AP Physics C
Drozdoff 8–9
Quiz Solutions — Chapter 9, 10/22/2007

Scored out of 12 points (2 points per problem).

1 $\mathbf{p} = m\mathbf{v}$ (vectors not required, but were noted if absent)

Scoring: Two points for $m\mathbf{v}$ or mv; $-\frac{1}{2}$ if inconsistent use of vectors

2 Answers accepted included the following:

- a zero net external force (the condition for conservation of momentum) implies $\mathbf{p}$ is constant because $\mathbf{F} = \frac{d\mathbf{p}}{dt}$ and if $\mathbf{F} = 0$, $\frac{d\mathbf{p}}{dt} = 0$, so $\mathbf{p}$ is constant.
- Newton's Third Law states that any force is responded to with a force of equal magnitude and opposite direction, and since these action-reaction pairs occur within a close system, they may be considered to cancel for a zero net force and thus no impulse, so no change in momentum
- Space is homogeneous (shift symmetric); that is, position and momentum are Pontryagin duals.
- any reasonably intelligent versions or combinations of the above

Scoring: two points for full, proper explanation; deductions commensurate with deficiency of answers

3 $\mathbf{J} = \int \mathbf{F}\,dt$ (accepted with limits: $\mathbf{J} = \int_{t_i}^{t_f} \mathbf{F}\,dt$, or using $\mathbf{I}$ for impulse; vectors not required but were noted if absent)

Scoring: all or nothing

4 An elastic collision conserves K; an inelastic collision does not conserve K (some K is lost as heat, sound, and/or to deform the objects colliding)

Scoring: one point for definition of elastic collision; one point for definition of inelastic collision

5 $\frac{\pi}{2}$ or 90° (reluctantly accepted: 100 grad)

Scoring: all or nothing

6 the cue ball stops and its momentum is transferred to the hit ball, which goes in the same direction as the cue ball had

Scoring: one point for statement that momentum is conserved; one point for specific explanation