Chapter F

Mechanics

F1 Force and Momentum

In these questions ignore the effects of friction & drag.

F1.1 What is the momentum of a 750 kg car going at 31 m s^{-1}?

F1.2 What is the momentum of an electron (mass = 9.1×10^{-31} kg) travelling at 3.0×10^7 m s^{-1}?

F1.3 If a 20 000 kg bus accelerates from 10 m s^{-1} to 25 m s^{-1}, what is the change in momentum?

F1.4 A 50 g ball is travelling at 2.0 m s^{-1} when it hits a wall and rebounds at 1.5 m s^{-1}. Calculate the change in momentum.

F1.5 A 750 kg car takes 15.3 s to accelerate from 5.0 m s^{-1} to 31 m s^{-1}. Calculate the force needed to do this.

F1.6 A 70 kg person jumps in the air and is travelling downwards at 2.0 m s^{-1} when their feet touch the ground. If it takes the person 0.30 s to stop, calculate the resultant force on them.

F1.7 I am trying to push start a car which has stopped. If the biggest force with which I can push the car is 420 N, and the car has a mass of 1025 kg, how fast will it be going after 8.0 s of pushing?

F1.8 Calculate the force needed to accelerate a 50 000 kg spacecraft from rest to 7000 m s^{-1} in four minutes.

F1.9 An alpha particle (mass = 6.7×10^{-27} kg) is fired at the nucleus in a gold atom with a speed of 3.5×10^6 m s^{-1}. It bounces off at the same speed in the opposite direction. If the collision takes 10^{-19} s, what is the average force?

F1.10 How long would it take a 637 N force to accelerate a 65 kg physics teacher from rest up to a speed of 100 m s^{-1}? (NB this is over 200 mph)