Science 11 Resource Package

Physical Science: Motion in Our World

Suggested Lessons and Activities

The following lessons and activities meet some of the foundational and learning objectives as outlined for Science 11 – Physical Science: Motion in Our World. Teachers should be reminded that these are only suggested activities and that they can and should be adapted to meet individual learning needs. The order that the lessons appear in is only a suggested order. Teachers can and should integrate their own lessons and ideas within the suggested lessons outlined in this unit.

The lessons outlined in this document consist of four sections. "Foundational and Learning Objectives" provides the numbers that correspond to the objectives that are identified in *Guidelines for Developing Modified Courses: Science 11 (Basic)*. "Lesson Overview" provides a brief description of the suggested lesson or activity. "Instructional Documents" lists Teacher Support Material or Student Handout documents that are directly related to the lesson. "Supporting Resources" lists resources from various sources that may be directly related to the lesson, that may support instructional content within the lesson or that may be alternate ways of meeting all or some of the foundational and learning objectives outlined in the lesson.

The guidelines and objectives for Science 11 reflect the units of the renewed Science 10 (2005) curriculum. Therefore, in addition to the *Guidelines for Developing Modified Courses: Science 11 (Basic)*, teachers should use the document *Science 10: Curriculum Guide* to assist with unit planning and instruction for Science 11. *Science 10: Curriculum Guide* provides sections on key questions, key concepts, pre-instructional questions as well as suggested teaching strategies and activities for each of the foundational objectives within each unit. Curriculum documents are available on-line at http://www.learning.gov.sk.ca/.

List of Lessons for Motion in Our World

Lesson #	Name of Lesson
1	Science Challenge
2	Motion Related Technology
3	Purchasing a Car
4	Canadian Contributions to Motion
5	Uniform Motion vs. Non-Uniform Motion
6	Speed Challenge
7	Calculating Speed, Distance and Time
8	Graphing
9	Understanding Graphs
10	Calculating the Slope of a Graph
11	Distance-Time Activities
12	Speed, Time & Acceleration
13	Forces and Motion

Teacher Note: Before proceeding with labs and activities that investigate relationships among distance, time and speed it is suggested that teachers help students to develop skills in:
a) calculating speed, distance and time
b) graphing
c) understanding graphs and
d) calculating the slope of a graph.

Lessons seven through ten will focus on building these skills.

Foundational and Learning Objectives

MW1 Explore motion-related technologies

1. Acquire, with interest and confidence, additional science knowledge and skills using a variety of resources and methods, and adopt behaviours and attitudes that project a positive self image. (PSD, CD 1.3)

Each student should achieve ***at least one*** of the following objectives:

5. Evaluate the design and function of a motion-related technology using identified criteria such as safety, cost, availability, and impact on everyday life and the environment. (CCT, PSD)
8. Describe examples of Canadian contributions to science and technology in motion-related fields such as transportation, sport science, or space science. (TL)

MW2 Observe and describe the motion of everyday objects

1. Observe and describe the motion of everyday objects qualitatively using personal words and phrases. (COM)
2. Categorize the motion of everyday objects as uniform and non-uniform. (CCT)

MW3 Investigate the relationship among distance, time, and speed for objects that undergo uniform motion

1. Collect data about everyday objects that undergo simple linear motion. (NUM)
2. Design an experiment and identify specific variables to be tested. (TL)
3. Develop appropriate sampling procedures for data collection in an experiment. (NUM)
4. Use appropriate instruments such as ticker timers, stopwatches, photogates, or motion detectors to collect data effectively and accurately.
7. Construct distance-time graphs to represent the uniform motion of everyday objects. (NUM)

MW4 Investigate the relationship among speed, time, and acceleration for objects that undergo uniformly accelerated motion

1. Collect data about everyday objects that undergo uniformly accelerated motion. (NUM)
2. Work collaboratively to plan and carry out investigations, as well as to generate and evaluate ideas to practice the skills, knowledge, and attitudes needed to work effectively with and for others. (PSD, CD 2.3)
3. Construct and analyze distance-time and speed-time graphs of objects that undergo uniform acceleration. (NUM)
4. Describe quantitatively the relationship among speed, time, and acceleration.
5. Select and use appropriate vocabulary, units, symbols, and graphs to communicate information about moving objects. (COM)

MW5 Analyze graphically and mathematically the relationship among distance, speed, time and acceleration for objects that undergo simple linear motion or uniformly accelerated motion

1. Describe quantitatively the relationship among distance, time, speed, and acceleration for everyday objects that undergo simple linear motion (uniform motion or uniformly accelerated motion).
8. Read and interpret graphs to develop an understanding of the relationships among numbers. (NUM)

Lesson 1 – Science Challenge

Foundational and Learning Objectives: MW1: 1

Lesson Overview:

In this lesson students could be introduced to the unit on motion by completing one or more science challenge activities related to motion. This would be a means of creating interest in this unit and helping students to acquire additional science knowledge and skills.

Instructional Document(s):

1. Science Challenge - Take Flight (Student Handout).

2. Science Challenge - The Incredible Airship (Student Handout).

Supporting Resource(s):

1. Paper Airplane Exploration, p.137 *Nelson Science 10: Concepts and Connections*.

2. Balloon Car Contest, pp.150-151 *Nelson Science 10: Concepts and Connections* or Balloon Car Contest, pp. 360-361 *Nelson Science 10*.

3. Air Power, p. 289 *Sciencepower 10*.

4. Self Propelled Learning found online at: http://www.pbs.org/saf/1103/teaching/teaching3.htm.

Lesson 2 – Motion Related Technology

Foundational and Learning Objectives: MW1: 5

Lesson Overview:

In this lesson students will work in pairs, or on their own, to research one motion-related technology. They will be asked to find information on the history, development, uses and benefits of the technology as well as the science of how the technology works. The information they gather will be visually presented to the class.

Instructional Document(s):

1. Motion Related Technology Presentation (Student Handout).

2. Motion Related Technology Presentation - Marking Rubric (Teacher Support Material).

Lesson 3 – Purchasing a Car

Foundational and Learning Objectives: MW1: 1, 5

Lesson Overview:

In this lesson students can explore a motion related technology by completing a research project on purchasing a car. The students will use a variety of resources to compare several vehicles based on certain criteria and then make a decision on what would be the best vehicle to purchase.

