

## 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? *object rest/motion stays until outside force*
2. What is inertia? *tendency not to change (rest motion)*
3. How does inertia relate to mass? *same*
4. What is the second law of motion?  *$F=ma$*
5. What is the difference between weight and mass? *weight is w/gravity*
6. Why is friction considered to be a force? *push or pull against motion*
7. What force acts on EVERY OBJECT? *gravity*
8. What does it mean for an object to be in "equilibrium"? *all forces cancelled*
9. What is the third law of motion? *equal + opposite*
10. What does "equal and opposite force" mean?  
*same  $F$  on each object*

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

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

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:  $50 \cdot 10 = 500 \text{ N}$
2. Calculate in Newtons the weight of a 2000 kg elephant:  $2000 \cdot 10 = 20000$
3. An apple weighs 1 N. What is its mass in kg? What is its weight in lbs?  $1 \cdot 0.1 = 0.1$      $1 \cdot 2.2 = 2.2$
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?  
 $10 \text{ N} \rightarrow$      $15 \text{ N} \rightarrow$      $25 \text{ N} \rightarrow$
5. If forces of 10 N and 15 N act in opposite directions on an object, what is the net force?  
 $10 \text{ N} \rightarrow$      $15 \text{ N} \leftarrow$      $5 \text{ N} \leftarrow$
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:  $1.8(1.2) = 2.16 \text{ N}$
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?  
 $30000(4) = 120000 \text{ N}$      $\frac{120000}{30000} = 4 \text{ m/s}^2$
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.  $15 - 5 = 10 \text{ N}$   
 $\frac{10}{5} = 2 \text{ m/s}^2$
9. Find the mass of an object that has a force of 30 N applied to it and is accelerating at  $7 \text{ m/s}^2$ :

$$\frac{30}{7} = 4.28 \text{ kg}$$