

## GIANCOLI READING ACTIVITY

### Section 4-7

1. Big Idea(s): The interactions of an object with other objects can be described by forces.
2. Enduring Understanding(s): All forces share certain common characteristics when considered by observers in inertial reference frames.
3. Essential Knowledge(s):
  - a. 3.A.1: An observer in a particular reference frame can describe the motion of an object using such quantities as position, displacement, distance, velocity, speed, and acceleration.
    - i. Displacement, velocity, and acceleration are all vector quantities.
    - ii. Displacement is change in position. Velocity is the rate of change of position with time. Acceleration is the rate of change of velocity with time. Changes in each property are expressed by subtracting initial values from final values.
    - iii. A choice of reference frame determines the direction and the magnitude of each of these quantities.
  - b. 3.A.2: Forces are described by vectors.
    - i. Forces are detected by their influence on the motion of an object.
    - ii. Forces have magnitude and direction.
  - c. 3.A.4: If one object exerts a force on a second object, the second object always exerts a force of equal magnitude on the first object in the opposite direction.
  - d. 3.B.1: If an object of interest interacts with several other objects, the net force is the vector sum of the individual forces.
  - e. 3.B.2: Free-body diagrams are useful tools for visualizing forces being exerted on a single object and writing the equations that represent a physical situation.
    - i. An object can be drawn as if it was extracted from its environment and the interactions with the environment identified.
    - ii. A force exerted on an object can be represented as an arrow whose length represents the magnitude of the force and whose direction shows the direction of the force.
    - iii. A coordinate system with one axis parallel to the direction of the acceleration simplifies the translation from the free-body diagram to the algebraic representation.
4. Learning Objective(s):
  - a. (3.A.1.1): The student is able to express the motion of an object using narrative, mathematical, and graphical representations.
  - b. (3.A.1.2): The student is able to design an experimental investigation of the motion of an object.

- c. (3.A.1.3): The student is able to analyze experimental data describing the motion of an object and is able to express the results of the analysis using narrative, mathematical, and graphical representations.
  - d. (3.A.2.1): The student is able to represent forces in diagrams or mathematically using appropriately labeled vectors with magnitude, direction, and units during the analysis of a situation.
  - e. (3.A.4.1): The student is able to construct explanations of physical situations involving the interaction of bodies using Newton's third law and the representation of action-reaction pairs of forces.
  - f. (3.A.4.2): The student is able to use Newton's third law to make claims and predictions about the action-reaction pairs of forces when two objects interact.
  - g. (3.A.4.3): The student is able to analyze situations involving interactions among several objects by using free-body diagrams that include the application of Newton's third law to identify forces.
  - h. (3.B.1.1): The student is able to predict the motion of an object subject to forces exerted by several objects using an application of Newton's second law in a variety of physical situations with acceleration in one dimension.
  - i. (3.B.1.2): The student is able to design a plan to collect and analyze data for motion (static, constant, or accelerating) from force measurements and carry out an analysis to determine the relationship between the net force and the vector sum of the individual forces.
  - j. (3.B.1.3): The student is able to reexpress a free-body diagram representation into a mathematical representation and solve the mathematical representation for the acceleration of the object.
  - k. (3.B.2.1): The student is able to create and use free-body diagrams to analyze physical situations to solve problems with motion qualitatively and quantitatively.
5. Read section 4-7 in your textbook.
6. Describe what a *free-body diagram* is and how it is used in problem solving. \_\_\_\_\_

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7. Use the chart below (or reproduce on a separate sheet of paper) to illustrate the solution to one of the example problems in this section (Examples 4-9 to 4-15, Conceptual Examples don't count). In the left column you must list the **Problem Solving** step from page 85 in your textbook. The right column should then be the application of that step in solving the Example problem.

Problem Solving Step	Application to Example Problem # _____

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- Answers may be typed or neatly printed. Drawings may be freehand, but try to make use of the 'Shapes' or 'Insert Clipart' functions of MS Word. If you submit this assignment electronically, the filename must be in the following format, "LastnameFirstinitialPerXReadActX-X".

9. **50% Bonus:** Create a comic to illustrate one of the steps of the problem solving process mentioned above using the following instructions,
- a. Go to the website [http://marvel.com/games/play/34/create\\_your\\_own\\_comic](http://marvel.com/games/play/34/create_your_own_comic) . Note: This website may be blocked on school computers.
  - b. Select “Create A Comic Strip” for a 1-3 panel comic, or “Create a Comic Book” for a 1-12 page comic book.
  - c. Follow the instructions on the website to create your comic.
  - d. When you are finished, select “Download”.
  - e. Select “Ok”
  - f. The name for your file should be, ***YourNameReading ActivityX-X.pdf***. Make sure you keep the “.pdf” extension
  - g. Select “Save”.
  - h. If you are completing this assignment electronically, you can open the pdf file, take a snapshot of your comic, and then paste it at the end of this assignment. Otherwise, print your comic and turn in separately, or upload to FOCUS.