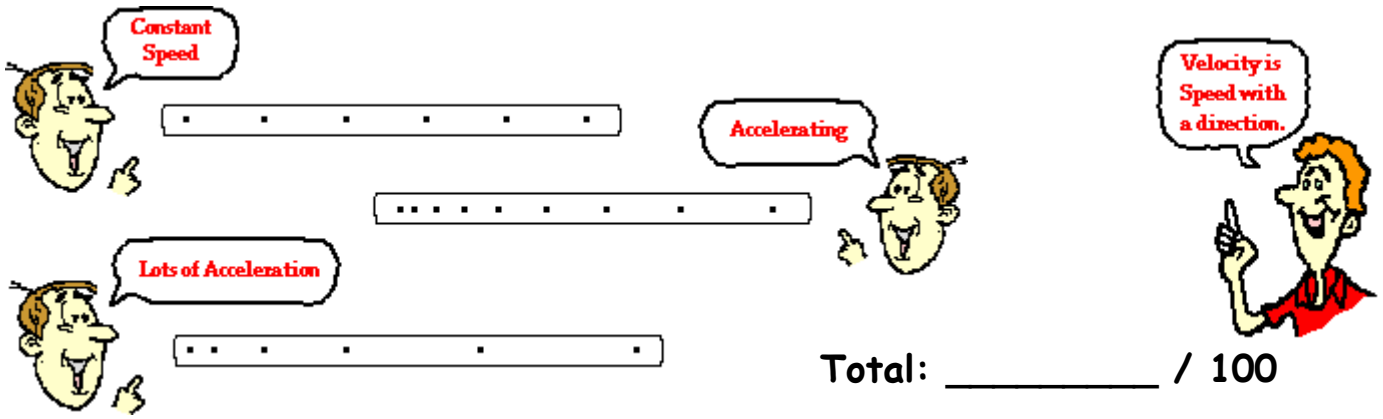

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Annex 3.

MEASURING MOTION – SUBMARINES

UNIFORM LINEAR MOTION

SUBJECT: Physics ***GRADE: 11th***

Name: _____ Date: _____

In this project you have been asked to make a research in submarines as well as motion with constant velocity. Read instructions carefully and answer the questions given. Don't forget to include bibliography at the end of your project.

Submarine is any naval vessel that is capable of propelling itself beneath the water as well as on the water's surface. This is a unique capability among warships, and submarines are quite different in design and appearance from surface ships. Submarines first became a major factor in naval warfare during World War I (1914–18), when Germany employed them to destroy surface merchant vessels. In such attacks submarines used their primary weapon, a self-propelled underwater missile known as a torpedo.

1. Make a historical review about submarines, including the following questions.

Who was the inventor of the first submarine? When? Where? How fast could it travel? How did it look like? How much did it weigh? How much was its height and length? How did it work? **(50 points)**

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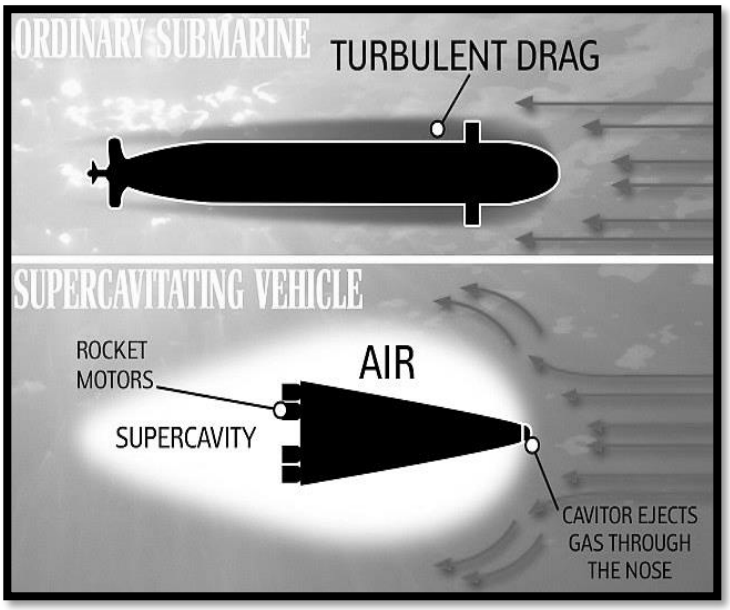
2. Which is the best attack submarine in the world? The nuclear- powers submarines! The main mission of a nuclear-powered attack submarines is to engage enemy submarines and ships. It must have good sonar to detect enemy submarines. Also it is extremely important to approach enemy boats and warships undetected. And leave the area after engagement undetected by enemy anti-submarine ships and maritime patrol aircraft. Some of the latest attack submarines can launch cruise missiles against ships and inland targets. Currently, the fastest submarines are stuck at speeds of 74 km/h.

