

Unit 14 Themed – Vocabulary and Equations – Circular Motion, Forces & Newton's Laws

$E_i = E_f$ (conservation of energy) GPE = mgh KE = $\frac{1}{2}mv^2$ ME = KE + GPE Wt = mg W = Fd P = W/t AMA = F_o/F_i IMA = d_i/d_o Eff. = W_o/W_i Eff. = P_o/P_i $f = \mu N$ $F_{net} = ma$ $a_c = v^2/r$ $F_c = ma_c$ (circ.) $g's = a_c/9.8$ $x = \text{circumference} = 2\pi r$ $v = \sqrt{2g\Delta h} = \sqrt{19.6\Delta h}$	$v = \frac{\Delta x}{\Delta t}$ $a = \frac{\Delta v}{\Delta t}$ $\Delta x = v_0 \Delta t + \frac{1}{2} at^2$ $v_f^2 = v_i^2 + 2a \Delta x$ $v_f = v_0 + a \Delta t$ $\Delta x = v_x \Delta t$ $v_{yi} = v \sin\theta$ $v_x = v \cos\theta$ $p = mv$ $p_i = p_f$ $(m_1v_1 + m_2v_2)_i = (m_1v_1 + m_2v_2)_f$ $I = \Delta p = m\Delta v = F\Delta t$	Equation					
		$v_{yf} = v_{yi} + at$	√	√	√	√	⊗
		$\Delta y = \frac{(v_{yi} + v_{yf})}{2} t$	⊗	√	√	√	√
		$\Delta y = v_{yi}t + \frac{1}{2}at^2$	√	√	√	⊗	√
		$v_{yf}^2 = v_{yi}^2 + 2a\Delta y$	√	⊗	√	√	√

$1609 \text{ m} = 1 \text{ mi}$ $60 \text{ mph} = 27 \text{ m/s}$ $1 \text{ hp} = 746 \text{ W}$ $1 \text{ lb} = 0.4536 \text{ kg}$ $1 \text{ mi} = 1609 \text{ m}$ $1 \text{ W-s} = 1 \text{ J}$ $1 \text{ ft} = 0.3048 \text{ m}$

Symbols: Δ , x , v , t , Δv , Δt , a , f , i , $f_{s,max}$, f_k , F_g , a_c , Vocabulary: previous vocabulary Newton (N), friction, normal force	coefficient of friction (COF, μ) static friction, sliding friction, kinetic friction free body diagram (FBD), Newton's law(s) (IFA)	centripetal, centrifugal, tangential speed, centripetal acceleration, centripetal force, circumference g-force, black out, red out, klothoid loop, center of mass
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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
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 μ , weight, normal force, motion, speed, contact area, etc.
16. I know what COF (μ) 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

Circular motion, gravity

1. I understand that circular motion requires a center-directed force
2. I know what blackouts and red outs are, how coasters produce them and how klothoid loops are used to combat them
3. I can look at circular motion examples and identify the source of centripetal forces
4. I know the difference between centripetal force and centrifugal force (inertia) and which one is real
5. I can use basic geometry knowledge to help solve circular motion problems
8. I understand the law of gravitation and gravity is a relatively weak force, but is only capable of attraction
9. I know that a normal force is required to feel weight as experienced in elevators and by astronauts

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 in uniform circular motion