Newton's Laws

1. The engine of a car of mass 800kg, which is travelling along a straight horizontal road, is producing a driving force of 1200N. Assuming that there are no forces resisting the motion, calculate the acceleration of the car.

2. A van is pulling a broken-down car of mass 1200kg along a straight horizontal road. The only force acting on the car is the tension in the horizontal tow bar. Calculate the acceleration of the car when the tension is 750N.

3. For the first stage of its motion on the runway, before take-off, an aircraft of mass 2200kg has a constant acceleration 4.2m/s2. Calculate the magnitude of the force necessary to provide this acceleration.

4. A novice skier is being pulled along a horizontal section of a nursery slope. Given that her acceleration of 0.8m/s2 is provided by a force of 52N, calculate her mass.

5. Two children are sliding a puck to each other on a frozen lake. The puck, of mass 0.4kg, leaves one child with a speed of 5m/s and is stopped by the other child, 8m away. Calculate the deceleration of the puck, and find the frictional force resisting the motion of the puck.

6. A man pushes a car with a force of 127.5N along a straight horizontal road. He manages to increase the speed of the car from 1m/s to 2.8m/s in 12 seconds. Find the mass of the car.

7. A runaway sledge of mass 10kg travelling at 15m/s reaches a horizontal snow field. It travels in a straight line before it comes to rest. Given that the force of friction slowing the sledge has magnitude 60N, calculate how far the sledge travels in the snow field.

8. A hockey player hits a stationary ball of mass 0.2kg. The contact time between the stick and the ball is 0.3secs and the force exerted on the ball by the stick is 60N. Find the speed with which the ball leaves the stick.

9. A boy slides a box of mass 2kg across the floor of the stage in the school theatre. The initial speed of the box is 8m/s and it comes to rest in 5m. Calculate the deceleration of the box and find the frictional force between the box and the floor.

10. A boat of mass 3000kg, travelling at a speed of u m/s is brought to rest in 20 seconds by water resistance of 370N. Find the value of u.

11. A car of mass 1000kg runs out of petrol and comes to rest just 30m from a garage. The car is pushed with a force of 120N, along a horizontal

road towards the garage. Calculate the acceleration of the car and find the time it takes to reach the garage.

12. A bullet of mass 0.12kg is travelling horizontally at 150m/s when it enters a fixed block of wood. Assuming that the bullet's motion remains horizontal and that the force resisting the motion has constant magnitude 10kN, calculate how far the bullet penetrates the block.

13. A jet plane of mass 30000 kg touches down with a speed of 55m/s and comes to rest after moving for 560m in a straight line on the runway. Assuming that the only forces stopping the plane are provided by the reverse thrust of its two engines, and that these are equal and directed in the opposite direction of motion, calculate the magnitude of the thrust in each engine.

Newton's Laws

1. The engine of a car of mass 800kg, which is travelling along a straight horizontal road, is producing a driving force of 1200N. Assuming that there are no forces resisting the motion, calculate the acceleration of the car. $1.5m/s^2$

2. A van is pulling a broken-down car of mass 1200kg along a straight horizontal road. The only force acting on the car is the tension in the horizontal tow bar. Calculate the acceleration of the car when the tension is 750N. $0.625m/s^2$

3. For the first stage of its motion on the runway, before take-off, an aircraft of mass 2200kg has a constant acceleration $4.2m/s^2$. Calculate the magnitude of the force necessary to provide this acceleration. 9240N

4. A novice skier is being pulled along a horizontal section of a nursery slope. Given that her acceleration of $0.8m/s^2$ is provided by a force of 52N, calculate her mass. 65kg

5. Two children are sliding a puck to each other on a frozen lake. The puck, of mass 0.4kg, leaves one child with a speed of 5m/s and is stopped by the other child, 8m away. Calculate the deceleration of the puck, and find the frictional force resisting the motion of the puck.
   $-1.56m/s^2$ and -0.624N

6. A man pushes a car with a force of 127.5N along a straight horizontal road. He manages to increase the speed of the car from 1m/s to 2.8m/s in 12 seconds. Find the mass of the car. 850kg

7. A runaway sledge of mass 10kg travelling at 15m/s reaches a horizontal snow field. It travels in a straight line before it comes to rest. Given that the force of friction slowing the sledge has magnitude 60N, calculate how far the sledge travels in the snow field. 2.5s

8. A hockey player hits a stationary ball of mass 0.2kg. The contact time between the stick and the ball is 0.3secs and the force exerted on the ball by the stick is 60N. Find the speed with which the ball leaves the stick. 90m/s

9. A boy slides a box of mass 2kg across the floor on the stage in the school theatre. The initial speed of the box is 8m/s and it comes to rest in 6.4 seconds. Calculate the deceleration of the box and find the frictional force between the box and the floor. $-1.25 m/s^2$ and -2.5N

10. A boat of mass 3000kg, travelling at a speed of u m/s is brought to rest in 20 seconds by water resistance of 370N. Find the value of u. 2.47m/s

11. A car of mass 1000kg runs out of petrol and comes to rest just 30m from a garage. The car is pushed with a force of 120N, along a horizontal road towards the garage. Calculate the acceleration of the car and find the time it takes to reach the garage. 0.12m/s^2, 22.4 secs

12. A bullet of mass 0.12kg is travelling horizontally at 150m/s when it enters a fixed block of wood. Assuming that the bullet's motion remains horizontal and that the force resisting the motion has constant magnitude 10kN, calculate how far the bullet penetrates the block. 0.135m

13. A jet plane of mass 30000 kg touches down with a speed of 55m/s and comes to rest after moving for 560m in a straight line on the runway. Assuming that the only forces stopping the plane are provided by the reverse thrust of its two engines, and that these are equal and directed in the opposite direction of motion, calculate the magnitude of the thrust in each engine. 40.5kN