Instructional Document(s:

1. Purchasing a Second Hand Car – Project (Teacher Support Material).

2. Student Worksheet – Used Car Research (Student Handout).

Supporting Resource(s):

1. How Could You Choose the Best Vehicle?, pp. 144-145 *Nelson Science 10: Concepts and Connections*.

Lesson 4 – Canadian Contributions to Motion

Foundational and Learning Objectives**:** MW1: 8

Lesson Overview:

In this lesson students will research an example of a Canadian contribution to science and technology in a motion related field. They will find information such as the background of the inventor, how and when the device was developed, and how the device works. They will then present their findings to the class with the use of visual aids.

Supporting Resource(s):

1. Home Grown Solutions p. 294 *Sciencepower 10*.

2. Transportation in Canada p. 290-293 *Sciencepower 10*.

Lesson 5 – Uniform Motion vs. Non-Uniform Motion

Foundational and Learning Objectives**:** MW2: 1, 2

Lesson Overview:

In this lesson students will watch action related clips from movies in order to observe and describe motion of everyday objects. This activity should help students to begin to understand the differences between uniform and non-uniform motion.

Instructional Document(s):

1. Uniform Motion vs. Non-Uniform Motion (Teacher Support Material).

Supporting Resource(s):

1. Observing Uniform Motion, p. 153 *Nelson Science 10: Concepts and Connections*.

Lesson 6 – Speed Challenge

Foundational and Learning Objectives: MW3: 1

Lesson Overview:

In this lesson students will be introduced to the relationships among speed, distance and time. The students will perform various tasks, such as walking and hopping, for predetermined distances and collect data about their motion. They will then answer questions to analyze their motion.

Supporting Resource(s):

1. Speed Challenge found at The Science Spot http://www.sciencespot.net/Media/speedchall.pdf.

2. Your Speed, p. 352-353 *Nelson Science10* or Your Speed, p. 142-143 *Nelson Science 10: Concepts and Connections*.

Lesson 7 - Calculating Speed, Distance and Time

Foundational and Learning Objectives: MW5: 1

Lesson Overview:

In this lesson students will complete assignments or activities that help them to understand mathematical relationships related to motion. They will be involved with calculating speed, distance and time of objects in motion.

Instructional Document(s):

1. Speed, Distance and Time Calculations (Student Handout).

Supporting Resource(s):

1. Speed Machines found at The Science Spot
   http://www.sciencespot.net/Media/speedmach.pdf.

2. Average Speed, pp. 146-149 *Nelson Science 10: Concepts and Connections*.

3. Measuring the Average Speed of Falling Objects, p.148 Nelson *Science 10: Concepts and Connections*.

Lesson 8 – Graphing

Foundational and Learning Objectives: MW3: 7

Lesson Overview:

In this lesson students will review previous graphing skills and acquire new skills for setting up and plotting points on a graph. There are no instructional documents provided for this lesson but the various supporting resources listed could be used to help guide students through the graphing process.

Supporting Resource(s):

1. Distance – Time Graphs, pp. 154-155 *Nelson Science 10: Concepts and Connections* or Distance – Time Graphs, pp. 362-365 *Nelson Science 10*.

2. Graphing, pp. 290-292 *Nelson Science 10: Concepts and Connections* or Graphing, pp.699-701 *Nelson Science 10*.

3. Drawing a Line Graph, p. 602-605 *Sciencepower 10*.

Lesson 9 - Understanding Graphs

Foundational and Learning Objectives: MW5: 8

Lesson Overview:

In this lesson students will begin to understand how the line on a graph can be used to describe the motion of the object by completing assignments related to understanding and analyzing the shape of a graph. If motion detectors are available, teachers could set up an activity where students mimic a graph on the screen as the move toward and away from the motion detector.

Instructional Document(s):

1. Understanding Graphs (Student Handout).

2. Analysis of Distance – Time Graphs (Student Handout).

Supporting Resource(s):

1. Motion Detectors
   *motion detectors and software are available through most scientific supply companies.

Lesson 10 – Calculating the Slope of a Graph

Foundational and Learning Objectives: MW5: 1, 8

Lesson Overview:

In this lesson students will develop skills in calculating the slope of a graph. Acquiring the skills to calculate slope will help students to analyze graphically and mathematically the relationship among distance, speed, time and acceleration for objects that undergo simple linear motion or uniformly accelerated motion.

Instructional Document(s):

1. Slope (Student Handout).

Supporting Resource(s):

1. Distance-Time Graphs, pp. 154-155 *Nelson Science 10: Concepts and Connections* or Distance-Time Graphs, pp. 362-365 *Nelson Science 10*.

2. What's in A Slope, pp. 324-325 *Sciencepower 10*.

Lesson 11 – Distance – Time Activities

Foundational and Learning Objectives**:** MW3: 1,2,3,4, 7; MW5: 1, 8

Lesson Overview:

In this lesson students should complete one or more lab activities in order to investigate the relationship among distance, time, and speed for objects that undergo uniform motion. In the *Distance – Time Activity* students will use appropriate instruments to collect data for objects in uniform motion. Students will then construct distance – time graphs to represent the motion of the objects and to analyze graphically the relationship among distance, speed and time for objects undergoing simple linear motion.

Instructional Document(s):

1. Distance – Time Graph Activity (Student Handout).

Supporting Resource(s):

1. Investigation - Determining an Average Speed, pp. 156-157 *Nelson Science 10: Concepts and Connections* or Investigation – Determining an Average Speed, pp. 372-373 *Nelson Science10*.

2. Slow But Sure, pp. 308-309 *Sciencepower 10*.

Lesson 12 – Speed, Time & Acceleration

Foundational and Learning Objectives: MW4: 1, 2, 3, 4, 5; MW5: 1, 8

Lesson Overview:

In this lesson students will investigate the relationship among speed, time and acceleration. They will use an activity based approach to look at how much they speed up when they first start running. Through this activity students will discover what a position – time graph looks like when something accelerates.

