Assume the gravitational force of the Earth is 9.81 m/s^2.

1. On Earth, Larry the trucker weighs 981 N. On Mars, Larry weighs 371 N. If a force (acting perpendicular to gravity) of 54 N horizontally accelerates Larry at *a* m/s^2 on a frictionless surface on Earth, what force in N would accelerate Larry horizontally at *a* m/s^2 on a frictionless surface on Mars?
2. Solve for *a* in the above question.

Larry parks his truck on an uphill incline.

3. A spherical solid ball, a thin hoop, and a solid cylinder are at rest the higher end of the truck. They all have the same mass and same radius. They all begin rolling without slipping from rest at the same time. Which one will have the greatest translational velocity at the bottom of the truck?
    a. Ball
    b. Hoop
    c. Cylinder
    d. They will all have the same translational velocity

4. Which one will reach the bottom of the truck last?
    a. Ball
    b. Hoop
    c. Cylinder
    d. They will all reach the bottom of the truck at the same time

Larry and his truck, with total mass 4000 kg and length 16 m, travel at a constant speed of 26 m/s on a level road.

5. What is the magnitude of the gravitational force exerted by the truck on the road?
6. What is the magnitude of the normal force exerted by the road on the truck?
7. The truck is hit head-on by a flock of 30 geese, each with mass 5 kg, that travel at a speed of 23 m/s in a direction opposite to the truck. After impact, the geese fall motionless to the ground, without touching the truck as the truck drives over them. What is the new speed of the truck?
8. Frightened by the onslaught of geese, Larry the trucker (who has a mass of 100 kg) dives out of the driver's side door (on the left-hand side) with a velocity of 15 m/s perpendicular to the truck and parallel to the road. What is the new speed of the truck?
9. The truck, now with mass 3900 kg, continues in a straight line and slows to a stop over the next 1000 m. What is the magnitude of the average acceleration of the truck over this time period?
10. Larry the trucker can run at a top speed of 8 m/s. Starting from rest, he accelerates to his top speed at a constant acceleration of 3 m/s^2. How long does it take for Larry to reach top speed?
11. What distance does Larry travel as he accelerates to his top speed in a straight line towards his runaway truck during the period from rest to top speed?
12. Larry is short of vision and, while running at top speed, collides with his truck (which is at rest) and sticks to it. What is the new speed of the truck-Larry system?
13. After a series of mishaps, Larry manages to get back into his truck. The total mass of the truck is now 4000 kg and the velocity of the truck is 26 m/s relative to the road. However, the back of the truck is open! If a chair with mass 10 kg is ejected out of the back of the truck by Barry the trucker with a velocity of -26 m/s relative to the road at a height 1 m above the road, how far will it be from the truck when it hits the ground?
14. Larry's truck continues to lose mass at a rate of 3 kg/s, as Barry the trucker continues to eject objects from the back of the truck with a velocity of -26 m/s relative to the road. What is the speed of the truck after 2 minutes?

15. Larry crashes his truck. It lands sideways on the incline of a hill. Larry's truck will remain at rest on the incline if the frictional force acting on the truck against the component of gravity parallel to the incline is equal to the component of gravity parallel to the incline. The frictional force is calculated using a coefficient of static friction. Given that the truck remains at rest on the hillside slope inclined θ degrees above the horizontal, but would slide down the surface if the incline was above θ degrees from the horizontal, what is the coefficient of static friction between the truck and the hill?
    a. sin(θ)
    b. cos(θ)
    c. tan(θ)
    d. csc(θ)
    e. sec(θ)
    f. cot(θ)

Larry's truck now has a mass of 2000 kg. To escape from a vengeful Barry, Larry dives into his experimental truck and drives towards the nearby cliff. Given a coordinate plane with Larry's house at the origin, the y-axis in the north-south direction, and the x-axis in the east-west direction, Larry's position (in m) after time *t* for the first 12 seconds is given by the equations $x(t) = 5t^2$ and $y(t) = 6t^2$.

16. What is Larry's speed at 12 seconds?
17. At *t*=12, Larry's engine fails, causing it to stop accelerating the truck, as he enters a storm that imparts a force **F** (in N) on the truck, where **F**=(1500, 1000). What is the magnitude of the net acceleration of the truck?
18. Larry arrives at the cliff 15 seconds after entering the storm. The cliff can be plotted on the coordinate plane with the equation y=c. What is the value of c, in m?
19. What is Larry's position on the coordinate plane when he arrives at the cliff?
20. Barry, with a mass of 100kg drops out of a chopper above the point where Larry reaches the cliff. Neglecting air resistance, Barry falls straight down from a height of 90 m above the ground. As the record-breaking storm has stopped, Barry falls straight down until he hits the ground. What is Barry's kinetic energy immediately before he hits the ground?