UNIT PLAN

FORCES AND MOTION: DYNAMICS

Day / Topic	Curriculum Expectations	Agenda	Materials Needed	Assessment / Evaluation	References
Chapter 1 - Kinematics					
Day 1 - Speed and Velocity in One and Two Dimensions	**B2.2 solve problems related to motion**, including projectile and relative motion, **by adding and subtracting two-dimensional vector quantities, using vector diagrams, vector components, and algebraic methods** [PR, AI, C]	Hook: Leviathan Canada's Wonderland (5 min)	YouTube Video		http://www.youtube.com/watch?v=cym2hj4SVqw
		Discussion on what students know about distance, velocity and related formulas (5 min)		- Prior Knowledge Assessment	
		Instruction (Review) - Speed and Other Scalar Quantities - Velocity and Other Vector Quantities - Position and Velocity Graphs - Displacement and Velocity in Two Dimensions (30 min)	PPT Presentation - *Notes_k1 [pdf]* - *Solve 5 Samples on the Student Textbook*	- Observation	- Nelson. Physics 12 p. 6 - 17

		Activity: - Graphing Linear Motion (20 -30 min)	- Chart Paper - *Try this Activity_k1 [pdf]*	- Observation - Peer Feedback	Nelson. Physics 12 p. 12
		Consolidation (5 min)	Summary		
		Homework			Nelson. Physics 12 p. 17
Day 2 - Acceleration in One and Two Dimensions	**B2.2 solve problems related to motion**, including projectile and relative motion, **by adding and subtracting two-dimensional vector quantities, using vector diagrams, vector components, and algebraic methods** [PR, AI, C]	Discussion on what students know about acceleration of motion and related formulas (5 min))		- Prior Knowledge Assessment	
		Take up Homework (10 – 15 min)		- Observation	
		Instruction (Review) - Acceleration and Average Acceleration in One Dimension - Graphing Motion with Constant Acceleration - Solving Constant Acceleration Problems - Acceleration in Two Dimensions (30 – 35 min)	PPT Presentation - *Notes_k2 [pdf]* Worksheet: *WS_k2 [pdf]*	- Observation	- Nelson. Physics 12 p. 18 – 31
		Activity: - Graphing Motion with	- Chart Paper - *Try this Activity_k2 [pdf]*	- Observation - Peer Feedback	Nelson. Physics 12 p. 23

		Acceleration (15 min)			
		Consolidation: (5 min)	Summary		
		Homework:			Nelson. Physics 12 p. 30 – 31
Day 3 - More problems with Acceleration - Acceleration Due to Gravity	**B2.2 solve problems related to motion**, including projectile and relative motion, **by adding and subtracting two-dimensional vector quantities, using vector diagrams, vector components, and algebraic methods** [PR, AI, C]	Take up Homework (10 – 15 min)		- Observation	
		- Activity More Problems with Acceleration (30 min)	- Worksheet: *WS_k3 [pdf]*	- Observation - Peer Feedback	
		Instruction: - Measuring the Acceleration Due to Gravity - Calculations Involving Free Fall (20 – 25 min)	- PPT Presentation - Worksheet: *Samples 1 and 2 Problems 9, 10 (student Textbook)*	- Observation	- Nelson. Physics 12 p. 32 - 40
		Consolidation: (5 min)	Summary		
		Homework:			- Nelson. Physics 12 p. 37 - 38
Day 4 - Projectile Motion	**B2.2 solve problems related to** motion, including **projectile** and relative **motion**, by adding and subtracting two-dimensional vector quantities, using vector diagrams, vector	Discussion on what students know about projectiles and their applications (5 min))		- Prior Knowledge Assessment	
		Take up Homework (10 – 15 min)		- Observation	