Instructional Document(s):

1. Your Acceleration (Student Handout).

Supporting Resource(s):

1. Defining Acceleration, p. 178 *Nelson Science 10: Concepts and Connections*.

2. Constant Acceleration, p.184 - 185 *Nelson Science 10: Concepts and Connections*.

3. The Definite Difference, pp. 360-361 *Sciencepower 10*.

Lesson 13 – Forces and Motion

Foundational and Learning Objectives: MW2: 1, 2; MW4: 4, 5; MW5: 1, 8

Lesson Overview:

In this lesson students could watch the video *Forces and Motion* from the Assignment Discovery Series as a review (or an introduction) to the Motion in Our World unit. The content of this video includes several objectives from this unit, as outlined above. Teachers should draw student's attention to the motion related concepts in the video as forces are not a part of this course.

Instructional Document(s):

1. Forces and Motion – Video (Teacher Support Material).

Supporting Resource(s):

1. Forces and Motion (video). Refer to the resources section in the *Science 11 Introduction* for further information.

Student Handout

SCIENCE CHALLENGE - TAKE A FLIGHT

Objective:

To construct an aircraft and launcher, using only the materials provided. To win, the aircraft must execute the greatest horizontal displacement through the air from the point of launch.

Materials:

- 50 popsicle sticks
- 2 sheets of 21.6 x 28 cm paper
- 3 small paper clips
- 2 jumbo paper clips
- 2 elastic bands
- white glue or glue gun

Rules:

1. The paper may be cut or torn.

2. The aircraft must be capable of gliding.

3. The aircraft must be launched by the release of a trigger mechanism.

4. The launching system must be freestanding, reusable and capable of being reloaded within two minutes. The launch will take place from the floor.

5. Two launches will be made. The greatest displacement will be recorded.

6. Failure to meet any of the design criteria will result in disqualification.

Student Handout

SCIENCE CHALLENGE - THE INCREDIBLE AIRSHIP

Objective:

To design and construct an aircraft that will stay aloft for as long as possible.

Materials:

- 6 sheets of paper (21.6 x 27.9 cm)
- 1 meter of masking tape
- Scissors

Rules:

1. The aircraft can be held aloft by unaided air resistance only.

2. The aircraft must be made from at least one piece of paper.

3. Timing will begin the moment the aircraft is released by a team member and end when the aircraft comes to rest.

4. Each team will be given two trails. The best time will be used to determine the team score.

5. You will have only 40 minutes to complete your aircraft**.**

Questions:

1. How long did your aircraft stay aloft? How did this compare to the other groups?

2. How could you improve your design?

3. What did you learn about resistance, if anything?

4. What did you learn about aircraft design, if anything?

5. Did all members of your group contribute equally to the design of your aircraft?

6. Did you enjoy this science challenge?

7. What mark out of 10 do you think your group deserves?

Student Handout

MOTION RELATED TECHNOLOGY PRESENTATION

Objective:

To research and present information about a motion-related technology that is still used in modern society. This can be any device that makes movement easier or more enjoyable.

Project Requirements:

While working in pairs or on your own, you must research the *history, development, uses and benefits* of one motion-related technology. This material must then be visually presented to the class. Your presentation must be one-two minutes in length, cover all major points of the research including some *interesting facts*, and the *science of how the technology works.* You must have full group participation and a minimum of *one visual aid* (poster, powerpoint, example of the technology).

Evaluation:

Your overall individual mark for this project will come from three sources:
a) Teacher Evaluated Presentation (26)
b) A Self-Evaluation (3) (of your own overall effort and work ethic)
c) A Peer Evaluation (3) (of your partners overall effort and work ethic)

Self-Evaluation

I, _____ believe that I deserve a mark of ___ out of 3 for the work that I did as part of the presentation and research team for this project. Three reasons I deserve this mark are:
1. _____
2. _____
3. _____

Peer-Evaluation

I believe that _____ deserves a mark of ___ out of 3 for the work that they completed as part of the presentation and research team for this project. Three reasons why they deserve this mark are:
1. _____
2. _____
3. _____

TSM
Teacher Support Material

MOTION RELEATED TECHNOLOGY PRESENTATION MARKING RUBRIC

Group Members: Topic:

Presentation Mark: /26

Presentation Criteria	**INC**	**Poor**	**Fair**	**Great**	**Outstanding**
Accuracy of Information Presented (history, development, use etc.)	0	2	4	6	8
Accuracy of Technology and Science related Concepts	0	1	2	3	4
Verbal Communication Skills (voice speed, volume, etc.)	0	1	2	3	4
Non-Verbal Communication Skills (eye contact, body language)	0	1/2	1	1 1/2	2
All Group Members Participated	0	1/2	1	1 1/2	2
Use of Visual Aids	0	1/2	1	1 1/2	2
Preparation and Good Use of Class Time	0	1	2	3	4

	_____	_____
Self Evaluation	/3	/3
Peer Evaluation	/3	/3
Overall Mark	/32 = %	/32 = %
	Comments:	Comments:

TSM
Teacher Support Material

PURCHASING A SECOND HAND CAR – PROJECT

For this activity have your students go through the local newspaper and the classified ads or Prairie Auto Find (www.prairieautofind.ca) and look for second hand cars. Each vehicle will have some specific criteria (you decide) re: cost $5000 to 10000 dollars with less than 200 000 kilometers. Have each student fill out the attached chart and decide which of the two cars is the best value and provide reasons why. Then have the students calculate the cost of driving the car from their home town to a city (for example) and do a calculation for each of the best cars. They could then use a Lemon-Aid book or something similar to see if it still is the best car. This project would likely take a day or two to complete.

