1. Two disks (D1, D2) connected by a compressed spring are sliding on a frictionless surface. The disks have masses \( m_1 = 0.1 \text{ kg} \) and \( m_2 = 0.2 \text{ kg} \). The initial speed of the disks is 2 m/s and the velocity is at an angle of 45° relative to the x-axis, until the spring is released at *.
   After the spring is released, D1 moves along the x-axis and D2 moves along the y-axis.
   a) Find the final speeds \( u_1 \) and \( u_2 \) of the two disks.  
   b) Let the change in total kinetic energy be \( \Delta E_k = E_{k_f} - E_{k_i} \). Is \( \Delta E_k \) less than, equal, or greater than 0?

\[ u_1 = 4.2 \text{ m/s} \]
\[ u_2 = 2.1 \text{ m/s} \]
\[ \Delta E_k < 0 \quad \Delta E_k = 0 \quad \Delta E_k > 0 \quad \text{X} \]

2. The figure shows a trace from an electro-cardiogram (ECG). Find a) the period \( T \) between heartbeats, b) the frequency \( f \) in Hertz, and c) the frequency in beats per minute (bpm)

\[ T = 0.66 \text{ s} \]
\[ f = 1.5 \text{ (Hz)} \]
\[ f = 90 \text{ (bpm)} \]

3. A block with mass \( m = 5 \text{ kg} \) is attached to a spring with spring constant \( k = 200 \text{ N/m} \).
   a) What is the angular frequency \( \omega \) for this block/spring system? A force of 10 N is applied against the block.  
   b) What is the magnitude \( x_0 \) of the displacement of the block from its equilibrium position? The block is released and accelerates back through its equilibrium position.  
   c) How long \( t \) does it take for the block to reach the equilibrium position?
   d) What is the maximum speed \( u_0 \) of the block?

\[ \omega = 6.3 \text{ rad/s} \]
\[ x_0 = 0.05 \text{ m} \]
\[ t = 0.25 \text{ s} \]
\[ u_0 = 0.315 \text{ m/s} \]

4. The acceleration due to gravity on the surface of Mars is \( g_{\text{Mars}} = 3.71 \text{ m/s}^2 \). The radius of Mars is \( r_{\text{Mars}} = 3390 \text{ km} \).
   a) What is the speed \( v_{\text{z}} \) of a satellite in orbit close to the surface of Mars?  
   b) What is the orbital period \( T_{\text{z}} \) for such a satellite?

\[ v_{\text{z}} = 3.55 \text{ km/s} \]
\[ T_{\text{z}} = 6 \times 10^3 \text{ s} \]

\[ a = \frac{v_{\text{z}}^2}{r} \]
\[ v = \sqrt{\frac{g_{\text{Mars}} r_{\text{Mars}}}{r}} \]
\[ T = \frac{2\pi r}{v} = 6.3 \times 10^4 \text{ s} \]
\[ T = 6 \times 10^3 \text{ s} \]