**Newton’s 3 Laws of Motion Practice Set**

1. A little boy pushes a wagon with his dog in it. The mass of the dog and wagon together is 45 kg. The wagon accelerates at 0.85 m/s2. What force is the boy pulling with?

2. A 68 kg runner exerts a force of 59 N. What is the acceleration of the runner?

3. Three women push a stalled car. Each woman pushes with a 425 N force. What is the mass of the car if the car accelerates at 0.85 m/s2?

4. When an F-14 airplane takes-off an aircraft carrier it is literally catapulted off the flight deck. The plane's final speed at take-off is 68.2 m/s. The F-14 starts from rest. The plane accelerates in 2.0 seconds and has a mass of 29,545 kg. What is the total force that gets the F-14 in the air?

5. A sports car accelerates from 0.00 to 27 m/s, in 6.3 seconds. The car exerts a force of 4106 N. What is the mass of the car?

6. A cartoon plane with four engines can accelerate at 8.9 m/s2 when one engine is running. What is the acceleration of the plane if all four engines are running and each produces the same force?

7. A rocket accelerates in a space at a rate of "1.0 g." The rocket exerts a force of 12,482 N. Later in flight the rocket exerts 46,458 N. What is the rockets new acceleration? What is the rocket's new acceleration in "g's?"

8. A locomotives mass is 18181.81 kg. What is its weight?

9. What is the weight of an infant whose mass is 1.76 kg?

10. The surface gravity of the Sun is 274 m/s2. How many Earth gʼs is this?

11. A very fast car accelerates from a rest to 32 m/s, (71.68 mph), in 4.2 seconds. What is the acceleration of the car and how many gʼs is this?

12. The Space Shuttle travels from launch to 529.2 m in 6.0 seconds. What is the acceleration of the shuttle and how many gʼs is this?

13. The space shuttle’s mass, (with boosters) is 654,506 kg. The average force of the shuttle’s engines is 25,656,635.2N. What is the acceleration of the shuttle in m/s2 and gʼs to 3 sig digs?

14. A little boy, mass = 40.0 kg, is riding in a wagon pulled by his HUGE dog, Howard. What is the acceleration of the wagon if the dog pulls with a force of 30.0 N? (Assume the wagon rolls on a frictionless surface).

15. A speedboat in the water experiences an acceleration of 0.524 m/s2. The boat's mass is 842 kg. What is the force that the boat's engines are putting out?

16. A stalled car is pushed with a force of 342 N from rest. How far does the car travel in 12 seconds if its mass is 989 kg?

17. How far does the car travel in the previous problem if the pushing force is doubled?

18. A little boy is pulling a wagon full of 10 bricks. The mass of the wagon is too small to be considered. If the boy later is pulling the wagon with the same force and the wagon has 45 bricks in it, then how does the acceleration of the 45 brick wagon compare to the acceleration of the 10 brick wagon?

19. What force does the car exert if its mass is 1201 kg and the car goes from 5.4 m/s to 16.3 m/s in 107 meters?

20. What are Newton's 3 Laws and which ones are used in shaking a Ketchup bottle to get the Ketchup out when it is "stuck" in the bottle? Explain

21. A 1027 kg car is resting at a stoplight. The car moves with a force of 1528 N for 22 s. Then the car travels at a constant velocity for 10 seconds. Finally, the car stops with a force of 4056 N. What distance does the car travel during its journey?

**Answers**:

1) 38 N

2) 0.87 m/s2

3)1500 kg

4) 1.0 x 106 N

5) 9.6 x 102 kg

6) 36

7) 3.7 gʼs

8) 178181.7 N

9) 17.3 N

10) 28.0 gʼs

11) 7.7 m/s2, 0.76 gʼs

12) 29 m/s, 3.0 gʼs

13) 29.4 m/s, 3 gʼs

14) 0.750 m/s2

15) 441 N

16) 25 m, (0.34 m/s2)

17) 50 m

18) accel of 45 brick wagon = (1/(4.5))[accel of the 10 brick wagon)

19) 1.3 x 103 N

20) 1st When you shake the bottle you are moving the bottle and the ketchup inside. When you halt the bottle, the ketchup wants to continue its motion and will try to do so, moving it towards the opening.

21) 360.05m + 327.32 + 135.64m = 8.2 x 102 m

**Newton’s 3 Laws Practice Set 2**

1. Use the third law of motion together with a diagram of the action-reaction pair(s) to explain each situation.

a) A person with ordinary shoes is able to walk on a sidewalk.

b) A rocket accelerates in the vacuum of outer space.

2. A certain string breaks when a force of 225 N is exerted on it. If two people pull on opposite ends of the string, each with a force of 175 N, will the string break? Explain.

3. According to Newton’s third law, when a horse pulls on a cart, the cart pulls back with an equal force on the horse. If, in fact, the cart pulls back on the horse as hard as the horse pulls forward on the cart, how is it possible for the horse to move the cart?