IB Physics Year 1 Fall Final Review Problems.

1. Error propagation: If $Q=(3)x^{2}-ad$, calculate Q complete with its uncertainty when x = 3.50 ±0.02 m/s, a = 15.0 ± 0.5 m/s2, and d = 0.248 ±0.002 m. Use dimension analysis to determine the proper unit for Q.
2. Kinematics w/ graphs: A police car at rest, passed by a speeder traveling at a constant 112 km/h, takes off in hot pursuit. The police officer catches up to the speeder in 765 m, maintaining a constant acceleration. a) Qualitatively plot the position versus time graph and the velocity versus time graph for both cars from the police car’s start to the catch up point. b) Calculate how long it took the police officer to overtake the speeder, c) the required police car acceleration, and c) the speed of the police car at the overtaking point.
3. Projectile motion: A projectile is shot from the edge of a cliff 125 m above ground level with an initial speed of 105 m/s at an angle of 37.0° above the horizontal. a) Determine the time taken by the projectile to hit a point P at ground level. b) Determine the distance between P and the base of the cliff. c) Determine the magnitude and direction of the velocity of the projectile when it hits P. d) What is the highest altitude obtained by the projectile?
4. Friction problem on incline: A small block of mass 2.35 kg is given an initial speed 12.3 m/s up a ramp inclined at 50° to the horizontal. How far up the slope does it travel if the coefficient of dynamic friction is 0.18? If the coefficient of static friction is 0.38, what happens when it reaches this point? (Does it stop there or does it turn around and accelerate back down the slope? If it stays, find the force of static friction. If is turns around, find it’s acceleration as it slides back down.)
5. Multibody pulley problem: A 28.0 kg block is connected to an empty 1.00 kg bucket by a cord running over a frictionless pulley. (The coefficient of static friction between the table and the block is 0.450 and the coefficient of dynamic friction is 0.320. Sand is gradually added to the bucket until the system just begins to move. a) Find the mass of the sand added to the bucket. B) Determine the acceleration of the system if the flow of sand stops when the system begins to move.