**ECE 105 Tutorial Problems for Week 4**

**Thursday’s Problem**

A rollercoaster ride has one giant 12 m radius loop that has the cars upside down on top. The bottom of the loop is at ground level. The ride starts at a height of 32 m, and after emerging from the loop the cars are braked by friction, the kinetic coefficient being 0.65.

1. By what fraction will a passenger of mass of 75 kg feel lighter at the very top of the loop?
2. How far and how much time will it take the car to come to a stop?

**Thursday’s Group Work**

**1**  As the rollercoaster reaches the bottom of the loop the 75 kg passenger will feel their weight to be:

1. Weightless
2. The same as normal
3. Lighter than normal
4. Heavier than normal

**2** As the rollercoaster reaches the point of the loop midway between top and bottom the 75 kg passenger will feel their weight to be:

1. Heavier than normal
2. Lighter than normal
3. Weightless
4. The same as normal

**3** How does your answer to part (a) change for a 100 kg passenger?

**a)** The 100 kg passenger will feel proportionally heavier at the bottom than the 75 kg passenger

**b)** The answer does not change

**c)** The 100 kg passenger will feel proportionally lighter at the bottom than the 75 kg passenger

**d)** It is not possible to determine the if the answer changes without additional information

**4** If the rollercoaster were 10% more massive, after leaving the loop it would come to a stop

**a)** At the same distance

**b)** At a longer distance

**c)**  At a shorter distance

**d)** The answer depends on the weight of all the passengers

**5** Which forces in this problem are conservative?

**a)** gravity

**b)** friction

**c)** both friction and gravity

**d)** friction, gravity, and the normal force

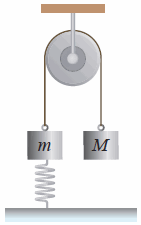
**Thursday’s Answer**

1. There is negligible friction on the way down to the bottom of the loop. A careful reading of the question indicates that only after leaving the loop is friction significant.

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**(b)**



**Friday’s Problem**

Two masses, *M* = 18.5 kg and *m* = 7.2 kg, are attached to each other with a rope that passes over a massless hanging pulley as shown in the figure at left. Mass m is attached to one end of an unstretched spring (with spring constant k), whose other end is attached to the ground. The system is originally held at rest and then released. If *m* moves a distance *d*:

1. What is the speed of m when *k* = 0 and *d* = 38 cm?
2. What is the speed of m when *k* = 376 N/m and *d* = 38 cm?

**Friday’s Group Work**

**1**  If the two masses were equal to 18.5 kg, how would your answer to part (a) change (k=0 case)?

1. The speed of m would be smaller at d=38cm, but not zero
2. The speed of m would always be zero and the spring would not compress
3. The speed of m would be larger at d=38cm
4. There would be no change in the speed of m at d=38cm

**2** If the two masses were equal to 18.5 kg, and *k* = 376 N/m:

1. The speed of m would be zero and the spring would remain unstretched/uncompressed
2. The speed of m would be zero and the spring would compress
3. The speed of m would be zero and the spring would stretch
4. The speed of m at d=38cm would be the same as in the problem question (*M* = 18.5 kg and *m* = 7.2 kg)

**3** If M=0 then m would

**a)** Remain at rest

**b)** Move down and compress the spring and would have v>0 at 38 cm

**c)** Move down and compress the spring and just stop (v=0) at 38 cm

**d)** Move down and compress the spring but it would not reach 38 cm

**4** If m=0 then M would

**a)** Remain at rest

**b)** Move down and stretch the spring but it would not reach 38 cm

**c)**  Move down and stretch the spring and would have v>0 at 38 cm

**d)** Move down and stretch the spring and would have v=0 at 38 cm

**5** Which forces in this problem are conservative?

**a)** only gravity

**b)** both the spring and gravity

**c)** only the spring

**d)** neither the spring nor gravity

**Friday’s Answer**