Suggested Resources:

Sanford Evans Gold Book
Used Vehicle Value Guide
ISSN 0381 – 8179

Consumer Reports' Used Car Buying Guide
Consumer Union of US
Yonkers, New York 10703
ISBN 09 755388 – 6 – 1

Phil Edmonston
Lemon – Aid
Used Cars and Minivans
Fitzhenry and Whiteside Ltd.
195 Allstate Parkway
Markham Ontario L3R 4T8
ISBN 1 – 55041 – 593X

www.sanfordevans.com

www.edmunds.com

www.kbb.com

www.consumerquide.com

Fuel Consumption Guide (Natural Resources Canada website)

Student Handout

STUDENT WORKSHEET - USED CAR RESEARCH

Name _____

Part 1: Vehicle Comparison Chart

	Year	Make	Model	Engine	Odometer Reading	Cost	Fuel Economy L/100 km
1							
2							
3							
4							
5							
6							

Part 2: Questions

1. Choose the two best vehicles from above and explain why they would be the best purchase.

Choice #1	Why?
Choice #2	Why?

Do some research on your two choices, using websites/resources provided by ther teacher. Answer questions #2 - 4 based on your research.

2. What websites and resources did you use?

3. In the space provided below state a minimum of three pieces of information about each vehicle from you research.

Choice #1	Information from research:
Choice #2	Information from research:

4. Have your research findings changed your choices of the two best vehicles? Explain why or why not?

TSM
Teacher Support Material

UNIFORM MOTION VS. NON-UNIFORM MOTION

Purpose:

Students will observe and describe various types of motion in an entertaining and educational way.

Task:

Students are to take out blank pieces of paper and write the titles of the action movies for the clips be shown. For each scene cue the student on whom or what they are supposed to observe. During the scene students are to describe the types of motion. For example speeding up, slowing down, and standing still. Each time there is a change in motion, example speeding up than slowing down; students need to record this on their paper. Students should be continually recording the whole scene. When the scene is done students are to discuss what types of motion they saw. At the end ask students if they observed uniform motion and discuss.

Note:

Scenes from various movies can be used. Action movies tend to work best at holding the attention of students and for finding motion. Some suggestions include: "Gone in 60 Seconds", "Mission Impossible Three" and "Finding Nemo". Any movie can be used as long as there is motion to be observed. Be sure to advise students of language content and violence in some movies and obtain parent permission if necessary. Use your own discretion.

Student Handout

SPEED, DISTANCE AND TIME CALCULATIONS

Show all of your work for each of the questions below.

	Distance	Time	Average Speed
A	10.5 m	4.3 s	
B		8.2 s	25 m/s
C	164 km		110 km/h

1. Use the appropriate formulas to find the information required to fill in the blanks in the chart above. Show each step of the calculation and round each answer appropriately.

2. Grace roller blades to school, a total distance of 4.5 km. Overall the trip takes her .35 h. What is Grace's average speed in km/h during the trip?

3. Curtis is trying to predict the time required to ride his bike to his summer job. He knows that the distance to his job is 3.2 km and that he can usually average about 20 km/h on his bike. Calculate how long the trip will take.

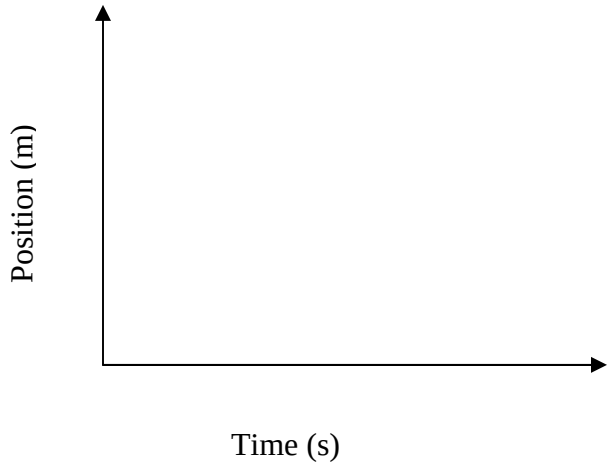
4. Convert:
   a) 56 km/h to m/s.

   b) 45 m/s to km/h

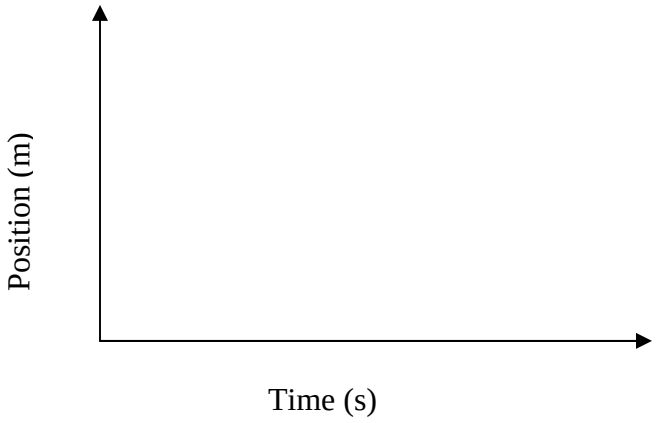
Student Handout

UNDERSTANDING GRAPHS

1. You walk 4 m across a room in 2 seconds and then turn around and slowly walk back 1 m. It takes you 4 seconds. Sketch this motion on the graph below.

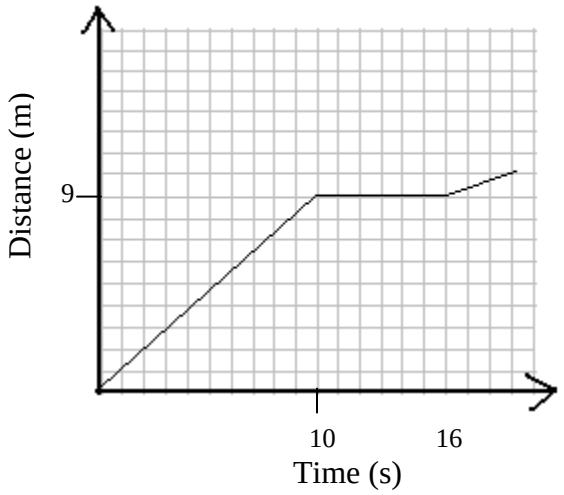


2. It takes your dog 3 seconds to run 10 m towards a cat. The cat hisses so your dog runs back 3 m. This takes 2 seconds. They both stand and stare at each other. The dog slowly moves 2 m forward in 5 seconds. Sketch the dog's motion on the graph below.

