Dr. Mohammad Hussein PHY 105 Recitation 3 26/10/2023

1. A force of magnitude F acts on an object of mass m that is initially at rest and accelerates it to speed v in a time T. Suppose the mass of the object is doubled, and the magnitude of the force acting on it is quadrupled (i.e., becomes 4F). In terms of T, how much time does it take for the object to accelerate from rest to a speed v now? 0.5 T

Insight: If the mass m were quadrupled instead of doubled, the acceleration would be $a_{new} = 4F/4m = a_{old}$, and hence the time required to accelerate to speed v would remain unchanged.

2. A force *F* pushes on the first of three boxes in the manner indicated by the figure blow. Find the magnitude of the contact force:

(a) between boxes 1 and 2. 6.46 N

(b) between boxes 2 and 3. 3.91 N



Free tip: The boxes must each have the same acceleration, but because they have different masses the net force on each must be different. Note also that the force exerted by box 1 to the right accelerates boxes 2 and 3.

Note: You should be able to validate your answers by solving each part using two different approaches.

3. An object acted on by three forces moves with constant velocity. One force acting on the object is in the positive x direction and has a magnitude of 6.5 N; a second force has a magnitude of 4.4 N and points in the negative y direction. Find the magnitude and direction of the third force acting on the object.

7.8 N, θ = 146° based on our convention.

Insight: The vector sum of all the forces acting on any object that is not accelerating must be zero. It's extremely important to distinguish between the absence of forces acting on an object and the absence of a net force acting on the object.

4. A newborn baby's brain grows rapidly. In fact, it has been found to increase in mass by about 1.6 mg per minute.

(a) How much does the brain's weight increase in one day? 0.023 N

(b) How much time does it take for the brain's weight to increase by 0.15 N? 6.6 days Hint: mg stands for milligram.

Insight: The weight of the brain of the newborn is approximately 300 grams (10% of body weight) in contrast to the adult brain, which weighs approximately 1400 grams (2% of body weight). If the newborn brain kept gaining weight at the rate of 1.6 mg/min it would reach adult size in 477.4 days or about 16 months. In reality it reaches the adult brain weight between six and fourteen years of life.

Hmm, I bet you will enjoy your next semester anatomy and physiology classes!

5. When you lift a ball straight upward by an applied force of 82 N, the ball accelerates upward with an acceleration a. If you lift with a force of 92 N, the ball's acceleration is 2a. Find:

(a) the weight of the ball. 72 N

(b) the acceleration a. 1.36 m/s²

Insight: In the first case, 72 N of force supported the weight of the ball and 10 N accelerated it at a rate of 1.36 m/s^2 . In the second case, 20 N of net force accelerated the ball at a rate of 2.72 m/s^2 .