

Honors

Additional Newton Problems

NAME Key DATE _____ BLOCK _____

1. If a baby has a mass of 5.0 kg, what does it weigh?

$$\begin{aligned} W &= mg \\ &= (5 \text{ kg})(9.8 \text{ m/s}^2) \\ &= 49 \text{ N} \end{aligned}$$



Answer: _____

2. On the moon, the gravity is 1/6 that of Earth. While on the moon, Buzz Aldrin carried on his back a support system that would weigh over 1760 N on Earth. a) What did the backpack weigh on the moon? b) What was its mass on the moon?

$$a. \frac{1760 \text{ N}}{6} = 293 \text{ N}$$

$$\begin{aligned} b. m &= w/g \\ &= \frac{1760 \text{ N}}{9.8 \text{ m/s}^2} \\ &= 180 \text{ kg} \end{aligned}$$



Answer: a. 293 N
Answer: b. 180 kg

3. To make extra money during the summer, Mr. Garber, a 66.0 kg physics teacher, paints the outsides of houses while sitting on a 4.0 kg plank suspended by two vertical cables. What is the tension in each of the two cables?

$$\begin{aligned} W &= mg \\ &= (66 \text{ kg} + 4 \text{ kg})(9.8 \text{ m/s}^2) \\ &= 686 \text{ N} \div 2 = \end{aligned}$$



Answer: 343 N

4. Sidney Crosby makes a slap shot and hits a .22 kg hockey puck with a force of 95 N. How fast does the puck accelerate?

$$a = \frac{F}{m}$$
$$= \frac{95 \text{ N}}{.22 \text{ kg}}$$



Answer: 432 m/s²

5. A common malady in runners who run on too hard a surface is shin splints. If a runner's 7.0 kg leg hits pavement so that it comes to a rest with an acceleration of -200 m/s² on each hit, how much force must the runner's leg withstand on each step?

$$F = ma$$
$$= (7.0 \text{ kg})(200 \text{ m/s}^2)$$
$$= 1400 \text{ N}$$



Answer: 1400 N

6. In the district soccer championship finals, Elizabeth kicks a .600 kg soccer ball with a force of 80.0 N. How much does she accelerate the soccer ball from rest in the process?

$$a = \frac{F}{m}$$
$$= \frac{80 \text{ N}}{.600 \text{ kg}}$$



Answer: 133 m/s²

7. Lindsey Vonn is skiing in the Olympics. She has a mass of 73 kg and her skis take up an area of .31 m². How much pressure does she exert when she's standing in her skis?

$$P = \frac{F}{A}$$

$$= \frac{715.4 \text{ N}}{.31 \text{ m}^2}$$

$$w = mg$$

$$F = (73 \text{ kg})(9.8 \text{ m/s}^2)$$

$$= 715.4 \text{ N}$$



$$= 2308 \text{ Pa}$$

Answer: 2308 Pa

8. What force must you exert on a ball point pen in order to apply a pressure of 67,000 Pa on a piece of paper, if the ball of the pen has a surface area of 1.2 mm² touching the paper?

$$F = PA$$

$$= (67,000 \text{ Pa})(1.2 \times 10^{-6} \text{ m}^2)$$

$$= .08 \text{ N}$$

$$1.2 \text{ mm}^2 \times \frac{1 \text{ m}^2}{1,000,000 \text{ mm}^2} = 1.2 \times 10^{-6} \text{ m}^2$$



Answer: .08 N

9. Asad cuts his knee in a fall while chasing a soccer ball. If a 6 N force is exerted in Asad's knee during the fall, applying a pressure of 1000 Pa on an area of his skin, what is the area of the cut that results from the impact?

$$A = \frac{F}{P}$$

$$= \frac{6 \text{ N}}{1000 \text{ Pa}}$$

$$= .006 \text{ m}^2$$

Answer: .006 m²



10. The amazing 72 kg Gambini walks across a 30.0 m long tightrope high above a 3-ring circus. If a 10 cm² area of Gambini's foot presses on the rope, how much pressure does Gambini apply on this area?

$$\begin{aligned}
 W &= mg \\
 &= (72 \text{ kg})(9.8 \text{ m/s}^2) \\
 &= 705.6 \text{ N}
 \end{aligned}$$

$$\begin{aligned}
 P &= \frac{F}{A} \\
 &= \frac{705.6 \text{ N}}{.001 \text{ m}^2}
 \end{aligned}$$



$$10 \text{ cm}^2 \times \frac{1 \text{ m}^2}{10,000 \text{ cm}^2} = .001 \text{ m}^2$$

Answer: 705,600 Pa

11. In the TV show, *The Addams Family*, Uncle Fester found it quite comfortable to sleep on a bed of nails. Though this doesn't sound like the most pleasant way to take a nap, it is not too painful if many nails are placed fairly close together. a) If Uncle Fester has a mass of 54 kg and his body covers 700 nails, each with a surface area of 1.00 mm², what is the pressure exerted on his body? b) What would be the pressure if Uncle Fester napped on a bed made of only 1 nail?

$$\begin{aligned}
 W &= mg \\
 &= (54 \text{ kg})(9.8 \text{ m/s}^2) \\
 &= 529.2 \text{ N}
 \end{aligned}$$

$$\begin{aligned}
 \text{All:} & \quad 700 \times 1.0 \times 10^{-6} = 7.04 \times 10^{-4} \text{ m}^2 \\
 P &= \frac{F}{A} \\
 &= \frac{529 \text{ N}}{7.0 \times 10^{-4} \text{ m}^2} \\
 &= 756,000 \text{ Pa} \\
 &\quad \text{OR} \\
 &= 7.6 \times 10^5 \text{ Pa}
 \end{aligned}$$



$$1.00 \text{ mm}^2 \times \frac{1 \text{ m}^2}{1,000,000 \text{ mm}^2} = 1.0 \times 10^{-6} \text{ m}^2$$

$$\begin{aligned}
 \text{One:} \\
 P &= \frac{F}{A} \\
 &= \frac{529.2 \text{ N}}{1.0 \times 10^{-6} \text{ m}^2}
 \end{aligned}$$

Answer: a. 756,000 Pa OR 7.6 × 10⁵ Pa

Answer: b. 529,000,000 Pa OR 5.3 × 10⁸ Pa

$$\begin{aligned}
 &= 529,000,000 \text{ Pa} \\
 &\quad \text{OR} \\
 &= 5.3 \times 10^8 \text{ Pa}
 \end{aligned}$$