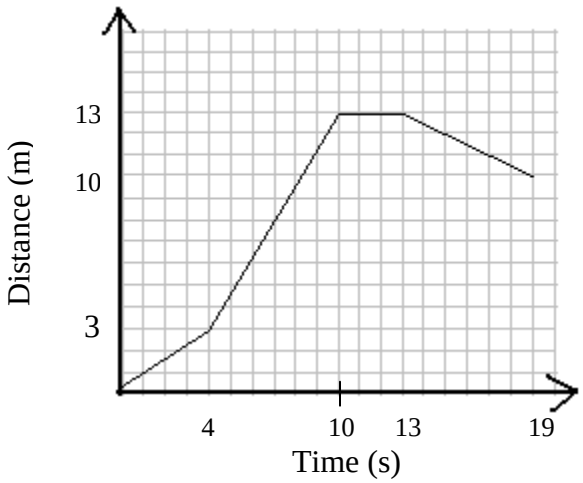


3. Describe the motion of the graphs below.

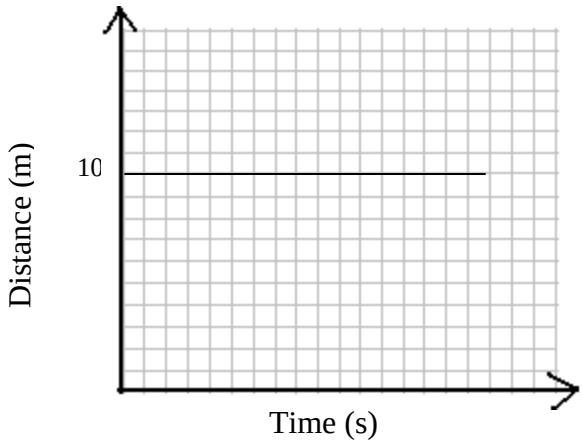
a.



b.



c.



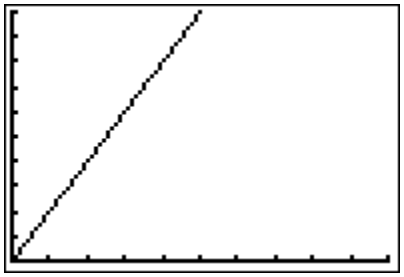
Student Handout

ANALYSIS OF DISTANCE – TIME GRAPHS

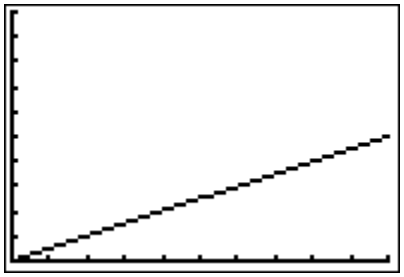
The following graphs are all graphs with distance on the vertical axis and time being on the horizontal axis.

For each of the following graphs, describe the motion and position of the object.

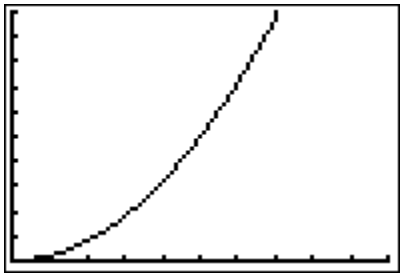
a)



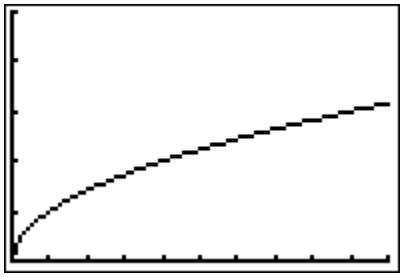
b)



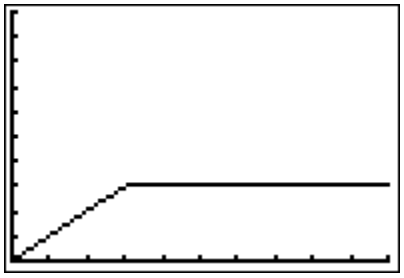
c)



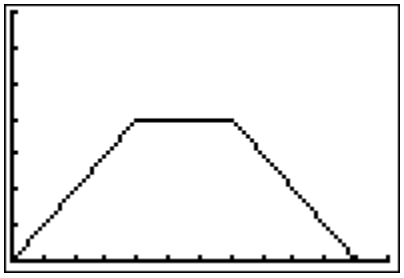
d)



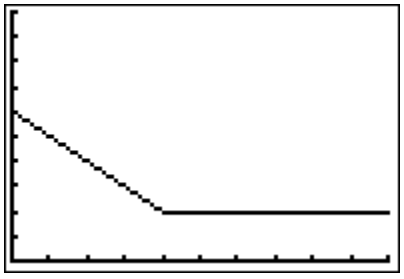
e)



f)

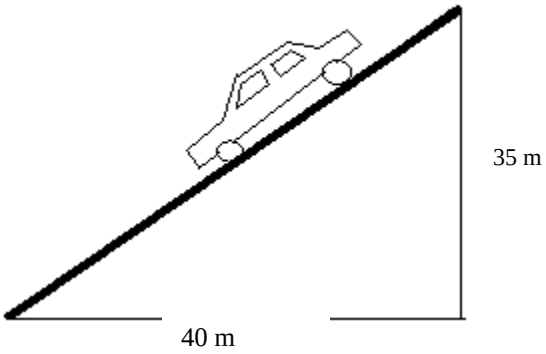


g)



Student Handout

SLOPE



How steep is the hill? Slope is a measure of steepness.

slope = rise (change in height)
run (side to side length)

Let's find the slope of the hill on the left.

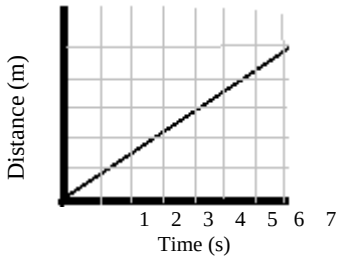
Slope = 35 m
40 m

slope = 0.87

Answer the following questions on this page.

