

PHYS 152 Practice exam 3

I. Multiple choices:

Only one answer is correct. Please choose the best answer you think. 5 points each question.

1. A rock is dropped from a high tower and falls freely under the influence of gravity. Which one of the following statements is true concerning the rock as it falls?
 - (a) It will gain an equal amount of momentum during each second.
 - (b) It will gain an equal amount of kinetic energy during each second.
 - (c) It will gain an equal amount of speed for each meter through which it falls.
 - (d) It will gain an equal amount of momentum for each meter through which it falls.
 - (e) The amount of momentum it gains will be proportional to the amount of potential energy that it loses.

2. In which one of the following situations is linear momentum NOT conserved?
 - (a) A bomb suspended by a string explodes into one hundred fragments.
 - (b) A bowling ball collides with ten pins.
 - (c) A golf ball is struck by a club.
 - (d) An astronaut floating in space throws a hammer away and subsequently moves in the opposite direction.
 - (e) A tree limb is struck by lightning and falls to the ground.

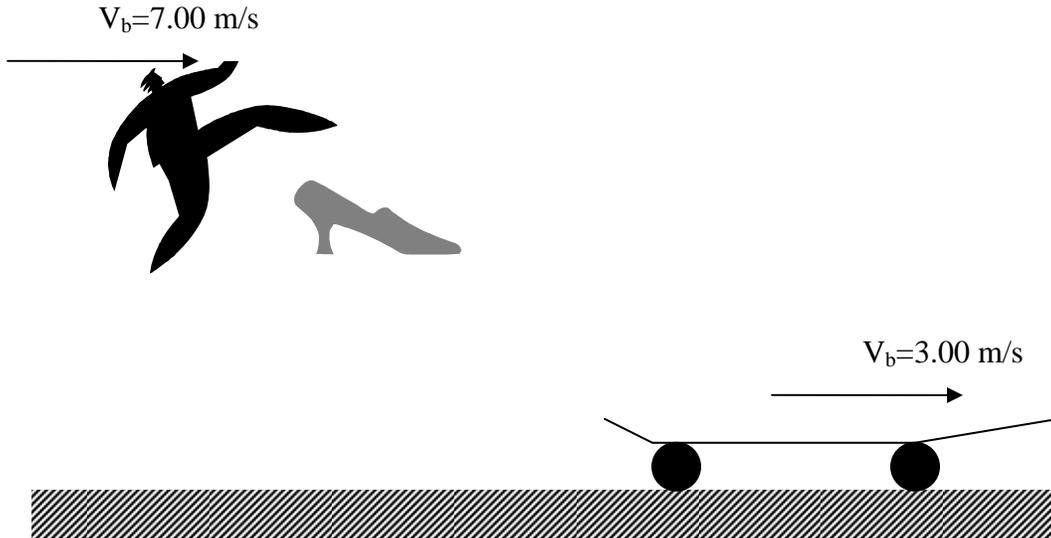
3. A tennis ball has a velocity of 12 m/s downward just before it strikes the ground and bounces up with a velocity of 12 m/s upward. Which one of the following statements concerning this situation is true?
 - (a) The momentum of the ball and the momentum of the earth both change.
 - (b) Neither the momentum of the ball nor the momentum of the earth changes.
 - (c) The momentum of the ball is changed, yet the momentum of the earth is not changed.
 - (d) The momentum of the ball is unchanged, yet the momentum of the earth is changed.
 - (e) Both the momentum and the kinetic energy of the ball change because of the collision.

4. Which one of the following statements concerning center of mass must be true?
 - (a) All of an object's mass is located at its center of mass.
 - (b) The center of mass of an object must be located within the object.
 - (c) The center of mass of a system of objects cannot change relative to the objects if there are only internal forces acting on the objects.
 - (d) The velocity of the center of mass of a system of objects is not affected by a collision of objects within the system.
 - (e) The velocity of the center of mass of a system of objects is zero when the sum of the external forces acting on the system is zero.

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II. Comprehensive questions: (Please carefully write down all your calculations, all steps may be counted for the partial credit.) You only need to answer 3 questions out of the four.

1. An extreme sport player is trying to catch a running skating board, as shown below. The player is running at a constant velocity of 7.00 m/s along the same direction of the board, which is traveling at a velocity of 3.00 m/s. The player has a mass of 60.0 kg and the board has a mass of 3.00 kg. Right after the player jumped into the air and before he landed on the board, one of his boots (mass of 1.00 kg) fell off his foot. (Please note: it just separated from the player, not being launched or kicked) The player managed to land on the board with only one shoe eventually. Assume all friction and resistance can be ignored. What is the **final** velocity of the player and the board when he safely landed on the board and balanced himself?



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2. A round disk, whose rotational inertia is 0.07 kgm^2 , is spinning around an axis passing through its center of mass at a constant angular speed of 3 s^{-1} as shown below. Somebody happened to drop a blub of gum onto the disc. The gum as a mass of 50 gram and fall at a distance of 50 cm away from the rotation axis. Assume all the frictions are negligible. What would be the angular speed of the disc after the gum is **stick** to the disc? Is this angular speed a constant?

