Dynamics Worksheet #2

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/s^2. What force is the boy pulling with?

2. A 1650 kg car accelerates at a rate of 4.0 m/s^2. How much force is the car's engine producing?

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

4. A crate is dragged across an ice covered lake. The box accelerates at 0.08 m/s^2 and is pulled by a 47 N force. What is the mass of the box?

5. Three (3) 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/s^2?

6. A tennis ball, 0.314 kg, is accelerated at a rate of 164 m/s^2 when hit by a professional tennis player. What force does the player's tennis racket exert on the ball?

7. In an airplane crash a woman is holding an 8.18 kg, baby. In the crash the woman experiences a horizontal de-acceleration of 88.2 m/s^2. How much force must the woman exert to hold the baby in place?

8. 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 seconds and has a mass of 29,545 kg. What is the total force that gets the F-14 in the air?

9. A sports car accelerates from 0 to 27 m/s, in 6.3 seconds. The car exerts a force of 4106 N. What is the mass of the car?

10. A sled is pushed along an ice covered lake. It has some initial velocity before coming to a rest in 15 m. It takes 23 seconds before the sled and rider comes to a rest. If the rider and sled have a combined mass of 52.5 kg, what is the magnitude and direction of the stopping force?

11. A car is pulled from rest with a force of 10,000 N. The car's mass is 1267 kg. However, when starting from rest, the car has a displacement of 394.6 m in 15 seconds.
    (a) What is expected acceleration of the car from the 10,000 N force?
    (b) What is the actual acceleration of the car from the observed velocity, displacement and time?
    (c) What is the difference in accelerations?
    (d) What force caused this difference in acceleration?
    (e) What is the magnitude and direction of the force that caused the difference in acceleration?

12. A boy can accelerate at 1.00 m/s^2 over a short distance. If the boy were to take an energy pill and suddenly have the ability to accelerate at 5.6 m/s^2, then how would his new energy-pill-force compare to his earlier force? If the boy's earlier force was 45 N, what is the size of his energy-pill-force?

13. A cartoon plane with four engines can accelerate at 8.9 m/s^2 when one engine is running. What is the acceleration of the plane if all four engines are running and each produces the same force?

14. While dragging a crate a workman exerts a force of 628 N. Later, the mass of the crate is increased by a factor of 3.8. If the workman exerts the same force, how does the new acceleration compare to the old acceleration?

15. A rocket accelerates in a space at a rate of 9.8 m/s^2. The rocket exerts a force of 12 482 N. Later in flight the rocket exerts 46 458 N. What is the rocket's new acceleration?

16. A little boy (mass = 40 kg) is riding in a wagon pulled by his dog, Howard.
    (a) What is the acceleration of the wagon if the dog pulls with a force of 30 N? (Assume the wagon rolls on a frictionless surface).
    (b) The wagon gets away from Howard and freely rolls until it hits a patch of ground that slows down the wagon until it comes to a rest. If it takes 10 seconds to come to a stop in 15 meters, what if the frictional force stopping the wagon?

17. A speed boat in the water experiences an acceleration of 0.524 m/s^2. The boat's mass is 842 kg. What is the force that the boat's engines are putting out?

18. A stalled car (mass = 989 kg) is pushed with a force of 342 N from rest.
    (a) How far does the car travel in 12 seconds?
    (b) How far does the car travel f the pushing force is doubled?

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

20. A 1027 kg car is at rest at a stop light. 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. Calculate the distance that the car travels during the whole trip.

Numerical Answers

1) 38.25 N
2) 6600 N
3) 0.87 m/s^2
4) 587.5 kg
5) 1500 kg
6) 51.50 N
7) 721.5 N
8) 1,007,484.5 N
9) 958.07 kg
10) 2.98 N
11)(a) 7.89 m/s^2
11)(b) 3.51 m/s^2
11)(c) 4.38 m/s^2
11)(d) friction
11)(e) 5549 N
12) 252 N
13) 35.6
14) new acceleration is 0.26 times the old acceleration
15) 36.48 m/s^2
16)(a) 0.75 m/s^2
16)(b) 12 N
17) 441.2 N
18)(a) 24.9 m
18)(b) 49.8 m
19) 1327 N
20) 823.2 m