**Page 1 - Linear Kinematics and Projectile Motion**

1. A bike coasts from 12.5 m/s to rest in a distance of 27.2 m. What is its acceleration? (-2.87 m/s/s)

2. An air rocket is launched vertically upward at a velocity of 28.0 m/s. What time will elapse before it is at an elevation of 27.0 m on the way up? on the way down? (1.23 s, 4.48 s) (I ask only for the time on the way down)

3-5: A ball rolls off the edge of a 15.0 m tall cliff with a purely horizontal velocity, and strikes the ground at a distance of 12.4 m from the base of the cliff.

3. What time was the ball in the air? (1.75 s)

4. What was the ball’s horizontal velocity? (7.09 m/s)

5. What is the speed of impact? (18.6 m/s) (I also ask you to make a drawing of the velocity with magnitude and angle)

**Page 2 - Dynamics (4.2) and Vertical Circle (5.2)**

1-3: A 1.60 kg mass hangs on a rope:

1. What does the tension need to be in the rope to accelerate the 1.60 kg mass upwards at 3.56 m/s/s? (+21.4 N )

2. What is the acceleration of the 1.60 kg mass if the tension in the rope is 19.3 N? (+2.25 m/s/s)

3. The 1.60 kg mass is moving upwards at 5.30 m/s and stops in a distance of 2.80 m. What is the tension in the rope as it is stopping? (+7.67 N)

4-5: A 5.30 kg mass moves at a constant speed in a vertical circle on the end of a 0.440 m long rod with a velocity of 1.90 m/s.

4. What force in what direction does the rod exert at the top?

5. What force in what direction does the rod exert at the bottom?

**Page 3 - Energy (6.1, 6.2) and a Momentum (7.1, 7.2)**

1. What is the minimum power rating a motor could have if it is to lift a 560. kg elevator 35.0 m in 78.0 seconds? (2470 W)

2. A massless spring with a spring constant of 34.0 N/m is compressed 5.80 cm horizontally and used to shoot an 18.0 gram marble across a frictionless table. What is the speed of the marble? (2.52 m/s)

3. A 580. kg rollercoaster is going 7.50 m/s on the top of a 1.20 m tall hill, how fast is it going on top of a 3.50 m tall hill? (Neglect friction) (3.34 m/s)

4. Two football players strike each other head on. Player 1 has a mass of 119 kg and is running 6.20 m/s to the East, and player 2 has a mass of 102 kg is running 4.20 m/s to the West. What is their post-collision velocity if they stick together? (Speed and direction) (1.40 m/s East)

5. A 60.0 kg rocket, 48.0 kg of which is fuel, burns 2.15 kg of fuel per second with an exhaust velocity of 982 m/s. What are its initial and final acceleration as it takes off from earth?

(25.4 m/s/s, 166 m/s/s)

**Page 4 - Rotational Mechanics (8.2) and Statics (9.3)**

1. A 0.400 m diameter, 4.30 kg sphere accelerates about its center at 6.80 rad/s/s. What is the torque? (0.468 mN)

2. A flywheel that is a 0.730 m diameter thin ring with a mass of 16.0 kg would require what torque to accelerate from rest to 1120 RPM in 8.10 seconds? (30.9 mN)

3. A 232 kg 4.10 m diameter (cylindrical) Merry go round is stopped from a speed of 94.0 RPM in 55.0 seconds. What frictional force applied tangentially at the edge would cause this? (42.6 N)

4-5: The uniform beam is 6.80 m long, and the person is standing 0.300 m from the right side, F1 is exerted at the left end, and F2 is exerted 1.80 m from the left side. Calculate the magnitude and direction of F1 and F2

(F1 = 1560 N down, F2 = 2320 N up)

**Y:**

**F1 =**

**F2 =**

**Γ:**