

SPH 3UI Midterm Practice Questions

- 1) A duck migrating south for the winter flies the first 55 km at 8.0 m/s, the next 15 km in 45 minutes, and finally spends the last 3 hours going 29 km/h. Determine its average speed.
- 2) Bart drops an egg from a tall tower and the splat of it hitting Homer is heard 5.2 s after the egg was released. Determine the height of the tower above Homer's head. ($v_{\text{sound}} = 340 \text{ m/s}$)
- 3) The bridge is washed out 125 m away. You are moving at 90 km/h and have a reaction time of 1.5 s. What is your acceleration if you stop just in time?
- 4) Maggie and Stewie are racing their tricycles down the street. They each start from rest. Maggie accelerates at 1.2 m/s^2 for the entire race. Stewie cheats by using a jet pack that accelerates him at 15 m/s^2 . Unfortunately for Stewie, the jet pack takes needs to warm up, so he leaves 4.5 s late and loses the race by 1.0 m. What was the distance of the race?
- 5) Snoopy went 3.2 km $\langle E \rangle$ and then 4.1 km $\langle N24^\circ E \rangle$. Charlie Brown went south 3.0 km. What displacement must Charlie Brown use to get back to Snoopy?
- 6) A stone is thrown off a 12.0 m high cliff at a velocity of 25 m/s at an angle of 35° to the horizon. How far from the base of the cliff will it land?
- 7) Calvin (25 kg) throws Hobbes (10 kg) to a velocity of 3.5 m/s [E]. Calvin's throwing motion takes 0.8 s to complete. This is done in a frictionless environment. Determine the force exerted on each 'person', and Calvin's final velocity.
- 8) How is the force of gravity between two objects changed if the mass of one is doubled and the distance between them is increased by 50%?
- 9) Derive a formula to determine the acceleration due to gravity on the surface of a planet of mass M and radius R .
- 10) A 1500 kg vehicle is pulled by a tow truck with a chain that makes a 30° angle above the ground. The tension on the chain is 7500 N. The wheels on the car are locked so that there is a coefficient of friction of 0.11 between the car and the road. Determine:
 - a) the normal force on the car
 - b) the force of friction
 - c) the acceleration of the car
 - d) the work done by friction over the first 2.0 s
 - e) the work done by the tow truck in 2.0 s
 - f) the total change in energy of the car in 2.0 s
- 11) Derive a formula that gives the power needed to lift a mass, m , at a constant speed, v .
- 12) A 6.0 kW motor lifts a 450 kg elevator 12 m at 0.5 m/s. What is the efficiency of the elevator?
- 13) A baseball player throws a baseball so that when it hits the ground 82 m away it has a speed of 90 km/h. He released the ball 1.7 m above the ground, and it had a speed of 18 m/s at its peak height. Determine,
 - a) the speed of the ball when it left the thrower's hand, and
 - b) the maximum height of the ball.
 - c) If the motion of the thrower accelerated the 145 g ball from rest for 2.2 m, what was the average force applied. (Solve in 2 different ways!)
- 14) A rollercoaster car is going 1.0 m/s at its maximum height, h , above the ground. At the bottom of this hill it is only 2.2 m above the ground, and moving at a speed of 45 km/h. Determine h if 20% of the energy is lost due to friction.