1. A hill has a *rise* of 10 m and a *run* of 5 m. What is the slope?

2.



Rise/Height = _____ meters

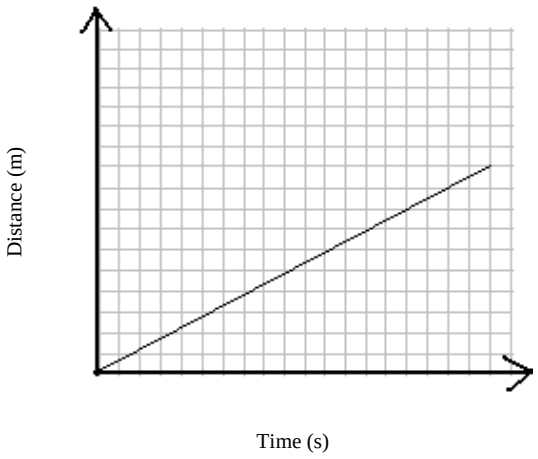
Run/Length = _____ seconds

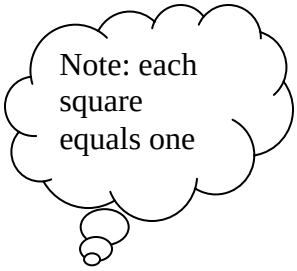
Slope = rise/run

= _____m ÷ _____s

= _____ m/s

3.





Rise (height) = _____ m

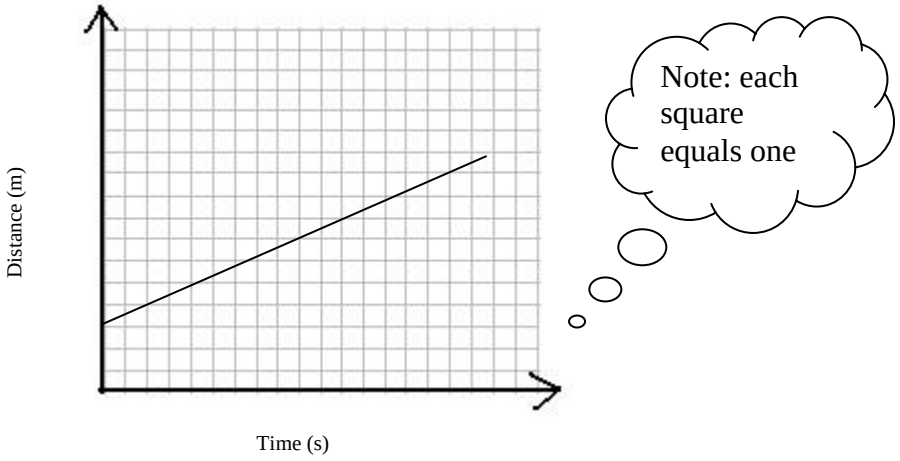
Run (length) = _____ s

Slope = rise/run

= _____m ÷ _____s

= _____ m/s

4.



Rise (height) = _____ m

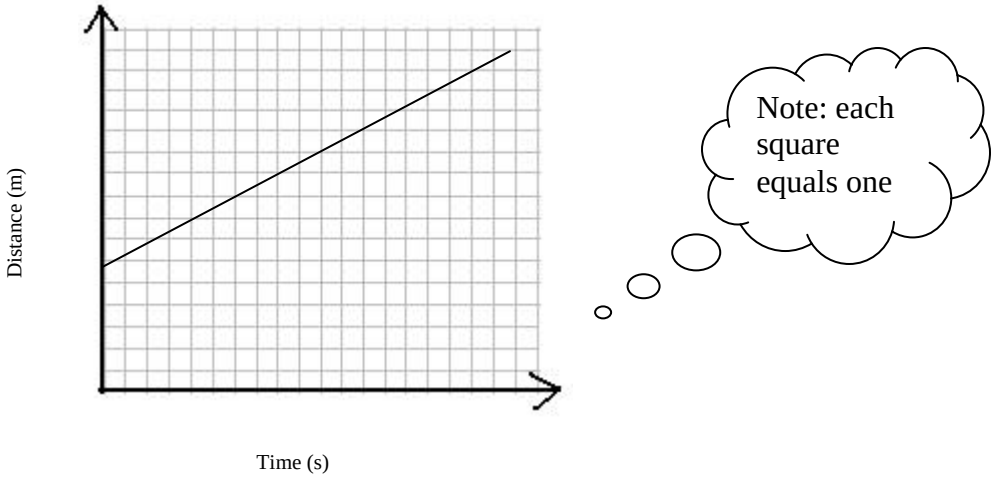
Run (length) = _____ s

Slope = rise/run

= _____m ÷ _____s

= _____ m/s

5.



Rise (height) = _____ m

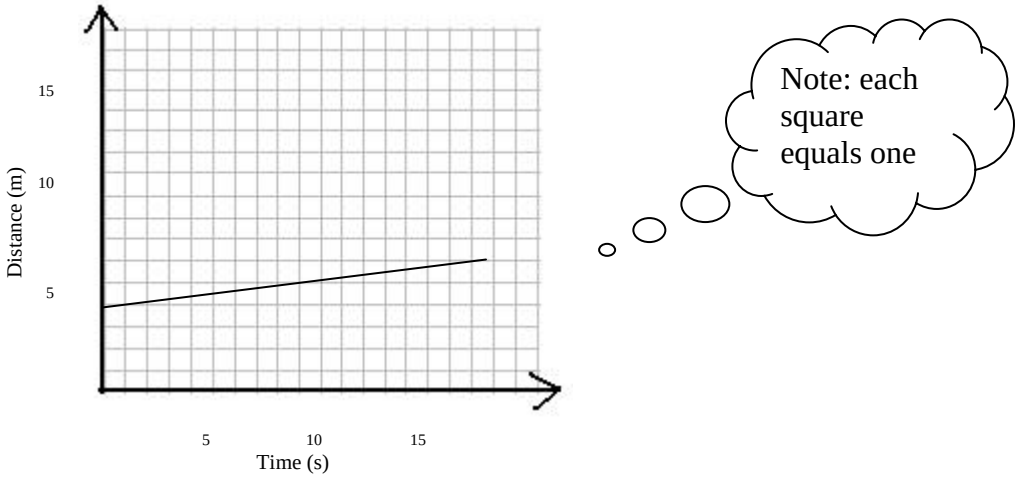
Run (length) = _____ s

Slope = rise/run

= _____m ÷ _____s

= _____ m/s

6.



