Solus to Ch 10, #’s 69, 70

**69 ••**

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| **Picture the Problem** Let the zero of gravitational potential energy be a distance *x* below the pivot as shown in the diagram. Because the net external torque acting on the system is zero, angular momentum is conserved in this perfectly inelastic collision. We can also use conservation of mechanical energy to relate the initial kinetic energy of the system after the collision to its potential energy at the top of its swing. | TipSol%2010-69 |

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| Using conservation of mechanical energy, relate the rotational kinetic energy of the system just after the collision to its gravitational potential energy when it has swung through an angle *θ*: | or, because *K*f = *U*i = 0,    and  (1) |
| Apply conservation of momentum to the collision: | or |
| Solve for *ω* to obtain: | (2) |
| Express the moment of inertia of the system about the pivot: | (3) |
| Substitute equations (2) and (3) in equation (1) and simplify to obtain: |  |
| Solve for *v*: | |
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| Evaluate *v* for *θ* = 90° to obtain: | |
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**70 ••**

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| **Picture the Problem** Let the zero of gravitational potential energy be a distance *x* below the pivot as shown in the diagram. Because the net external torque acting on the system is zero, angular momentum is conserved in this perfectly inelastic collision. We can also use conservation of mechanical energy to relate the initial kinetic energy of the system after the collision to its potential energy at the top of its swing. | TipSol%2010-70 |

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| Using conservation of mechanical energy, relate the rotational kinetic energy of the system just after the collision to its gravitational potential energy when it has swung through an angle *θ* : | or, because *K*f = *U*i = 0,    and  (1) |
| Apply conservation of momentum to the collision: | or |
| Solve for *ω* to obtain: | (2) |
| Express the moment of inertia of the system about the pivot: |  |
| Substitute equation (2) in equation (1) and simplify to obtain: |  |
| Solve for *v*: |  |
| Substitute numerical values and evaluate *v* for *θ* = 60° to obtain: | |
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