

## Unit 04 – Vocabulary and Equations – Forces & Newton's Laws

<p><b><u>Vocabulary:</u></b>          previous vocabulary          force, net force, equilibrium          electromagnetic force, gravity, long-range force          contact force, field force          mass (m), weight          normal          inertia          Newton (N)          friction          normal force          coefficient of friction (COF, <math>\mu</math>)          static friction, sliding friction, kinetic friction          free body diagram (FBD)          Newton's law(s) (IFA)</p>	<p><b><u>Symbols:</u></b>  <math>\Delta</math>, x, v, t, <math>\Delta x</math>, <math>\Delta v</math>, <math>\Delta t</math>, a, f, i, <math>f_{s,max}</math>, <math>f_k</math>,</p> <p><b><u>Equations &amp; constants:</u></b>  <b>You get these on test:</b></p> $v = \frac{\Delta x}{\Delta t} \qquad a = \frac{\Delta v}{\Delta t}$ $\Delta x = v_0 \Delta t + \frac{1}{2} a t^2, \quad v_f^2 = v_i^2 + 2a \Delta x$ $v = v_0 + a \Delta t \quad (v \text{ means } v_f)$ $v_x = v \cos\Theta, \quad \Delta x = v_x t, \quad v_i = v \sin \Theta, \quad \Delta y = v_y t$ $F = ma \quad F_f = \mu F_n \quad p = mv \quad I = \Delta P = F \Delta t$ $60 \text{ mph} = 27 \text{ m/s}; \quad 60 \text{ seconds} = 1 \text{ min.}; \quad 60 \text{ min} = 1 \text{ hr.}$
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### Unit Objectives - Williams

1. I understand all the vocabulary & math of this unit and all demos, videos, equations, and class assignments
2. I remember objectives & vocabulary from previous units.
3. I understand force is a push or a pull, and can distinguish contact and field forces such as gravity, magnetism and static electricity
4. I can draw/analyze free-body diagrams identifying  $F_N$ ,  $F_g$ ,  $F_A$  or  $F_T$  and  $F_f$  and analyze net forces
5. I can break down gravitational force on a surface into parallel and perpendicular components ( $F_{gx}$ ,  $F_{gy}$ )
6. I can break down forces into X and Y components and analyze these components independently
7. I can add vectors numerically by X and Y components or graphically using arrow representations
8. I understand that forces ON and object affect the motion of an object; forces BY and object do not
9. I realize that when all forces are balanced, the net force is zero and no acceleration takes place
10. I memorized all three Newton's laws by number. I can come up with examples of each kind and distinguish which law is primarily demonstrated when given sample questions.
11. That a floor can "push you" makes sense and this normal force is necessary or I feel weightless
12. I can compute weight, distinguish mass & weight, understand the universality of mass
13. I know friction always opposes the motion of an object and not necessarily the external forces on the object
14. I know how the normal force effects friction and how tilting surfaces changes normal and frictional force
15. I know what does/doesn't impact friction like  $\mu$ , weight, normal force, motion, speed, contact area, etc.
16. I know what COF ( $\mu$ ) is, its units, how many surfaces determine it and how motion/stillness affects it
17. I know how the value for static friction varies with applied force, but kinetic friction is constant

### DuPage ROE Objectives

101. I can distinguish between scalar and vector quantities.
201. I can draw a free body diagram.
202. I can identify the Law of Inertia (Newton's 1st Law) to various situations in the real world.
203. I can add force vectors graphically to find net force.
204. I can distinguish the difference between mass from weight.
205. I can recognize net force as the sum of the forces and not a force in itself.
206. I can calculate the net force based on the forces acting on an object in one dimension.
207. I can determine if an object will accelerate depending on the net force acting on it.
208. I can solve problems using Newton's 2nd Law
209. I can identify action-reaction force pairs (Newton's 3rd Law) and the fact that they act on two separate bodies.
210. I can identify the factors that create friction, and how friction will affect an object's motion.
211. I can identify the direction of the velocity, acceleration, and net force on an object undergoing uniform circular motion.