Rise (height) = _____ m

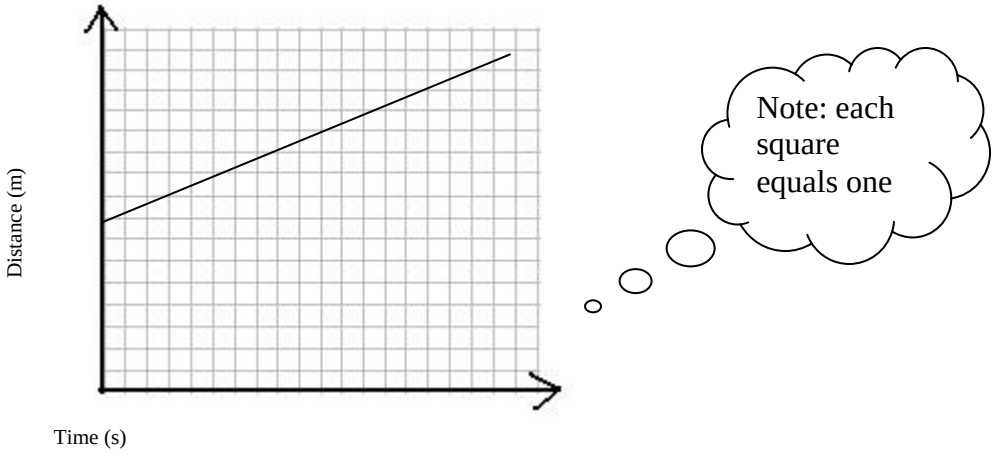
Run (length) = _____ s

Slope = rise/run

= _____m ÷ _____s

= _____ m/s

7.



Rise (height) = _____ m

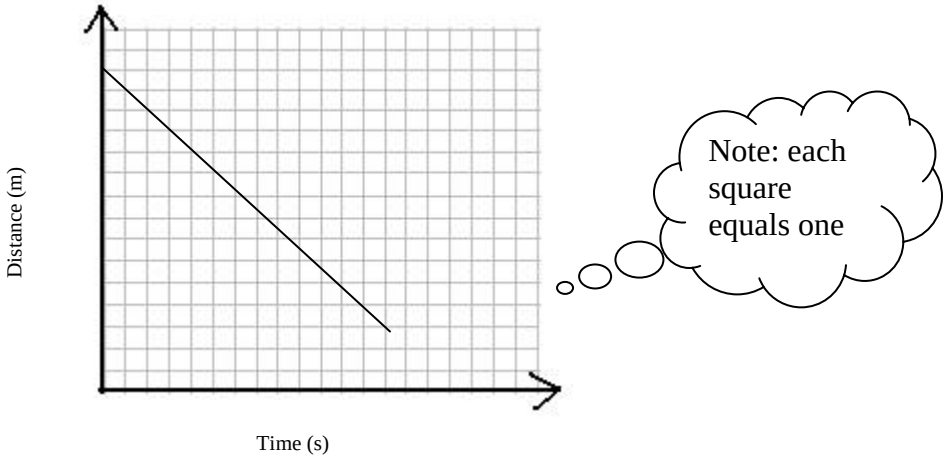
Run (length) = _____ s

Slope = rise/run

= _____m ÷ _____s

= _____ m/s

8.



Rise (height) = _____ m

Run (length) = _____ s

Slope = rise/run

= _____m ÷ _____s

= _____ m/

Student Handout

DISTANCE – TIME GRAPH ACTIVITY

In the following activity your group will choose a method of transportation and collect distance and time data for your "vehicle" in uniform motion. You will decide on a method of marking your time as you travel a distance in/on your vehicle. Your data will be collected and then graphed on a distance time graph. The average speed of your vehicle will be determined by calculating the slope of the graph.

Procedure:

1. Decide on a vehicle that your group will use to complete the activity and obtain the transportation device. (this should be done the day before the activity as directed by your teacher) Example vehicles could include bicycle, skateboard, wheelchair, scooter, etc. Be sure to check your choice with your teacher and use appropriate safety devices such as helmets, knee pads. etc.

2. Decide on a method to collect your distance data. You need some way of determining the distance traveled during each one second time interval. For example, you may what to have one member of the group drop an object such as a bean bag to mark the spot where the rider and the vehicle are at each consecutive second.

3. Using masking tape or chalk mark off a start line for the rider in the group.

4. Perform trial runs to identify possible problems with your method. (control all variables – e.g., the same person riding each time, the method of measuring and timing, etc.)

5. Perform your activity, with the rider beginning at the starting spot and transporting the vehicle at a uniform speed for a minimum of 6 seconds. During this time the rider or another group member should be using the chosen method of marking of the distance traveled each second.

6. Measure the total distance for each time interval and record your data table. Determine the individual distances by subtracting the total distance from the individual distance.

Your data must be recorded in a table like the sample one below.

Data Table for _____

Time (s)	Individual Distance (m)	Total Distance (m)
0	0.0	0.0
1	0.5	0.5
2	0.6	1.1
3	0.5	1.6
4	0.4	2.0
5		
6		

7. Plot a distance time graph of your data. Each person in your team must plot their own graph.

8. Draw a best fit line on your graph.

9. Calculate the slope of your graph.

10. Answer the questions below.

Questions:

1. What was the average speed of your vehicle in uniform motion in meters per second? In kilometers per hour?

2. Compare your graph to a classmate who used a different vehicle. From a qualitative observation of the lines on the two graphs, which vehicle has the greater speed? Explain.

