

Part A

You only have this period to finish this section. You must do a minimum of **60** points on this section and 100 points on the two sections combined. Please give all final answers in three significant figures.

You will only receive credit for reasons and solutions based on concepts from this chapter.

- A1. Dan is under the window of his true love and wants to throw a 96.0 gram rock up to the window to let her know he is waiting for her. He wants the rock to just hit the window that is 2.65 m above him. How fast does he need to release the rock? (10)
- A2. Amanda, mass 50.0 kg including bike, is riding her bike along a straight flat part of the road. She is not peddling but still moving forward at a constant velocity of 11.0 m/s. How high of a hill can she just make it up if she does not pedal? (10)
- A3. Once Amanda is over the hill in problem A2 she heads down that hill to a height 5.00 m below where she was before the hill. How fast is she moving if she pedaled on the way down doing 830 J of work on her pedals which are 85.0% efficient? (20)
- A4. Franklin is out playing football one fine afternoon. He kicks a ball with a velocity of 9.45 m/s at an angle of 56.0° to the horizontal. What is the maximum height the ball reaches? (20)
- A5. Jack is out on the Essex River with his boat. This boat has a 75.0 Hp motor on the back. Jack notices that he can travel at 12.5 m/s when in still water. What is the resistive force of the water against Jack's boat? (10) (1 Hp = 746 W)
- A6. An ideal Atwood machine has masses of 2.50 kg and 4.00 kg and is 1.50 m off the floor. When released with what velocity will the 4.00 kg mass hit the floor? (Assume the larger mass starts at the top and the smaller mass does not hit the machine.) (20)
- A7. One day you are out practicing with your bow and arrow. You put the 35.0 gram arrow on the string and pull it back a distance of 30.0 cm. The string and bow have a combined elastic constant of 370 N/m. When you release the arrow you notice that it travels 90 m before hitting a target at 12.0 m/s. What is the resistive force of the air on the arrow during its flight? (20)
- A8. A spring is going to be used to power a small toy car. The spring is going to be compressed a distance of 3.50 cm. It needs to power the 150. Kg car a total distance of 78.0 cm against a resistive force of 2.40 N. What spring constant does your spring need to have? (20)
- A9. Ask for and explain the demonstration (10) (RO)
- B1. Jamie gets her hands on a rubber band gun. She notices that the gun stretches the rubber bands that have a $k = 33.0$ N/m a displacement of 14.0 cm. At what maximum angle can Ashley launch the rubber bands as to not hit the ceiling that is 1.25 m above her? (20)

B2. You are making your mousetrap car and want it to go a distance of 75.0 m to break the record. You know the mousetrap spring has a constant of 270 N/m and stretches a distance of 5.50 cm. How much resistive force can you allow against your car for it to reach this distance? (20)

B3. Your summer job is to design a new rollercoaster. The coaster starts at the top of the track that is 32.0 m above the end of the track. You design the coaster with three hills, the top of each 6.00 m below the previous hill. The whole track is 360.0 m long with the hills evenly spaced. What is the maximum resistive force that can be against the 500 N train and it still finish the whole run? (Assume the train starts from 1.50 m/s at the top of the first hill.) (40)

B4. Shiv, mass 60.0 kg, is running to escape a tiger that is chasing him. He is running at a top speed of 8.00 m/s when he grabs a 2.75m long hanging rope. How fast is he going when he reaches the top of his swing? (20)

B5. A bomb, of mass 40.0 kg, is dropped from an airplane. After a certain distance the bomb is at terminal velocity. Explain what is happening before terminal velocity and at terminal velocity. (10)(RO)

B6. Colleen gets inspired by the pulley lab and decides to use a gang pulley set up to help her do some work at home. She needs to lift 20 boxes to a loft 4.00 m above her and each box has a mass of 35.0 Kg. She uses a pulley system that causes her to pull 12.0 m with a force of 126.7 N to lift each box to the loft. (40)

- a) How much work does Colleen do to move all the boxes?
- b) How much heat is generated while doing this work?