Researchers at the Harbin Institute of Technology in China are developing a 'supersonic' submarine that could travel from Shanghai to San Francisco (9,816 km) in less than two hours. Researchers say their new craft uses a radical new technique to create a 'bubble' to surround itself, cutting down drag dramatically. In theory, the researchers say, a supercavitating vessel could reach the speed of sound underwater, or about 1 km/s.



A 'supersonic' submarine travels in a straight line at ***a constant speed*** of 1,200 m/s. **(35 points)**

a. How can motion with constant speed be defined? Give an example.

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b. How is velocity different to speed?

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c. How far does the 'supersonic' submarine travel in 1 second?

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d. Calculate how many times the speed of light in vacuum (c = 3 x 10^8 m/s) is faster than the abovementioned speed of the 'supersonic' submarine.

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e. Calculate how many times the speed of sound in seawater (u= 1,500 m/s) is faster than the 'supersonic' submarine.

_____

_____

f. Calculate how many times the 'supersonic' submarine is faster than the first invented submarine?

_____

_____

g. How long would it take for the 'supersonic' submarine to travel the distance of the equator line?

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3. Rebels are in a submarine, hurrying away from the port. Their submarine can go at 30km/h. They will be safe if they can reach the boundary line, 300 km away. The submarine of the national navy arrives at the port. The national navy's submariners are late! The rebels have already travelled 150 km towards the boundary line.

(15 points)

a. How far are the rebels from the boundary line?

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b. Calculate how long it will take for the rebels to reach the boundary line.

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c. How fast must the national navy's submarine travel if it is to catch the rebels before they reach the boundary line?

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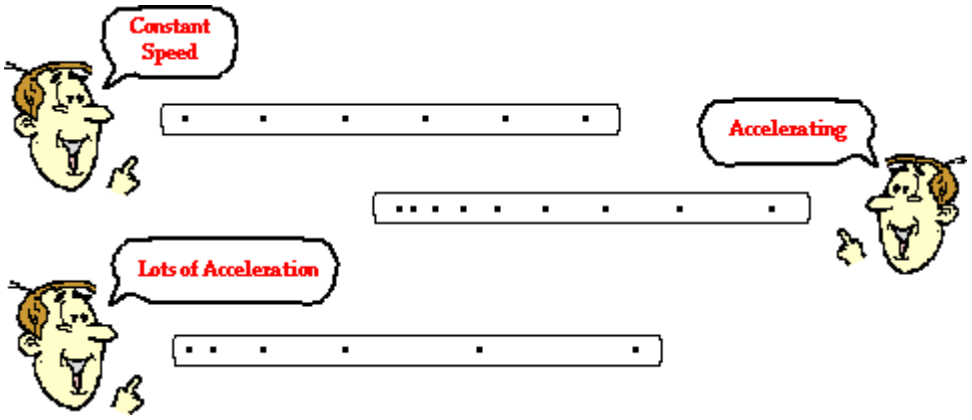

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Bibliography:

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Annex 4.

MEASURING MOTION – TRAINS

UNIFORM LINEAR MOTION

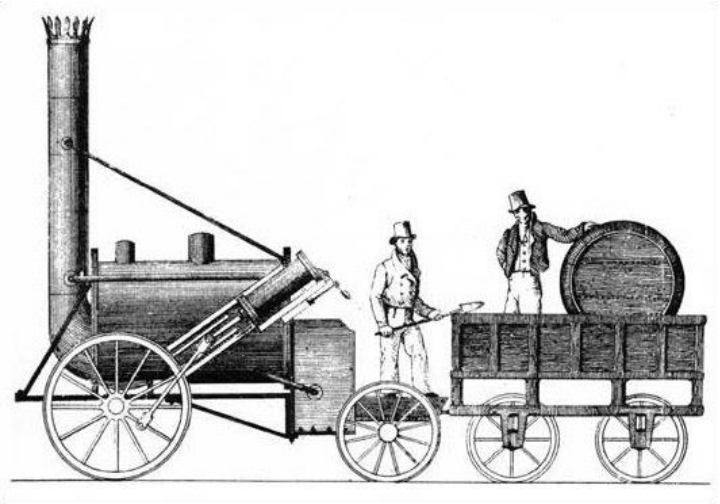
SUBJECT: Physics

GRADE:11th

Name: _____ Date: _____

In this project you have been asked to make a research in trains as well as motion with constant velocity. Read instructions carefully and answer the questions given. Don't forget to include bibliography at the end of your project.