		Instruction: - Analyzing the Motion of Objects Projected Horizontally - Analyzing More Complex Projectile Motion (30 min)	- PPT Presentation *Notes_k4_HP [pdf]* *Notes_k4_NHP [pdf]* *non-Notes_k4_NHP_example [pdf]*	- Observation	- Nelson. Physics 12 p. 41 - 51
components, and algebraic methods [PR, AI, C]		Activity: Golf Range Gizmo (20 min)	I need to book laptops for this activity - Worksheet: *GolfRangeSE_k4 [pdf]*	Evaluation: K/U 60% C 40%	http://www.explorelearning.com/index.cfm?method=cResource.dspView&ResourceID=26
		Consolidation: (5 min)	Summary		
		Homework			- Nelson. Physics 12 p. 50 - 51
Day 5 - Relative Motion	B2.2 **solve problems related to** motion, including projectile and **relative motion**, by adding and subtracting two-dimensional vector quantities, using vector diagrams, vector components, and algebraic methods [PR, AI, C]	Hook: Precision flying team The Snowbirds 2012 (3 min) Discussion on the Relative motion (2 min)	YouTube Video	- Prior Knowledge Assessment	http://www.youtube.com/watch?v=AHrJll99Vdk
		Take up Homework (10 – 15 min)		- Observation	
		Activity: - Comparing Horizontal Range	- Excel Spreadsheet - Chart Paper - *Try this Activity_k4*	- Group Work Observation - Peer Feedback	- Nelson. Physics 12 p. 49

		(10 min)	[pdf]		
		Instruction: - Frames of Reference and Relative Velocity (20 – 25 min)	- PPT Presentation *Notes_k5 [pdf]*	- Observation	- Nelson. Physics 12 p. 52 - 57
		Activity: Practice	Questions: *1 – 4 ((student Textbook)*	- Observation - Peer Feedback	
		Consolidation: (5 min)	Summary		
		Homework			- Nelson. Physics 12 p. 57
Day 6 **-** Lab Activities Investigating Projectile Motion	**B2.2 solve problems related to** motion, including **projectile** and relative **motion**, **by adding and subtracting two-dimensional vector quantities, using vector diagrams, vector components, and algebraic methods** [PR, AI, C]	Teacher Preparation: *Lab_proj_motion_TP [pdf]* Worksheet: *Lab_proj_motion_WS [pdf]* *Lab Report Due in Two Weeks (Day 17)*	*For the class:* - air table and related - - apparatus - bricks or books to support the raised end of the table *For each group of 4 or 5 students:* - metre stick *For each student:* - 3 sheets of construction paper - centimetre ruler - protractor	- Pre-Knowledge Requirements and Safety Issues: - Whole Class Discussion Evaluation: - K/U 10% - T/I 60 % - C 30%	- Nelson. Physics 12 p. 58 - 60
Day 7 - Chapter Review		Take up Homework (10 - 15 min)		- Observation - Peer Assessment	

		Review : - Speed and Velocity, Acceleration in One and Two Dimensions - Projectile Motion - Relative Motion (60 - 65 min)		- Group Work Observation - Peer Assessment	- Nelson. Physics 12 p. 64 – 67
		Homework			- Nelson. Physics 12 p. 63 (Self – Quiz)
Day 8 - Chapter Test		(75 min)	Test Sheet: *Test_kin [pdf]*	Evaluation: - 20 Marks: Multiple Choice Short Answer - 30 Marks: Problem Solving - K/U 20% - T/I 20% - C 20% - A 40%	http://schools.hwdsb.on.ca/highland/business highland/science/physics/
			Chapter 2 - Dynamics		
Day 9 - Forces and Free – Body Diagrams	**B2.3 analyse, in qualitative and quantitative terms, the relationships between the force of gravity, normal force**, applied force, force of friction, coefficient of static friction, and coefficient of	Intro: Traction System Discussion on Forces in everyday situation (5 min)		- Prior Knowledge Assessment	- Nelson. Physics 12 p. 70
		Activity: - Predicting Forces (10 min)	*Try this Activity_d1 [pdf]*	- Demonstration	- Nelson. Physics 12 p. 69

