

# Newton's Three Law of Motion QUIZ REVIEW SHEET

## Established Goals:

- ✓ Recognize that inertia is a property of matter that can be described as an object's tendency to resist a change in motion and is dependent upon an object's mass (Newton's first law of motion).
- ✓ Determine the effect (direction and magnitude) of the sum of the forces acting on an object (net force).
- ✓ Using information about net force and mass to determine the effect on acceleration (Newton's second law of motion)
- ✓ Analyze force pairs (action/reaction forces) when given a scenario and describe their magnitudes and directions (Newton's third law of motion).

## Essential Understandings:

- The mass of an object DIRECTLY affects the inertia of that object.
  - If you increase the mass, you increase the inertia and vice versa.
- The force on an object DIRECTLY affects an object's acceleration.
  - If you increase the force, you increase the acceleration and vice versa.
- The mass of an object INVERSELY affects an object's acceleration.
  - If you increase the mass, you decrease the acceleration and vice versa.
- For every action, there is an EQUAL and OPPOSITE reaction.

## Essential Questions:

1. What is the first law of motion?
2. What is inertia?
3. How does inertia relate to mass?
4. What is the second law of motion?
5. What is the difference between weight and mass?
6. Why is friction considered to be a force?
7. What force acts on EVERY OBJECT?
8. What does it mean for an object to be in "equilibrium"?
9. What is the third law of motion?
10. What does "equal and opposite force" mean?

Unit 2: Newton's Laws of Physics-MATH REVIEW PROBLEMS

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Equations:  $w = m g$        $F = m a$        $a = \frac{F}{m}$        $m = \frac{F}{a}$

Constants:  $g = 10 \text{ m/s}^2$        $10 \text{ N} = 1 \text{ kg} = 2.2 \text{ lbs.}$

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PROBLEM: *Complete and SHOW WORK on all problems.*

1. Calculate the weight of a person with a mass of 50 kg:
2. Calculate in Newtons the weight of a 2000 kg elephant:
3. An apple weighs 1 N. What is its mass in kg? What is its weight in lbs?
4. If forces of 10 N and 15 N act on an object in the same direction. What is the net force on the object?
5. If forces of 10 N and 15 N act in opposite directions on an object, what is the net force?
6. Calculate the horizontal force that must be applied to produce an acceleration of  $1.8 \text{ m/s}^2$  for a 1.2 kg puck on a horizontal friction-free air table:
7. What is the acceleration of a 747-Jumbo Jet with a mass of 30,000 kg in takeoff when the thrust (force) for each of its four engines is 30,000 N?
8. Calculate the acceleration of a 5 kg box on a table if you push with a horizontal force of 15 N. The force of friction is present and is 5 N.
9. Find the mass of an object that has a force of 30 N applied to it and is accelerating at  $7 \text{ m/s}^2$ :

# Review: Newton's Three Laws

## Chapters 4-6

### Chapter 4

- Newton's First Law
  - Inertia: object in motion stays in motion
  - Stationary object, stays stationary
    - Unless force acts on it
- Mass= kilograms
  - More massive means more force required
- Weight= force of gravity on an object
  - $2x \text{ mass} = 2x \text{ weight}$
  - $1 \text{ kg} = 2.2 \text{ lbs}$
  - $1 \text{ kg} = 9.8 \text{ N}$
- $W = mg$
- Net force = total of all forces
- Equilibrium = net force = zero
- Natural vs. violent motion
- Friction: touching resistant force
  - No friction= repeating motion

### Chapter 5

- Newton's Second Law
  - $F = m \times a$
  - More mass = less acceleration with same force
  - Inverse =  $\downarrow \uparrow$
  - Directly =  $\uparrow \uparrow$  or  $\downarrow \downarrow$  equal in magnitude
- Pressure = force per area
- Free fall: terminal velocity
  - Air resistance = gravity
  - Net force = zero
  - Acceleration = zero

### Chapter 6

- Newton's Third Law
- Interaction among 2 objects
  - Equal and opposite
- Action/ reaction pairs: interchangeable
- Difference depends on mass
- Same force, different reactions