Trains are transport vehicles that are used as a series of connected cars that run along a track. They are powered by various methods of fuel and are typically separated into different types, depending on their purpose. The railway system has a rich history and trains are fascinating for their appearance, sound and function, which is why many people like to study them or build model trains. These vehicles have opened doors for greater communication and transport throughout the world.



1. Make a historical review about trains, including the following questions.

Who was the inventor of the first train? When? Where? How fast could it travel? How did it look like? How much did it weigh? How much was its height and length? How did it work? **(50 points)**

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2. The world's fastest train isn't the newest, the shiniest, or even the one with the most expensive tickets. Charging $8 per person, per ride, the Maglev runs 19 miles from Shanghai's Pudong International Airport to the Longyang metro station on the outskirts of Shanghai. That's right—the train, which takes just over 7 minutes to complete the journey using magnetic levitation (maglev) technology, doesn't go to the city center. As such, the bulk of the passengers since its 2004 debut have been travelers on their way to and from the airport, cameras out and ready to snap a photo of the speed indicators when the train hits 431 km/h (267 mph).
Japan has again demonstrated its prowess in high-speed rail travel with its state-of-the-art maglev train setting a world record of just over 600km/h (373mph).

A magnetic train (Maglev) travels in a straight line at ***a constant speed*** of 500 km/h.
(35 points)

a. How can motion with constant speed be defined? Give an example.

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b. How is velocity different to speed?

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c. How far does the Maglev travel in 1 second?

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d. Calculate how many times the speed of light in vacuum ($c = 3 \times 10^8$ m/s) is faster than the abovementioned speed of the Maglev.

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e. Calculate how many times the speed sound in air (c = 343 m/s) is faster than the speed of Maglev.

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f. Calculate how many times the Maglev is faster than the first invented train?

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g. How long would it take for the Maglev to travel the distance of the equator distance?

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3. A passenger train leaves the platform at 5:00 a.m. from Athens to Thessaloniki, the terminal station, at a constant speed of 100 km/h. Mr. Sleepyhead lost the train because he overslept and arrived at the train station at 5:30 am. The next train is a magnetic one and starts travelling from Athens towards Thessaloniki when the previous train has already travelled 400 km towards the terminal station. Mr. Sleepyhead knows that the distance between the abovementioned cities is 500 km for both routes. **(15 points)**

a. How far is the passenger train from the terminal station?

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b. Calculate how long it will take for the passenger train to reach the terminal station.

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c. How fast must the magnetic train travel if it is to reach the terminal station before the passenger train?

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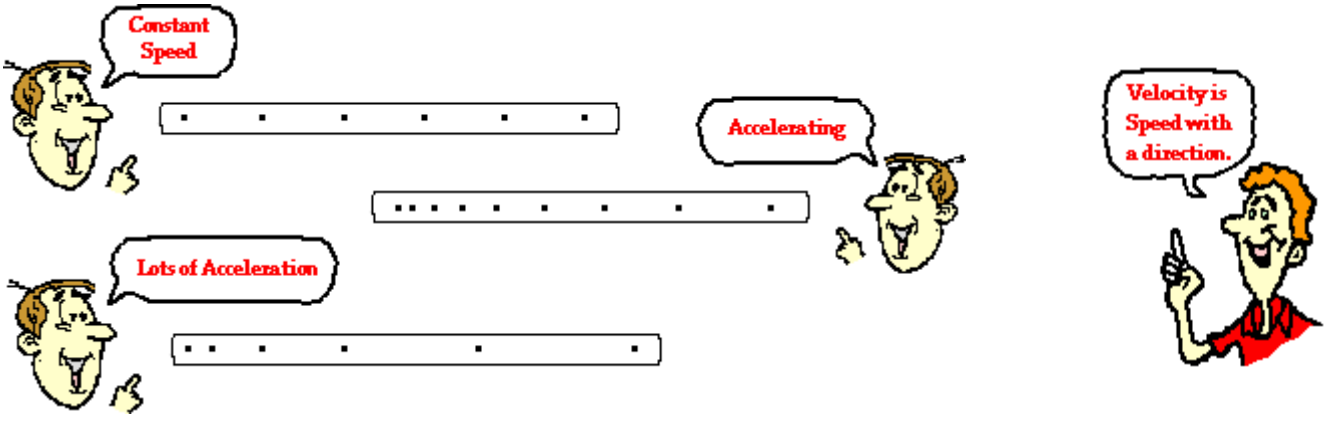

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Bibliography: