“Fact or Friction” (50,000 points) Multiple-Guess-Pick-The-Best-Answer-Fill-In-The-Bubbles

1.) (a) The Work Energy Theorem says that the Work done on an object changes its ________ Energy.
   A = Static  B = Kinetic  C = Potential  D = Radial Inward
   E = Tangent  F = Radial Outward
   A  B  C  D  E  F  

(b) The ________ coefficient of friction is always the smaller.
   A = Static  B = Kinetic  C = Potential  D = Radial Inward
   E = Tangent  F = Radial Outward
   A  B  C  D  E  F  

(c) Rodney the Reindeer goes around and around on his string because there is a ________ Force.
   A = Static  B = Kinetic  C = Potential  D = Radial Inward
   E = Tangent  F = Radial Outward
   This is U.C.M.  A  B  C  D  E  F  

(d) There is no centrifugal force. If Rodney’s string breaks, his initial motion is ________ to the circle.
   A = Static  B = Kinetic  C = Potential  D = Radial Inward
   E = Tangent  F = Radial Outward
   A  B  C  D  E  F  

(e) An object tossed straight up, will have only ________ Energy at its turning point.
   A = Static  B = Kinetic  C = Potential  D = Radial Inward
   E = Tangent  F = Radial Outward
   At rest at turning point.  A  B  C  D  E  F  

(f) A woman throws a ball horizontally. The work she does on the ball results in the ball gaining ________ Energy.
   A = Static  B = Kinetic  C = Potential  D = Radial Inward
   E = Tangent  F = Radial Outward
   Same as in (1a).  A  B  C  D  E  F  

In parts (g)-(i), select which of Newton’s 3 laws or the 2 Conservation laws that best describes the situation.

(g) A car speeding up to merge into the expressway traffic.
   A = Newton’s 1st  B = Newton’s 2nd  C = Newton’s 3rd
   D = Momentum  E = Energy  F = None of these
   A  B  C  D  E  F  

(h) The force of the Earth on the Moon and the force of the Sun on the Moon.
   A = Newton’s 1st  B = Newton’s 2nd  C = Newton’s 3rd
   D = Momentum  E = Energy  F = None of these
   A  B  C  D  E  F  

(i) The difference between a totally elastic collision and a totally inelastic collision.
   A = Newton’s 1st  B = Newton’s 2nd  C = Newton’s 3rd
   D = Momentum  E = Energy  F = None of these
   A  B  C  D  E  F  

(j) A golf ball sitting on a tee, just before it is struck.
   A = Newton’s 1st  B = Newton’s 2nd  C = Newton’s 3rd
   D = Momentum  E = Energy  F = None of these
   3 4 5 6 7 8
“Drivin’ Along in My Automobile…” (50,000 points)

2.) A car (mass = 2110 kg) is driving along at a constant speed of 67 mph (29.9 m/s).  (a) Find the weight of the car.

\[ w = mg = (2110 \text{kg})(9.81 \text{m/s}^2) = 20,700 \text{N} \]

(b) The engine has to supply a force of 3450 N just to overcome air resistance.  If there wasn’t air resistance, find the acceleration \( a \) that a force of 3450 N would have on this car.

\[ F = ma \]
\[ a = \frac{F}{m} = \frac{3450 \text{N}}{2110 \text{kg}} = 1.635 \text{m/s}^2 \]

(c) The coefficients of friction are 1.00 and 0.820 respectively.  What is the maximum braking force that the car can supply while under complete control?

The Maximum Braking Force would be Maximum Static Friction.

\[ F_N = w = mg = 20,700 \text{N} \]
\[ F_{f,k} = \mu_k F_N = (0.820)(20,700 \text{N}) = 16,970 \text{N} \]
\[ \sum F_i = -F_{f,k} = ma, \quad a = \frac{-F_{f,k}}{m} = \frac{-16,970 \text{N}}{2110 \text{kg}} = -8.043 \text{m/s}^2 \]

(d) A dog runs across the road and the driver stomps on the brake pedal, skidding to a stop in a distance \( d \).  Find \( d \).

Skidding tells us this would be Kinetic Friction.

\[ F_N = w = mg = 20,700 \text{N} \]
\[ F_{f,k} = \mu_k F_N = (0.820)(20,700 \text{N}) = 16,970 \text{N} \]
\[ \sum F_i = -F_{f,k} = ma, \quad a = \frac{-F_{f,k}}{m} = \frac{-16,970 \text{N}}{2110 \text{kg}} = -8.043 \text{m/s}^2 \]

\[ F = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2 \]
\[ F = \frac{1}{2}mv_0^2 \]
\[ d = \frac{-mv_0^2}{2F} = \frac{-2110 \text{kg} (29.9 \text{m/s})^2}{2(-16,970 \text{N})} \]
\[ = 55.58 \text{m} \]

(e) While traveling at a speed of 67 mph (29.9 m/s), the driver falls asleep at the wheel and drifts over to the right, running into a parked SUV (mass = 2890 kg).  Find the speed of the wreck, \( V \).

\[ P_{	ext{before}} = P_{	ext{after}} \quad ; \quad p = mv \]
\[ m_1v_1 + m_2v_2 = (m_1 + m_2) V \]
\[ V = \frac{m_1v_1 + 0}{m_1 + m_2} \]
\[ V = \frac{(2110 \text{kg})(29.9 \text{m/s})}{(2110 \text{kg} + 2890 \text{kg})} \]
\[ = 12.62 \text{m/s} \]