	kinetic friction, **and solve related two-dimensional problems using free-body diagrams, vector components, and algebraic equations [AI, C]**	Instruction: - Common Forces - Drawing Free-Body Diagrams - Analyzing Forces on Stationary Objects (25 – 30 min)	- PPT Presentation *Notes_d1 [pdf]*	- Observation	- Nelson. Physics 12 p. 70 - 76
		Activity: Problem Solving (20 – 25 min)	Questions : 4 – 10 *(student Textbook, p. 72 - 75)*	- Observation - Peer Assessment	
		Consolidation (5 min)	Summary		
		Homework			- Nelson. Physics 12 p. 76
Day 10 - Newton's Laws of Motion	**B2.5 analyse, in qualitative and quantitative terms, the relationships between the motion of system and the forces involved, and use free-body diagrams and algebraic equations to solve related problems** **[AI, C]**	Hook: Roller Coaster (2 min) Discussion on applied force that causes the coaster to accelerate forward and the effect of the back seat pressing hard against you. (3 min)	YouTube Video	- Prior Knowledge Assessment	http://www.youtube.com/user/undercovertourist?v=K6oRz3Surtk
		Take up Homework (10 - 15 min)		- Observation	
		Instruction: - Newton's First Law of Motion - Newton's Second	- PPT Presentation *Notes_d2_12 [pdf]* *Notes_d2_3*	- Observation	- Nelson. Physics 12 p. 77 - 87

		Law of Motion - Weight and Earth's Gravitational Field - Newton's Third Law of Motion (30 – 35 min)			
		Activity: Newton's Third Law (15 - 20 min)	Worksheet: *WS_d2 [pdf]*	- Observation - Peer Assessment	
		Consolidation (5 min)	Summary		
		Homework			- Nelson. Physics 12 p. 87
Day 11 - Applying Newton's Laws of Motion	**B2.5 analyse, in qualitative and quantitative terms, the relationships between the motion of system and the forces involved, and use free-body diagrams and algebraic equations to solve related problems** [AI, C]	Discussion on applications of Newton's Laws in Real Life (5 min)		- Prior Knowledge Assessment	
		Take up Homework (10 - 15 min)		- Observation	
		Instruction: - Solving Problems in a Systematic Way - Applying Newton's Third Law of Motion (20 – 25 min)	- PPT Presentation *Notes_d3 [pdf]*	- Observation	- Nelson. Physics 12 p. 88 – 96
		Activity: Practice (25 min)	Questions: 3, 5, 6, 8, 10, 11 *(student Textbook, p.*	- Observation - Peer Assessment	

			62 - 64)		
		Consolidation (5 min)	Summary		
		Homework			- Nelson. Physics 12 p. 88 - 96
Day 12 - Forces of Friction	**B2.1 use appropriate terminology related to dynamics, including, but not limited to:** inertial and non-inertial frames of reference, components, centripetal, period, frequency, **static friction, and kinetic friction** [C] **B3.2 explain the advantages and disadvantages of static and kinetic friction in situations involving various planes**	Hook: Friction (2 min) Discussion on Friction (3 min)	YouTube Video	- Prior Knowledge Assessment	http://www.youtube.com/watch?v=RkEv-9S6VuE
		Take up Homework (10 - 15 min)		- Observation	
		Instruction: - Coefficients of Friction - Fluid Friction and Bernoulli's Principle (25 – 30 min)	- PPT Presentation *Notes_d4 [pdf]*	- Observation	- Nelson. Physics 12 p. 97 - 107
		Activities: - Observing Triboluminescence (after the lesson: Coefficients of Friction) - Oil Viscosity - How Will the Cans Move? (after the lesson: Fluid Friction and	*Try this Activity_d4 [pdf]*	- Group Work Observation - Peer Feedback	- Nelson. Physics 12 p. 101 - Nelson. Physics 12 p. 102 - Nelson. Physics 12 p. 105

		Bernoulli's Principle) (15 – 20 min)			
		Consolidation (5 min)	Summary		
		Homework			- Nelson. Physics 12 p. 106 - 107
Day 13 - Inertia and Non – Inertial Frames of Reference	**B2.1 use appropriate terminology related to dynamics, including, but not limited to: inertial and non-inertial frames of reference**, components, centripetal, period, frequency, static friction, and kinetic friction [C] **B3.1 distinguish between reference systems (inertial and non-inertial) with respect to the real and apparent forces acting within such systems**	Hook: Inertia (2 min) Discussion on real life applications (3 min)	YouTube Video	- Prior Knowledge Assessment	http://www.youtube.com/watch?v=T1ux9D7-O38
		Take up Homework (10 - 15 min)		- Observation	
		Instruction: - Inertia and Non – Inertial Frames of Reference (20 – 25 min)	- PPT Presentation *Notes_d5 [pdf]*	- Observation	- Nelson. Physics 12 p. 108 - 111
		Activity: Practice	Questions *1 – 3 (student Textbook, p. 110 1 – 4 (student Textbook, p. 111)*	- Observation - Peer Assessment	
		Consolidation (5 min)	Summary		
		Homework			- Nelson. Physics 12 p. 115 p. 116 (Self – Quiz)

