# Chapter 3 - Mechanism of Injury:
Understanding the Kinematics of Trauma Test Questions

1. Using the physics formula $KE = \frac{1}{2} m v^2$, which factor emerges as the most important for predicting severity of injury?

    a. m = momentum
    b. injury severity is inversely proportional to the combined mass of the colliding objects
    c. velocity
    d. kinetic energy is directly related to injury severity, and is predicted by ½ inertia times (mass and velocity)^2

2. Select injuries you would anticipate for an injured car driver that was struck on his driver's side by another car running a red light in an intersection ("T-bone" crash), with both cars going at 40 mph.

    a. Neck hyper-flexion with T-8 compression fracture, open tib-fib fracture, and ruptured small bowel
    b. Multiple left rib fractures with pneumothorax, lung contusion, pelvis fracture, epidural hematoma
    c. Bilateral hip fracture-dislocations, anterior-posterior pelvis fracture, liver laceration
    d. Neck hyper-extension with cervical fracture and possible cord injury, bilateral patella fractures, bilateral lung contusions

3. Trauma can be defined as the application of excessive energy to the human body above it tolerance, resulting in damage. Some forms that this energy may take include…

    a. Kinetic, thermal, electrical, chemical, and radiological
    b. Gravity, blast, and quantum-physical
    c. Nano-kinetic, friction-traction, and hypoxic
    d. Crush, acceleration/deceleration, and inertial

4. Injuries due to explosions may be severe and difficult to treat, because…

    a. Of the effects of the blast wave itself on solid organs
    b. The effects of radiation may have a delayed presentation
    c. Of the difficulty in making the diagnosis of bowel perforation
    d. The injuries may be due to the blast-wave itself, combined with blunt injury, penetrating injury from flying debris, and burns
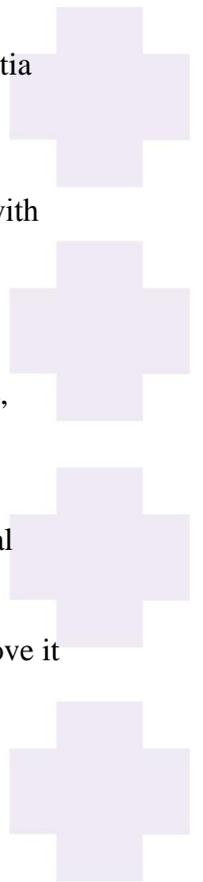
5. "Delta V" (ΔV) refers to…

   a. The combined velocities of two moving objects which collide
   b. The fact that the total force resulting in injury is diminished due to the "ride-down" time produced by the "wrinkle zone" of the car
   c. The vector or direction of forces involved in a collision
   d. Change in vector

6. A certain amount of kinetic energy is produced when a 180-pound person is driving a car which strikes a solid bridge abutment at 30 mph. If the car's speed in this example were increased to 42 miles per hour, this would…

   a. Result in damage that would increase by about 25% because 30 mph represents about 25% less velocity than 42 miles per hour
   b. Result in a "delta V" of 72 miles per hour
   c. Approximately double the kinetic energy, and thus the predicted severity of injury to the driver
   d. Produce some increased severity of injury, but not as much as when the driver weighs 225 pounds, since the mass is squared

7. Tissue damage may increase in gunshot wounds due to the dynamics of the projectile. Examples of these types of dynamics include:

   a. Bullet size
   b. Tumble, yaw, fragmentation, cavitation, and deformation
   c. Tattooing of the skin by gunpowder in close-range gunshots
   d. Fragmentation, deformation, pigmentation, and shotgun pellet spread

8. Bumper height from the pavement may be 24-36" in SUV's and larger pick-ups, while bumper height may be as low as 16-18" in some smaller cars. You are informed that the two trauma patients due to arrive shortly are a mother and small child who were struck by a SUV in a crosswalk. You could predict that…

   a. The speed they were struck is a good predictor of the severity of injuries
   b. The mother would be likely to have severe tib-fib fractures, while the child is more likely to have femur/hip/pelvis fractures
   c. If much speed was involved, both are likely to have a lot of road rash from sliding along the pavement after they are accelerated up to the speed the SUV was traveling
   d. All of the above

9. The withholding of essential energy can also produce injury, such as:

   a. Traumatic asphyxia, cerebral hypoxia from hanging, and frostbite
   b. Injuries produced by "negative pressures" within the blast zone
   c. Hemorrhagic and neurogenic shock
   d. None of the above

10. The most important practical concept to take away from a study of the kinematics of injury, useful for the practical prediction of injury severity, is that…

   a. Thermal, radiological, and blast-type injuries combined cause more severe injuries than blunt-type kinetic injuries, since most blunt injuries seen at trauma centers are actually from low-velocity events
   b. Mass squared means that injury severity increases exponentially as the combined mass of the moving objects increases
   c. "up and over", "down and under" and crumple-zone "ride-down" time are the most important predictors
   d. The mass of the moving object is related to the injury severity, and as the combined velocities of the moving objects increase, the resulting severity of injury exponentially increases