Warm Up Exercises: Unit 2, Forces II

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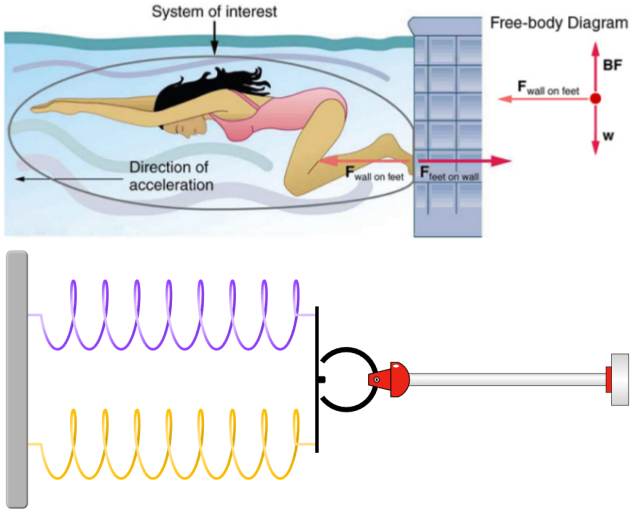

Figure 1: (Top) A swimmer pushes off the wall underwater. (Bottom) Two springs connected in parallel.

1 Memory Bank

1. $\vec{F} = m\vec{a}$ ... Newton's 2nd Law
2. $\vec{F}_{\rm AB} = -\vec{F}_{\rm BA}$ ... Newton's 3rd Law
3. $\vec{s} = -k\Delta\vec{x}$ ... Hooke's Law (spring force)
4. $\vec{f} = -\mu N\hat{i}$ ... Force of friction along horizontal
5. $\vec{F}_{\rm C} = -m\vec{r}\omega^2$ ... Centripetal force
6. $\vec{F}_{\rm C} = -(mv^2/r)\hat{r}$ ... Centripetal force

2 Chapter 5 - Forces I

1. (a) What net external force is exerted on a 1100.0 kg artillery shell fired from a battleship if the shell is accelerated at 2.40×10^4 m s^{-2}? (b) What is the magnitude of the force exerted on the ship by the artillery shell, and why? (c) What is the acceleration of the battleship, if its mass is 5×10^7 kg?
2. A swimmer pushes backward on an underwater wall (Fig. 1, top) with force of 800.0 N. The mass of the swimmer is 50 kg. (a) What is the acceleration of the swimmer? (b) Why does the swimmer accelerate to the *left*, if her applied force is to the *right?*
3. (a) If a 180 kg rugby player hits a 120 kg player, what is the ratio of their accelerations? (b) If the acceleration of the heavier player is observed to be +0.5 m s^{-2}, what is the acceleration of the lighter player?

3 Chapter 6 - Forces II

1. Three forces act on an object, considered to be a particle, which moves with constant velocity $\vec{v} = 3\hat{i} - 2\hat{j}$ m s^{-1}. Two of the forces are $\vec{F}_1 = 3\hat{i} + 5\hat{j}$ N and $\vec{F}_2 = 4\hat{i} - 7\hat{j}$ N. Find the third force.
2. Consider Fig. 1 (bottom). The two springs are connected *in parallel*. (a) If the k-value of each spring is 100 N m^{-1}, what force would each provide if stretched by 10 cm? (b) If connected in parallel, with what force would we have to pull to measure a displacement of 20 cm? (c) Consider the simulation to compare a single spring to two springs connected in parallel: `https://phet.colorado.edu/en/simulations/hookes-law`