Physical Science
Study Guide
Unit 3 Test – Monday, March 12

Key Terms:

- Force
- Tension
- Sliding Friction
- Elastic Force
- Inertia
- Newton's First Law of Motion
- System Schema
- Net Force
- Static Friction
- Newton
- Weight
- Newton's Second Law of Motion
- Gravity
- Contact Force
- Fluid Friction
- Flex Force (Normal Force)
- Mass
- Newton's Third Law of Motion
- Unbalanced Force
- Balanced Forces
- Rolling Friction
- Force Addition Diagram

Test Material by Subject:

Forces

- Types
  - Be able to recognize the different types of forces acting on an object
    - Tension (F_T)
    - Sliding Friction (F_{fk})
    - Fluid Friction (F_{fk})
    - Rolling Friction (F_{fk})
    - Static Friction (F_{fs})
    - Gravitational Field Force (F_g)
      - Know acceleration due to gravity
      - Understand the difference between weight and mass and how each may change
    - Flex Force a.k.a. Normal Force (F_N)
    - Elastic Force (F_e)
    - Contact Force ($F_{contact}$)
  - Recall that forces are indicated using arrows that indicate the size and direction of the force
  - Be able to draw a force diagram for an object given its circumstances
  - Be able to draw a system schema and/or force addition diagram for an object
  - Be able to write a sentence about an object's motion in terms of acceleration and force.
  - Recall that the unit for Force is Newtons (kgm/s^2)
- Net Forces
  - Be able to add all of the forces acting on an object to get the net force
  - Recall that forces acting in opposite directions subtract from each other. The resulting force is in the direction of the larger one. For example: 30N to the right and 20N to the left combine to a 10N force to the right.
- Balanced vs. Unbalanced Forces
  - Balanced Forces
    - Net force = 0; no acceleration
    - Understand that forces of equal size in opposite direction acting on a single object cancel each other out.
    - Remember that if an object is in constant motion (or at rest), then the net force is zero. Be able to apply this mathematically. For example: If a box is moving at a constant velocity and Jenny is applying 5N of force, then there are 5N of friction to balance it out.
  - Unbalanced Forces
    - Net force ≠ 0; there is acceleration

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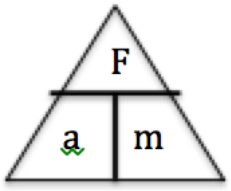
- There may be forces in opposite directions, but they are not equal in size. In a force diagram, one arrow will be larger than its opposite.
- This is how motion occurs

Newton's First Law of Motion

- Definition
  - Understand that objects resist changes to motion (they have inertia)
  - If an object is in motion, it will stay in motion indefinitely until an unbalanced force changes its motion
- Applications (these are examples – be able to apply the concepts to any object in motion or at rest)
  - To start the ball in broom ball, you had to apply a force in the direction you wanted the ball to move.
  - In the no-touch zone, you did not have to touch the ball at all for it to continue its motion.
  - To stop the ball in broom ball, you had to apply a force in the opposite direction of its motion.

Newton's Second Law of Motion

- Definition
  - The net force on an object is equal to the object's mass times its acceleration (F = ma)
  - This applies to more than just gravity! Therefore, the acceleration will not always be $9.8 m/s^2$ (unless we are talking about gravitational pull on Earth).
- Applications
  - Be able to calculate acceleration, force, or mass given the other two parts.
  - Be able to provide the appropriate units for a calculated quantity.
  - Example problem: What is the net force acting on a 15kg object with an acceleration of $10 m/s^2$?



$$F = ma$$

$$F = (15kg)\left(10\frac{m}{s^2}\right)$$

$$F = 150N$$

Newton's Third Law of Motion

- Definition
  - For any force applied to an object, there is an equal and opposite reaction force.
  - Understand that the reaction force is not usually applied to the same object as the original force.
  - The FORCES are always equal and opposite, even if the masses and accelerations are not.
- Applications
  - This law is applicable to any force applied to an object
  - Collisions are an excellent example of this law.
  - Understand that differences in mass and acceleration will cause the same force to have a different effect on two objects.

See "Essential Questions/Instructional Goals" File for the Unit on my website & Reference table for equations.