Day 14 - Lab Activities Measuring Coefficients of Friction	**B2.4 predict, in qualitative and quantitative terms, the forces acting on systems of objects, and plan and conduct an inquiry to test their predictions** [IP, PR, AI]	Teacher Preparation: *Lab_friction_TP [pdf]* Worksheet: *Lab_friction_WS [pdf]* *Lab Report Due in Two Weeks (Day 25)*	*For every group of 3 to 4 Students:* - metre stick - inclined plane(s) - several examples of materials that I want to test	- Pre-Knowledge Requirements and Safety Issues: - Whole Class Discussion Evaluation: - K/U 10% - T/I 60 % - C 30%	- Nelson. Physics 12 p. 113
Day 15 - Chapter Review - Chapter Quiz		Take up Homework (10 – 15 min)		- Observation	
		Chapter Review - Forces and Free – Body Diagrams - Newton's Laws of Motion - Forces of Friction **-** Inertia and Non – Inertial Frames of Reference (25 – 30 min)		- Group Work Observation - Peer Assessment	- Nelson. Physics 12 p. 117 - 119
		Chapter Quiz (25 – 30 min)	Quiz Sheet: *Quiz_dyn_solutions [pdf]*	Evaluation: - 10 Marks: Multiple Choice Short Answer - 20 Marks: Problem Solving - K/U 40%	http://schools.hwdsb.on.ca/highland/businesshighland/science/physics/

				- C 20% - A 40%	
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Day 16 - Uniform Circular Motion	**B2.6 analyse, in qualitative and quantitative terms,** the forces acting on and **the acceleration experienced by an object in uniform circular motion in horizontal and vertical planes, and use free-body diagrams and algebraic equations to solve related problems** [AI, C]	Hook: Circular Motion in Ice Skating (2 min) Discussion on other real life applications of the Circular Motion (3 min)	YouTube Video	- Prior Knowledge Assessment	http://www.youtube.com/watch?v=-DlhUW441fo
		Instruction: - Uniform Circular Motion - The Direction of Centripetal Acceleration - The Magnitude of Centripetal Acceleration (25 – 30 min)	PPT Presentation *Notes_c1.1 [pdf]* *Notes_c1.2 [pdf]*	- Observation	- Nelson. Physics 12 p. 122 - 127
		Activity: Simulating Circular Motion (20 – 25 min)	- I need to book laptops for this activity *Try this Activity_c1.2 [pdf]*	Evaluation: - K/U 50% - C 30% - A 20%	
		Consolidation (5 min)	Summary		

		Homework			- Nelson. Physics 12 p. 127
Day 17 - Analyzing Forces in Circular Motion Lab Report: Investigating Projectile Motion Due Today	B2.6 **analyse, in qualitative and quantitative terms, the forces acting on** and the acceleration experienced by an object **in uniform circular motion in horizontal and vertical planes, and use free-body diagrams and algebraic equations to solve related problems** [AI, C] **B3.3 explain the derivation of equations for uniform circular motion that involve the variables frequency, period, radius speed, and mass**	Discussion on the design of Highway curves: flat or banked? (5 min)		- Prior Knowledge Assessment	
		Take up Homework (10 - 15 min)		- Observation	
		Instruction: - Analyzing Forces in Circular Motion - Rotating Frames of Reference (20 – 25 min)	PPT Presentation - *Notes_c2 [pdf]*	- Observation	- Nelson. Physics 12 p. 128 - 138
		Case Study: - The Physics of the Looping Roller Coaster (20 – 25 min)	- I need to book laptops for this activity *Try this Activity_c2 [pdf]*	Evaluation: - K/U 50% - C 30% - A 20%	- Nelson. Physics 12 p. 131 - 132
		Consolidation (5 min)	Summary		
		Homework			- Nelson. Physics 12 p. 138
Day 18 - Universal Gravitation - Satellites and Space Stations	**B1.1 analyse a technological device that applies the principles of linear or circular motion** [AI, C] **B1.2 assess the impact**	Hook: Solar System (1 min) Discussion on the force of gravity (4 min)			http://www.youtube.com/watch?v=9R5P9Y9gRYY

