

KEY

This is P110, Quiz 6. As usual, you are allowed to use a cheat sheet and a calculator.

1. A person pushes a mass  $m$  across a frictionless surface, resulting in an acceleration  $a$ . If we double the mass, what force is required to reach the same acceleration?

- a. Same force  
☒ b. Twice the force  
 c. Half the force  
 d. Four times the force

$$F = ma$$

$\nwarrow$   $2x$   
 $\uparrow$   
 same

F should be  $2x$

2. In class we saw that an 80 kg pole vaulter needed 360 lbs of force to decelerate from 9 m/s to zero in 2 m. How much force would be required if the same vaulter stopped over 4m instead of 2m?

- a) Same force since mass is the same.  
 b) Twice the force  
☒ c) Half the force  
 d)  $\frac{1}{4}$  the force  
 e) 4 times the force

$$F = ma$$

$v_0$  same  
 $m$  " "

$$a = -\frac{v_0^2}{2x}$$

$x = 2x$

$\rightarrow \frac{1}{2} \rightarrow F \frac{1}{2}$

3. A typical adult weighing 176 lbs on the earth has a mass of 80 kg. What is the mass of a toddler (who weighs 18 lbs)?

- a) Depends on where they are weighed  
 b) 80 kg  
☒ c) 18 kg  
 d) 8 kg  
 e) 20 kg

weight is  $\frac{1}{10}$   
 so mass "

4. A child vaulter weighs half as much and runs half as slow as the adult vaulter in (2). Which of the following is true about the relative force and deceleration required to stop the kid?

- a) Same force,  $\frac{1}{4}$  the deceleration  
 b)  $\frac{1}{8}$  the force,  $\frac{1}{2}$  the deceleration  
 c)  $\frac{1}{4}$  the force,  $\frac{1}{2}$  the deceleration  
 d) Same force, same deceleration  
☒ e)  $\frac{1}{8}$  the force,  $\frac{1}{4}$  the deceleration

$$F \propto mv^2 \quad (\text{since } x \text{ is same})$$

$$a \propto v^2$$

$v \frac{1}{2} \rightarrow a \frac{1}{4}$

$m \frac{1}{2} \rightarrow F \frac{1}{2} \cdot \frac{1}{4} = \frac{1}{8}$

5. In class we saw that a force of 700 lbs was required to hit a golf ball ( $m = 0.46$  kg) at 170 mph, the speed necessary for a 300 yd drive. On the range you see a person hitting wedges 100 yds and correctly assume that the ball speed required is 57 mph. What is the contact force?

- a) 350 lbs  
 b) 700 lbs  
 c) 57 lbs  
 d) 19 lbs  
☒ e) 230 lbs

$$\Delta p = F \Delta t$$

$\frac{1}{3}$        $\uparrow$   
 same  
 $F \frac{1}{3} = 700$