Show all of your work on the following problems using appropriate unit conversions and significant digits rules.

1. A heavy truck involved in a collision is found in fifth gear. The gear ratio is 1.65; the drive axle ratio is 4.12. Diameter of the drive wheels is 46 inches [117 cm]. The minimum speed of the engine is 850 RPM; it is governed at 2100 RPM. Determine the maximum and minimum speeds of the truck.

2. A disabled large truck (flashers on) is blocking the travel lane behind a blind curve. A pickup travelling 65 mph [105 kph] comes around the curve and its driver attempts to stop. If the sight distance is 325 feet [99 m], the reaction time is 1.0 second, and the stopping drag factor is 0.65, can the vehicle be stopped in time?

3. 4600-pound [2087 kg] V-2 is stopped at a traffic signal when it is struck in the rear by 2800-pound [1270 kg] eastbound V-1. After impact V-1 travelled east 28 feet [8.5 m] at an average drag factor of 0.40. After impact V-2 travelled east 32 feet [9.8 m] at an average drag factor of 0.35. Calculate the impact speed of V-1.

4. For the collision in Problem 3, recalculate V-1's impact speed using dissipation of energy. V-1 has an average of 7 inches [18 cm] of crush on its front. V-2 has an average of 16 inches [41 cm] of crush on the rear. Use the following Campbell equations:

\[ S_{1} = V_{B1} = 1.46 \times C_{\text{avg}} + 7 \]

\[ S_{2} = V_{B2} = 1.15 \times C_{\text{avg}} + 5 \]

5. A pickup truck skids 51 feet [15.5 m] on a dirt surface (drag factor of 0.63), skids another 59 feet [18 m] on a grass surface (drag factor of 0.38) and hits a one foot [0.3 m] diameter tree head-on. The impact leaves a 28 inch [71 cm] deep dent in the front of the pickup. Using one of the equations below,

\[ S \text{ in mph, } C_{\text{MAX}} \text{ in inches: } S = 0.84 \times C_{\text{MAX}} + 4.0 \]

\[ S \text{ in kph, } C_{\text{MAX}} \text{ in cm: } S = 0.53 \times C_{\text{MAX}} + 6.4 \]

calculate the speed of the pickup at impact. Also calculate the speed of the pickup at start of skid on the dirt.

6. An automobile begins to yaw on a banked curve. The critical speed scuff mark laid down by the outside front tire was measured with a 60 foot [18.3 m] chord and found to have a middle ordinate of 16.5 inches [42 cm]. The LEVEL coefficient of friction is 0.78. Along the scuff mark the surface is banked 2%. Determine the speed of the vehicle.