

You may answer as many questions as you like.  
You only have this period to finish this section.  
You must do a minimum of **60** points on this section and  
100 points on the two sections combined.  
If you see (SO) following a problem you only need to write solutions.

## **You must do problem A1**

A1.

A2. Two cars of equal masses are approaching an intersection. Car A is traveling West at 12.0 m/s and Car B is traveling East at 7.00 m/s when they enter the intersection. If they undergo a complete inelastic collision with each other what velocity do they have afterwards? (20)

A3. A 25.0 g ball is released from a height of 2.33 m above a surface. If the ball collides with the surface and rebounds in 0.123 s what is the force on the surface? (20)

A4. Ask for the demonstration and describe in terms of momentum what happens and why. (RO)(10)

A5. You, mass 70.0kg, jump giving yourself a velocity of 7.66m/s upwards. With what velocity does the earth recoil? (10)

A6. A 50.0g bullet traveling at 380 m/s hits a 3.00 kg block of clay. How fast does the clay and the bullet move afterwards? (10)

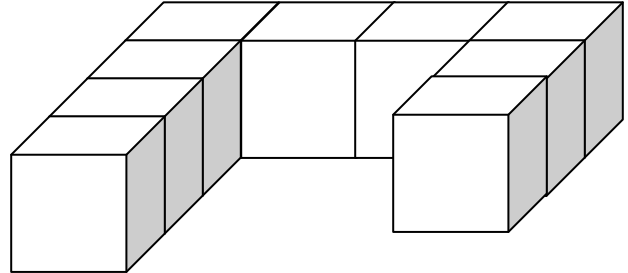
A7. The same bullet as in A6 hits a 3.00 kg block of rubber this time and rebounds elastically. What is the velocity of each afterwards? (20)

A8. A 10.0 kg ball and a 7.70 kg ball are separated by 1.35 m. Where is the center of mass of this system? (10)(SO)

A9. Your friend, mass 42.0 kg, is riding by on her bike, mass 4.00 kg, at a velocity of 2.53 m/s. You jump on the bike, you were at rest. What velocity do the two of you continue traveling if you have the same mass as your friend? (20)

You may answer as many questions as you like. Be aware that you need to finish in this sitting. Do enough points so both parts combine to be a minimum of 100 points.

B1. Find the center of mass of the boxes shown. Each box has a mass of  $M$  and is a cube of sides  $L$ . (30) (SO)



B2. A 35.0 g bullet travels at 430 m/s and hits a 2.78 kg block of wood hanging from a thin cord. How high does the block swing with the bullet embedded in the block? (20)

B3. You and a bunch of friends decide to play red rover on fine day after school. You pick Mike to come running over to your side. He has a mass of 85.0 kg and runs with a speed of 8.00 m/s. Mike does not really understand the game and instead of aiming for the space between people heads directly for Steve, mass 40.0 kg. Mike collides with Steve and they fly backwards. How fast do Mike and Steve fly backwards? (20)

B4. How much time does it take friction to stop a 3.50 kg block of wood traveling at 4.40 m/s if the coefficient of sliding friction between the block and the level surface is 0.84? (20)

B5. A 3.50 kg gun fires a 60.0 g bullet. The bullet leaves its muzzle with a velocity of 430 m/s. How fast does the gun move backwards? (10)

B6. In an elastic collision the two bodies each of mass 5.00 kg are touching for 0.103 s. If one mass was moving with a velocity of 3.00 m/s before the collision and the other was at rest, what was the average force involved in the collision? (20)

B7. You take a super ball, mass 12.0 g, and place it on top of a basketball, mass 200 g. Both are dropped from a height of 1.00 m. When they hit the ground the basketball does not bounce. How high does the super ball bounce? (20)

B8. Find the center of mass of the object shown below. Assume the rod has no mass. All other masses are in kg. (20)(SO)

