SPH3U0 **Newton’s First Law Application Problems** Date:\_\_\_\_\_\_\_\_\_

1. ***The Importance of Seatbelts in Forward Collisions***

***Scenario: Imagine a passenger is in a car which is travelling at a velocity of 100 km/h [Forward] on the highway.***

i) Describe the motion of the passenger’s body.

***The car comes to a sudden stop when it is involved in a collision.***

ii) If the passenger is NOT wearing a seatbelt, refer to Newton’s First Law to help you explain what will happen to their body when the car stops.

***Now let’s imagine the same scenario, except the passenger is now wearing a seat belt.***

iii) Explain how the seatbelt helps to protect the passenger in the event of a collision or sudden stop. Make sure to discuss application of an unbalanced force!!

http://t2.gstatic.com/images?q=tbn:oxa-_2AOXZMhdM:http://www.hscripts.com/freeimages/icons/traffic/regulatory-signs/seat-belt-required/seat-belt-required10.gif

2. ***The Importance of Headrests in Rear-end Collisions***

***Scenario: Imagine a passenger in a car which is at rest at a stop light. They are in an old fashioned car with no head rests-the seats come up to the top of their shoulders but their neck and head are unsupported.***

i) Describe the motion of the passenger’s body, head and neck while they wait at the light.

***Now imagine that a car approaching from behind rear-ends their car-suddenly accelerating their car and seat forward.***

ii) Considering that the seat is pushing against their body (up to their shoulders) how will their body move?

Considering that their head and neck are unsupported, what will their head and neck tend to do? What type of injury may result?

iii) Consider the design of the headrest shown below. If the passenger was in this type of seat, how would

 the headrest help to prevent the injury described above?

***3. Speed Limits on Highway and Road Curves***

***Scenario: Imagine a car travelling along a highway at 100 km/h [East] on a cold winter day. The car approaches an off ramp so the driver can turn south off the highway but as the car enters the curve it hits a patch of ice.***

i) Describe the initial motion of the car.

ii) If the car begins to skid when it hits the ice, describe the motion of the car as the driver attempts to enter the curve.

***The faster the car is going initially, the greater the force required to get it to turn from its initial direction to a new direction.***

iii) Explain why highway designers usually post signs similar to the one below on tight curves and on/off ramps on roads and highways.

http://www.nzta.govt.nz/resources/roadcode/heavy-vehicle-road-code/gfx/h-v-curve-65-sign.gif