	on society and the environment of technological devices that use linear o**r circular motion** [AI, C]	Take up Homework (10 - 15 min)		- Observation	
		Instruction: - Newton's Law of Universal Gravitation - Satellites in Circular Orbit - Apparent Weight and Artificial Gravity (25 – 30 min)	PPT Presentation *Notes_c3.1 [pdf]* *Notes_c3.2 [pdf]*	- Observation	- Nelson. Physics 12 p. 139 – 143 - Nelson. Physics 12 p. 145 - 151
		Activity: Practice (20 min)	Questions: *5, 8, 11 (student Textbook, p. 141 – 143)* *4, 6, 7, 10, 12 (student Textbook, p. 147 - 150)*	- Observation - Peer Assessment	
		Consolidation (5 min)	Summary		
		Homework			- Nelson. Physics 12 p. 157 – 158 (Self – Quiz)
Day 19 - Chapter Review - Chapter Quiz		Take up Homework (10 – 15 min)		- Observation - Peer Assessment	
		Chapter Review- Uniform Circular Motion - Forces in Circular Motion - Universal Gravitation - Satellites and		- Observation - Peer Assessment	- Nelson. Physics 12 p. 159 – 161

		Space Stations (25 – 30 min)			
		Chapter Quiz (25 – 30 min)	Quiz Sheet: *Sample Quiz_CM [pdf]*	Evaluation: - 10 Marks: Multiple Choice Short Answer - 20 Marks: Problem Solving - K/U 40% - C 20% - A 40%	http://schools.hwdsb.on.ca/highland/businesshighland/science/physics/
Day 20 - Lab Activities Analyzing Uniform Circular Motion	**B2.7 conduct inquiries into the uniform circular motion of an object**, **and analyse, in qualitative and quantitative terms, the relationships between centripetal acceleration, centripetal force, radius of orbit, period, frequency, mass, and speed** [PR, AI]	Teacher Preparation: *Lab_UCM_TP [pdf]* Worksheet: *Lab_UCM_WS [pdf]* *Lab Report Due in Two Weeks (Day 31)*	For each group of three or four students: - a reinforced glass tube with smooth ends - 1.5 m of fishing line or strong, smooth string - three one-holed rubber stoppers of equal size - metal masses (50 g, 100 g, and 200 g) - small paper clip or masking tape - electronic or triple-beam balance - metre stick For each student, depending on the method of data analysis chosen: linear graph paper (optional)	- Pre-Knowledge Requirements and Safety Issues Evaluation: - K/U 10% - T/I 60 % - C 30%	- Nelson. Physics 12 p. 152 - 153

			log-log graph paper (optional) graphing calculator (optional)		
Day 21 - Chapter 2 and 3 Review		Review of - Chapter 2 (35 min) - Chapter 3 (35 min)		- Observation - Peer Assessment	
Day 22 - Chapter 2 and 3 Review (If needed)		If needed, I will split the review in two days. If not needed, I will do the test today.		- Observation - Peer Assessment	
Day 23 - Chapter 2 and 3 Test		Test	Test Sheet: *Test_Dynamics_Ch2,3 [pdf]*	Evaluation: 20 Marks: Multiple Choice Short Answer 30 Marks: Problem Solving - K/U 20% - T/I 20% - C 20% - A 40%	

Resources

Student Textbook: Nelson Education. (2003). Physics 12: University Preparation. Nelson Education Ltd. Toronto, Ontario.

Sokol Kambo – SPH4U

Lab Resources (Worksheets and Teacher Prep): Dr. Cramer's Notes.

Worksheets and Teacher's Notes: Highland Secondary School. (2013). SPH4U. Hamilton-Wentworth District School Board. Retrieved from

http://schools.hwdsb.on.ca/highland/businesshighland/science/physics/

Gizmo worksheets: Explorer Learning Website http://www.explorelearning.com/