1. He would have thrown the gold away and lived, but he died because he was greedy. When you throw the gold, the gold exerts an opposite and equal force back, therefore you go back. Your system's net momentum remains the same before the man throws and after, the center of mass of the system will also remain the same
2. We use $KE = \frac{1}{2}mv^2$ and $\Delta p = mv$

   Now we try to get kinetic energy while using momentum

   $KE = \frac{1}{2} \times \frac{p^2}{m} = \frac{p^2}{2m}$

   Object 1 represents the massive object, while object 2 represents the non-massive object

   $KE_1 = KE_2$

   $\frac{p_1^2}{2m_1} = \frac{p_2^2}{2m_2}$

   $\frac{p_1^2}{p_2^2} = \frac{2m_1}{2m_2}$

   If 1 is the larger object, that means that the momentum will also increase
3. A.

   Because $W = FD$, and displacement is the same for both blocks, gravity will do more work on block B as $F = mg, m_B > m_A$

   B.

   They are all the same

   C.

   Block B will have a higher momentum as velocity remains the same, because $m_B > m_A$
4. D > A = C > B
5. A.

   The magnitude of momentum of the two boxes will be equal. We can determine this because of the equation $\Delta p = F\Delta t$, where the forces on both of the boxes are equal. Because force and time are equal, the magnitude of momentum will also be the same.

   B.

   Because the box on the left is 4 times heavier, it will have ¼ the speed compared to the box on the right. From part A, we know that momentum of both of the objects are the same.

   Let object 1 be the block with 4M, object 2 being the block with M:

   $\Delta p_1 = \Delta p_2$

   $\Delta p_1 = m_1 v_1$

   $\Delta p_2 = m_2 v_2$

   $m_1 v_1 = m_2 v_2$

   $4Mv_1 = Mv_2$

   $v_1 = \frac{v_2}{4}$

6. A. It's speed is $0.5\,\frac{m}{s}$, being the right direction.

   B. It's speed is $1\frac{m}{s}$, being in the right direction. I don't think there was no change in momentum anyways.
7. I would choose the bouncy ball. In both situations, the net momentum of the system remains the same. For the clay ball situation, after the collision, the momentum of the clay will be 0. However, for the bouncy ball situation, the momentum of the ball must not equal 0, but also must be negative. Thus, the impulse on the pole must be larger, which gives you a higher chance to knock down the pole.
8. This is impossible. This violates the law relating to the conservation of momentum. No matter what, internal forces cannot change the system's net momentum.
9. $m_1v_1 = (m_1 + m_2)v$

   $m_2 = \frac{m_1v_1}{v} - m_1 = 13950kg$
10. A.

    Just like in number 7, if it bounces off, the momentum is greater. This is because the bullet's momentum must be negative, meaning that the block has a larger impulse. Because the blocks are the same mass, if the momentum is greater, then velocity must increase. This means that the block in Case B will have a higher speed.

    B.

    $v_0 \geq v$

    The velocity of the bullet must be equal to or less than the initial velocity. In a situation where it's equal, no energy is lost. However the bullet cannot be greater than its initial velocity, this is because of the law of conservation of energy.
11. The scenario can be modeled with this equation:

    $m_{arch}v_{arch} + m_{arr}v_{arr} = 0$

    $v_{arch} = \frac{-m_{arr}v_{arr}}{m_{arch}} = -0.2\,\frac{m}{s}$

    The speed is $0.2\frac{m}{s}$in the left direction (assuming the archer shoots in the right)
12. Let object 1 be the ball of mass 0.44kg, and let object 2 be the ball of mass 0.22kg

    Using a system of equations:

    $m_1v_1 = m_1v_1' + m_2v_2'$

    $v_1 - v_2 = -v_1' + v_2'$

    $v_2' = v_1 - v_2 + v_1'$

    $m_1v_1 = m_1v_1' + m_2(v_1 - v_2 + v_1') \rightarrow v_1' = 1.1\frac{m}{s}$

    $v_2' = v_1 - v_2 + v_1' \rightarrow v_2' = 4.4\frac{m}{s}$

    Because v_1' and v_2' are both positive (they represent velocity), they are rolling east. Object 1 moves at $1.1\frac{m}{s}$and object 2 moves at $4.4\frac{m}{s}$

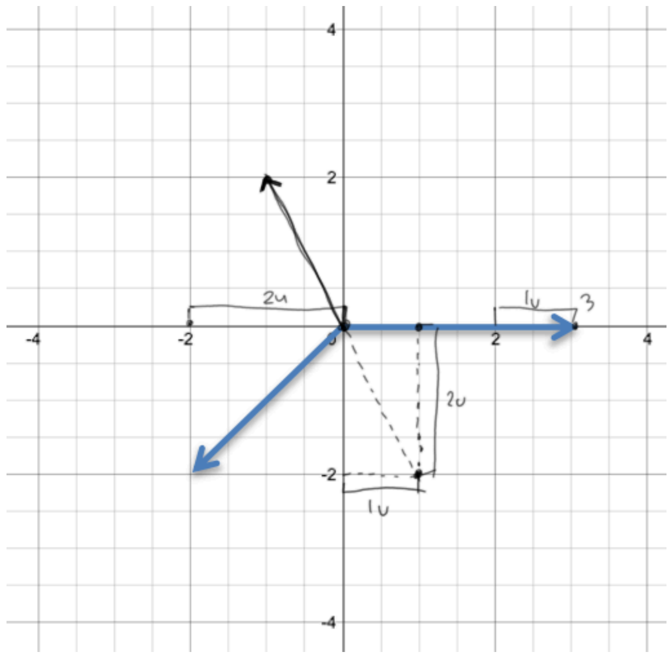
13. The scenario can be modeled with this equation:

$m_b v_b = (m_b + m_p) v_p$

$v_p = \frac{m_b v_b}{m_b + m_p} \rightarrow v_p = 1.775\frac{m}{s}$

$\frac{1}{2} m_p {v_p}^2 = m_p g h \rightarrow \frac{1}{2} {v_p}^2 = gh \rightarrow h = 0.16m$

14.



15.