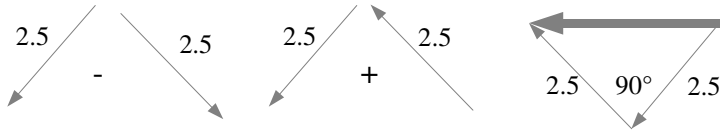
1. $K = \frac{1}{2}mv^2 = \frac{1}{2}\times 125\times 11.9^2 = 8.85\times 10^3$ J (3 s.f.)
2. a) First calculate the weight F of the weights.

   $F = mg = 0.20\times 9.8 = 1.96$ N

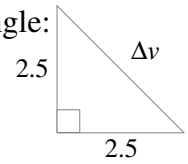
   $W = Fs\cos\theta = 1.96\times 1.0\times\cos(0) = 2.0$ J (2 s.f.)

   b) 2.0 J because of conservation of energy (the amount of work done is amount of potential energy gained)
3. $W = Fs\cos\theta = 345\times 5.0\times\cos(34°) = 1.43\times 10^3 = 1\times 10^3$ J (1 s.f.)

   The total work done on the crate is $2.86\times 10^3 = 3\times 10^3$ J (1 s.f.)
4. a) $\Delta\vec{v} = \vec{v}_{final} - \vec{v}_{\text{int }ial} =$



   This makes a right angled triangle:



   So the magnitude of change in velocity is $\Delta v = \sqrt{2.5^2 + 2.5^2} = 3.54$ ms^{-1} {using pythagoras}

   The change in velocity of the ball is 3.5 ms^{-1} away from the wall.

   b) $\vec{p} = m\vec{v}$

   ∴ The change momentum of the ball is $2.1\times 3.54 = 7.4$ kg ms^{-1} (2 s.f.) away from the wall.

   c) $\vec{F} = \frac{\Delta\vec{p}}{\Delta t} = \frac{7.4}{0.10} = 74$ N away from the wall

   d) 74 N away from the ball.

5. According to conservation of momentum, final = initial.

   $\therefore m_i v_i = m_f v_f$

   $\therefore v_f = \frac{m_i v_i}{m_f}$

   $\therefore v_f = \frac{8.2\times 10^3 \times 2.2}{8.2\times 10^3 + 3\times 10^3} = \frac{18040}{11200} = 1.61$ ms^{-1}

   The final speed of the train is 1.6 ms^{-1} (2 s.f.)