

Grade 12 Physics

SPH4U

Qinghao Hu

November 6, 2025

Contents

1 Unit 1A	3
1.1 Review of Describing and Graphing Motion	3
1.1.1 Position: \vec{d}	3
1.1.2 displacement: $\Delta\vec{d}$	3
1.1.3 Velocity: \vec{v}	3
1.1.4 Acceleration: \vec{a}	3
1.1.5 Graphing motion	3
1.2 Equations of Motion	5
1.2.1 Format requirements for answering Motion questionss	5
1.3 Adding and Subtracting 2-Dimensional Vectors	6
1.3.1 Vector addition and subtraction key words	6
1.3.2 Steps for solving a vector problem	6
1.3.3 Another question type	6
1.4 Frame of Reference	7
1.4.1 1 Dimension Frame of Reference	7
1.5 Relative Velocities in Two Dimensions	9
1.5.1 Recall	9
1.5.2 Definition	9
1.6 F.O.R in 2-D	10
1.7 Review of Netwon's Laws of Montion	11
1.7.1 Netwon's First Laws	11
1.7.2 Newton's second Law	11
1.7.3 Newton's Third Law	11
1.7.4 Free Body Diagrams (FBD)	12
1.7.5 Application of Newton's second Law	12
1.8 Review of Projectile Motion	13
1.8.1 basic	13
1.8.2 Special formula	13
1.8.3 An example question	14
1.9 Friction	14
1.9.1 Kinetic Friction	15
1.9.2 Static Friction	15
1.9.3 Remainder	15
1.10 Tension, compression and Pulleys	16
1.10.1 Tention: T	16
1.10.2 Compression: C	16
1.11 Inclined plane with Friction	17
1.11.1 How to determine the direction that the system will likely to accelerate	17
1.11.2 Example template	17

2 Unit 1B	18
2.1 Proportionality	18
2.2 Fictitious Forces and Apparent Weight	19
2.2.1 Compare Inertial and non-inertial F.O.R	19
2.2.2 Fictitious Forces	19
2.2.3 Apparent Weight	19
2.2.4 Some of the formulas	19
2.3 Lecture 2.5	20
2.3.1 Uniform Circular Motion	20
2.3.2 Centripetal acceleration	20
2.3.3 Formulas	20
2.4 Motion of a car on Banked Turn	21
2.4.1 Forces	21
2.4.2 Critical Speed	21
2.5 Universal Gravitation, Gravitational field	21
2.5.1 Force of Gravity	21
2.5.2 Gravational Fields	22
2.5.3 Differences between strength of gravity and acceleration	22
2.6 Satellites	23
2.6.1 Netwon's Cannon	23
2.6.2 Geosynchronous	23
2.6.3 Formulas related to satellite	23
2.7 Rotating Frame of Reference	25
2.7.1 Little problem	25
2.7.2 Perceived Acceleration in a Rotating Frame of Reference	26
3 Unit 2: Energy and Momentum	28
3.1 HEAD-ON Collisions	28
3.1.1 Equations	28

Chapter 3

Unit 2: Energy and Momentum

3.1 HEAD-ON Collisions

3.1.1 Equations

Under this section, I will derive Equations that is useful to solve for final velocity for each object when you have initial velocity for a HEAD-ON Collision question

The equation for \vec{v}_A'

$$\vec{v}_A' = \frac{m_A - m_B}{m_A + m_B} * \vec{v}_A \quad (3.1)$$

The equation for \vec{v}_B'

$$\vec{v}_B' = \frac{2m_A}{m_A + m_B} * \vec{v}_A \quad (3.2)$$

For questions which \vec{v}_B is not zero, we need change Frame of Reference to \vec{v}_B in order to solve the question. And change the FOR back later.