QUESTION 1

The missile at A takes off from rest and rises vertically to B, where its fuel runs out in 8 seconds as shown in Figure 1(A). If the acceleration varies with time as shown in Figure 1(B):

- Determine the height of the missile \( h_B \), and the speed \( v_B \) at position B.

If by internal controls the missile is then suddenly pointed \( 45^\circ \) as shown in Figure 1(A), and allowed to travel in free flight:

- Determine the maximum height attained, \( h_C \), and the range \( R \) to where it crashes at D.
YOU MUST SOLVE QUESTION 5.
You are required to work four of the five problems. QUESTION 5 MUST BE ONE OF THE FOUR PROBLEMS Clearly indicate which problems you are choosing. Show all work on the exam sheets provided and write your student personal identification (PID) number on each sheet. Do not write your name on any sheet.

Your PID number:____________________________

QUESTION 2

The horizontal force  $P = 12\text{lb}$ is applied to the block A of 8 lb against block B of 15 lb weight. The contact surfaces of blocks A and B are smooth so you can neglect friction:

Draw the free-body-diagrams of the two blocks.
Determine the acceleration of block B.
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Question 3

Block A has a mass of 4 kg and B has a mass of 6 kg. A spring having stiffness of $k=40$-N/m, is ATTACHED TO B BUT NOT A, and is compressed 0.3 m, from its unstretched state, against A and B as shown in Figure 3.

Determine the maximum angles $\theta$ and $\phi$ of the cords after the blocks are released from rest and the spring becomes unstretched and remains attached to B only. Ignore the weight of the spring.
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Question 4.

To test the manufactured properties of 2-lb steel balls, each ball is released from rest as shown in Figure 4 and strikes the 45° smooth inclined surface.

If the coefficient of restitution is to be $e = 0.8$: 
(a) Determine the distance $s$ to where the ball must strike the horizontal plane at A.
(b) At what speed does the ball strike point A?
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Question 5.

5(a). The velocity of point B on the shown disc is:

[ ] 2 m/s →

[ ] 2 m/s 60°

[ ] 3.864 m/s 30°

[ ] 3.864 m/s 15°

[ ] None of the above and the correct answer is ………

5(b). The system shown consists of a uniform rod of mass m and length 2R. The rod is hinged at O and is welded to a circular disc at A of mass m and radius R.

i) Determine the location of the center of mass, L_{cg}=

ii) Determine the mass moment of inertia about O, I_{oo}=

If the total mass of the system is 20 kg, L_{cg} = 2 meters, and radius of gyration of \( K_{oo} = 2.33 \ m \)

iii) Determine the location of the center percussion q=

iv) If the system is released from rest when \( \theta = 60^0 \), determine the angular acceleration of the system just after release.

v) If the system is released from rest when \( \theta = 0^0 \), determine the tangential reaction along \( e_t \) when \( \theta = 60^0 \) using Newton’s second law and the using the concept of percussion, and compare the two results.

vi) If the system is released from rest when \( \theta = 0^0 \), determine the normal reaction along \( e_n \) when \( \theta = 60^0 \).

vii) If the system is released from rest when \( \theta = 0^0 \), determine the kinetic energy of the system when \( \theta = 60^0 \).

viii) If the system is released from rest when \( \theta = 0^0 \), determine the angular momentum of the system about an axis through O when \( \theta = 60^0 \).