QTD 3  The motion of the balls is affected by air as well through its viscosity (essentially friction). At the same speed, the effect of air on both iron and base balls would be about the same in terms of force. However, both the gravitational force and inertial resistance to motion would be greater for the iron ball. Hence the air force is less important for the iron ball (relative to its weight and inertia), and it will fall faster. On the there is no air, hence both will fall at the same (slower) rate.

1) W  classroom
    N
    ______
   /         
  /           
 /     E    A

   My house

2) \( \Delta N = 5 \text{ mi/h} \) in both cases
   \( \Delta t = \text{ same in both cases} \)

   Hence \( a = \frac{\Delta N}{\Delta t} = \text{ same for both} \)
10) \( KE = \frac{1}{2} mv^2 = \frac{1}{2}(1500)(30)^2 = 675,000 \text{ J} \)

Assume all of the work done by the engine goes into this \( KE \) (neglects friction).

Then: \( W = KE = 675,000 \text{ Joules} \)

\[ P_{\text{work}} = \frac{W}{t} = \frac{675,000}{2} = 337,500 \text{ Watts} \]

12) \( PE \) of:

a) 3 kg block, \( h = 2 \text{ m} \)

\[ PE = mgh = (3)(9.8)(2) = 58.8 \text{ J} \]

b) \( k = 10^3 \text{ N/m} \) stretched 10 cm

10 cm = 0.1 m, so

\[ PE = \frac{1}{2}kx^2 = \frac{1}{2}(10^3)(0.1)^2 = 5 \text{ J} \]

c) 1000 cm\(^3\) bottle, pressure \( p = 10^4 \text{ N/m}^2 \) above atmosphere

1 cm = 0.01 m

\((1 \text{ cm})^3 = (0.01 \text{ m})^3 = 10^{-6} \text{ m}^3\)

1000 cm\(^3\) = 10\(^{-3}\) m\(^3\)

\[ PE = \frac{1}{2} \frac{V}{P_0} r^2 = \frac{1}{2} \frac{10^{-3}}{10^{5}} (10^4)^2 = \frac{1}{2} \text{ Joule} \]