UNIVERSITY of ARKANSAS
1871

MEEG 2013 **Name:** _____

(Underline your **last name**.)

Test II ( ) **ID#:** _____

1. (30%) A 4-lb steel sphere B is released from the position B_1 and falls freely through a vertical distance h = 1.5528 ft before it hits a 3-lb aluminum sphere A with a downward velocity $\mathbf{v}_B$ as shown. The sphere A is initially at rest and the suspending wire is inextensible. If the coefficient of restitution between the spheres A and B is e = 0.7, determine (*a*) the velocity $\mathbf{v}_B$ just before impact, (*b*) the velocities $\mathbf{v}'_A$ and $\mathbf{v}'_B$ of the spheres A and B just after impact.

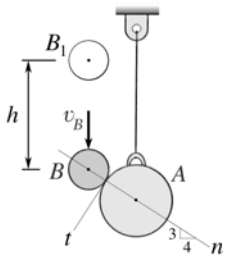

Fig. P1

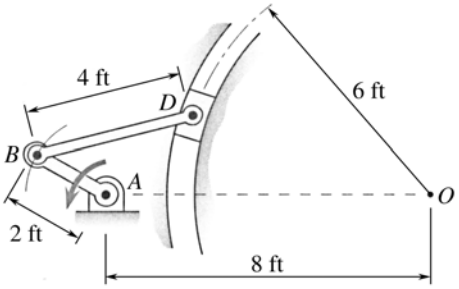

Fig. P2

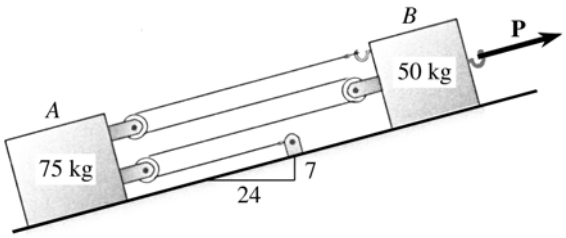

Fig. P3

2. (30%) A linkage is shown, where the slider D moves along a smooth circular groove of radius 6 ft as indicated. It is known that the crank AB rotates with a constant angular velocity $\boldsymbol{\omega}_{AB}$ = 2 rad/s ↺. Using the *parametric method*, determine the angular velocity $\boldsymbol{\omega}_{BD}$ of the link BD and the velocity $\mathbf{v}_D$ of the slider D when AB and BD become collinear with the line AO.

3. A system of blocks and pulleys is shown, where the coefficient of kinetic friction is μ_k = 0.2 between the support and the blocks A and B, which have masses of 75 kg and 50 kg, respectively. The applied force **P** is parallel to the incline and has a magnitude of 800 N. *Circle on this test sheet* the nearest item for each of the following:

A. (7%) The magnitude of the acceleration $\mathbf{a}_A$ of block A is
(*a*) 2.91 m/s^2. (*b*) 2.83 m/s^2. (*c*) 2.75 m/s^2. (*d*) 2.67 m/s^2. (*e*) 2.59 m/s^2. (*f*) 2.51 m/s^2.

B. (7%) The magnitude of the acceleration $\mathbf{a}_B$ of block B is
(*a*) 3.34 m/s^2. (*b*) 3.45 m/s^2. (*c*) 3.56 m/s^2. (*d*) 3.67 m/s^2. (*e*) 3.78 m/s^2. (*f*) 3.88 m/s^2.

C. (6%) The magnitude of the tensile force **F** in the cable connecting the blocks A and B is
(*a*) 143.0 N. (*b*) 141.4 N. (*c*) 139.9 N. (*d*) 138.4 N. (*e*) 136.9 N. (*f*) 135.3 N. (*g*) 133.8 N.

4. (20%) Non-numerical problem.

A. Describe *Chasles' theorem.*

B. Define the *kinetic energy* of a particle.

C. Define the *potential energy* of a particle.

D. How is the *gravitational potential energy* of a spacecraft in orbit around the earth defined?