

Physics 2204
Worksheet on Newton's Second Law

- 1 What happens to the acceleration of an object if the force is increased by a factor of 4?
- 2 What happens to the acceleration of an object if the mass is tripled?
- 3 What happens to the acceleration of an object if the force on the object is decreased by a factor of 3 and the mass is quadrupled?
- 4 What happens to the acceleration of an object if the force is increased by a factor of 5 and the mass is increased by a factor of 4?
- 5 A woman pushes a refrigerator across the floor at a steady speed of 20 cm/s. If she has to push with a force of 400 N to keep it moving, what is the force of friction on the refrigerator?
- 6 Calculate the net force acting on a 20.0-kg object if the acceleration is
 - a) 0.28 m/s^2 .
 - b) 5669 km/h^2 .
 - c) $(50.0 \text{ km/h})/\text{s}$.
- 7 What is the acceleration when an unbalanced force of 50.0 N is applied to
 - a) a 3.0-g penny?
 - b) a supertanker of mass $1.6 \times 10^8 \text{ kg}$?
 - c) a car of mass $2.2 \times 10^6 \text{ g}$?
- 8
 - a) A Sikorsky freight helicopter can easily lift a 5000.0-kg truck. If the acceleration of the truck is 1.5 m/s^2 up, what is the net force being applied by the helicopter?
 - b) Calculate the acceleration on a rocket of mass $2.5 \times 10^6 \text{ kg}$ if the net thrust of the rocket is $2.8 \times 10^7 \text{ N}$.
- 9 A jet reaches a takeoff speed of 95 m/s in 50.0 s, while a jet fighter reaches 60.0 m/s in 3.0 s. If each plane is $8.0 \times 10^4 \text{ kg}$, find the net force applied to each.
- 10 A supertanker of mass $1.0 \times 10^8 \text{ kg}$ travels 3.5 km, reaching a speed of 4.1 km/h from rest. What was the magnitude of the unbalanced force acting on it?
- 11 If it takes a human cannonball 1.5 s to exit a 1.6-m-long cannon, what is the average net force acting on the performer if his mass is 65 kg?
- 12 A net force of 200.0 N is applied to an object, causing its velocity to change from 30.0 km/h to 20.0 km/h in 2.3 s. What is the object's acceleration? What is its mass?
- 13 A car changes its velocity from 20.0 m/s [N] to 20.0 m/s [S] in 5.5 s. If the mass of the car is 1500 kg, what is the net force acting on it?

- 14 A bicycle of mass 14.6 kg and a rider of mass 50 kg generate a net force of 12 N. How fast are they going after 2.0 s?
- 15 A batter of mass 100 kg uses a bat of mass 3.0 kg to hit a 140-g ball. If the impact time is 0.010 s and the ball reaches a speed of 60 km/h from rest, what was the average force applied to the ball?
- 16 Repeat Problem 15, for a bat of mass 3.0 kg hitting a 140-g pitched ball moving at 60 km/h, causing it to fly off at 60 km/h along the same line as the pitch.
- 17 A tennis player is hitting a ball against a brick wall. The ball has a mass of 84 g and is travelling at 32 m/s when it hits the racquet. If the velocity is reduced to zero, 0.010 s after it hit the racquet, determine the average force exerted by the racquet on the ball during this phase of motion.
- 18 A force of 36 N gives a mass m_1 an acceleration of 4.0 m/s^2 . The same force gives a mass m_2 an acceleration of 12 m/s^2 . What acceleration will this force give to m_1 and m_2 if the two masses are fastened together?
- 19 What change in velocity would be produced by an unbalanced force of $2.0 \times 10^4 \text{ N}$ acting for 6.0 s on a $2.0 \times 10^3 \text{ kg}$ dragster?
- 20 Calculate the unbalanced force acting on a $4.0 \times 10^3 \text{ kg}$ truck that changes its velocity from 22.0 m/s to 8.0 m/s in 3.50 s?
- 21 How long does it take a 50.0 kg rider on a 10.0 kg bike to accelerate from rest to 4.0 m/s if the unbalanced force acting on it is 48 N?
- 22 What is the unbalanced force accelerating a 5.0 kg cannonball from rest to 150 m/s, if the force acts for 0.050s?
- 23 What is the final velocity of a 150 kg motorcycle driven by a 50.0 kg rider, accelerated from rest for 11.0 s by an unbalanced force of 800.0 N?