3. Write a short paragraph summarizing the experimental set-up you used. Include the following information:
   a) the independent and dependent variables in your activity
   b) any other factors that you carefully kept constant (controlled variables)
   c) your method of timing

4. In your judgment, does your graph show that you maintained a constant speed during the investigation? Give reasons for your answers.

5. Describe at least two "sources of error" that may have affected your results.

Student Handout

YOUR ACCELERATION

Purpose:

How much do you speed up when you start running?
What does a position-time graph look like when something accelerates?

Hypothesis:

What will the graph look like?

_____

_____

Materials:

- Pylons
- Measuring Tape
- Stop Watch

Procedure:

1. In a field or parking lot, measure out 25 m.

2. Place a pylon every 5 m.

3. A person will stand at each pylon with a stop watch.

4. A student will stand at the starting line and say "on your mark, get set, go." When the student says "Go," all students will start the stop watches. Another student will start running.

5. As one student runs past each pylon, the time keeper will write down the time in the table.

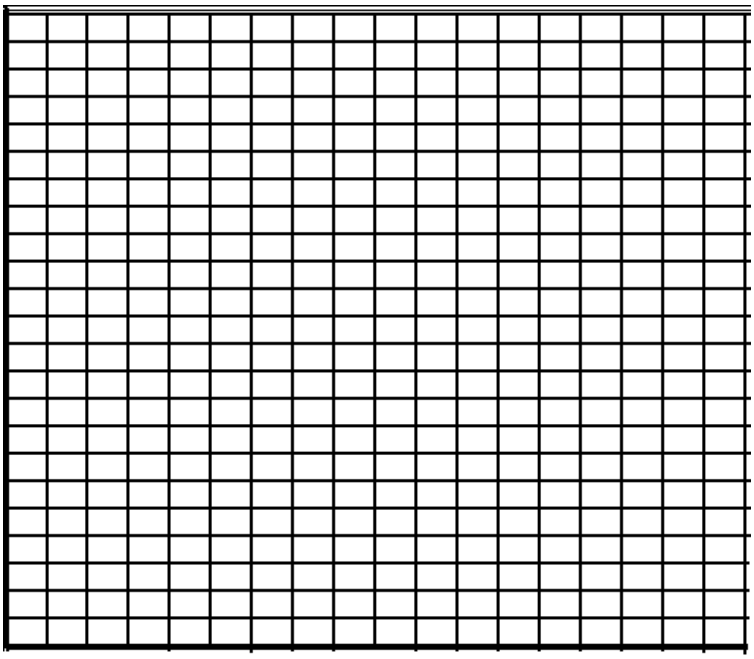
6. Answer the questions in the analysis section.

7. Write a conclusion.

Observations: Table #1: Your Distance and Time

Position (m)	Time (s)
0	0
5	
10	
15	
20	
25	

Analysis: Plot your points on the graph below based on **Table #1**.



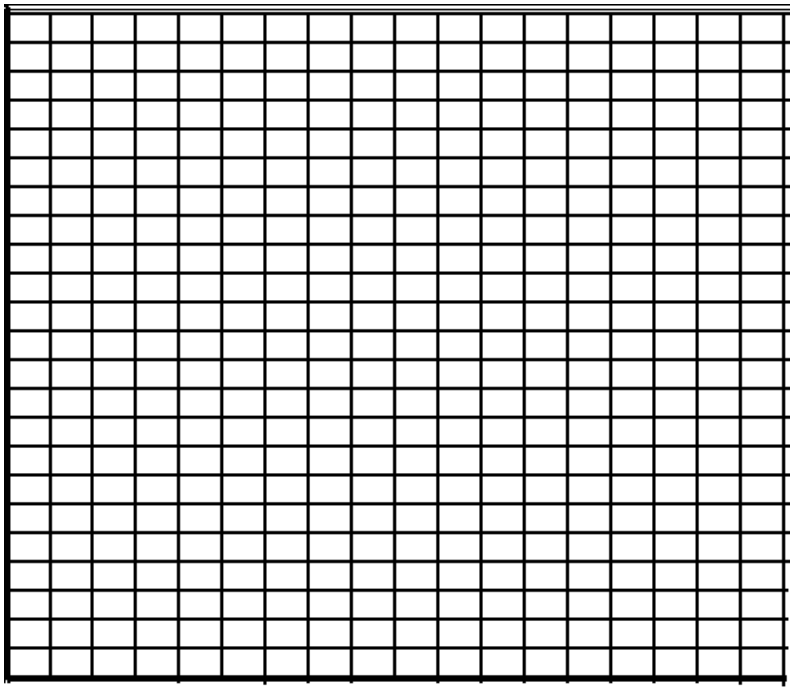
Calculate the average speed for each point.

Speed = distance traveled / time

Observations: Table #2: Speed and Time

Speed (m/s)	Time(s)

Analysis: Plot your points on the graph below based on **Table #2**.



Calculate the slope of the graph above.

Slope = rise/run

The acceleration of the runner is _____ m/s/s

Conclusion:

Describe the shape of your first graph.

Describe the shape of your second graph.

What is the acceleration of the runner?

TSM
Teacher Support Material

FORCES AND MOTION - VIDEO

Program Background:

Put students in the driver's seat as they learn how to measure speed and distance. This humorous, high-energy road show highlights the conditions that affect speed. Students will learn from professionals, high speed cyclists and sky divers, what they do to maximize velocity, and how shape and air resistance alter speed.

Resource Information:

Forces and Motion (Video). Assignment Discovery Series, Discovery Channel School, 2004 (25 minutes). Available from www.discoveryschool.com.

Viewing Guide

Suggested Questions:

1. Use the following questions for discussion purposes during and after viewing the video.
2. What are forces that you can feel?
3. What is the relationship between distance, time, and speed?
4. How can creating and analyzing graphs be useful for understanding forces and motion in objects?
5. What does the slope of a distance-time graph tell you?
6. In what ways do air resistance and the shape of an object influence its acceleration and speed?
7. How do you maintain a steady speed when riding a bicycle?
8. Why do skydivers use parachutes?

Suggested Minute Paper Topic:

Now that you have watched Forces and Motion, what is more important to you, the ability to reach a faster speed or a higher rate of acceleration?