Midterm Exam 03 (2018 Spring)

PHYS 203A: College Physics

Date: 2018 Apr 13

(Name) (Signature)

Instructions

1. Seating direction: Please be seated on seats with seat numbers divisible by 3.
2. Total time = 50 minutes.
3. There are 7 questions in this exam.
4. Equation sheet is provided separately.
5. To be considered for partial credit you need to show your work in detail and organize it clearly.
6. A simple calculator (with trigonometric functions) is allowed.
7. Use of mobile phones is strictly prohibited. It should stay out of reach during the exam.

1. (**10 points.**) The velocity of a 25 kg object chages from 5.0 m/s to 10.0 m/s while it traverses along a path. What is the total work done by all the forces acting on the object during this change in velocity.

2. (**10 points.**) Figure 1 shows a pendulum of length $L = 1.0\,\text{m}$ and mass $m = 5.0\,\text{kg}$. It starts from rest after it is moved a height $h = 0.40\,\text{m}$. Neglect air resistance.

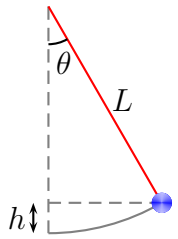

Figure 1: Problem 2.

(a) Determine the work done by the force of tension due to the string on the mass.

(b) Determine the change in the gravitational potential energy while the mass falls the height h.

(c) Determine the change in kinetic energy while the mass falls the height h.

3. (**10 points.**) An object has a kinetic energy of 60.5 J and a momentum of magnitude 11 kg·m/s. Find the speed and the mass of the object.

4. (**10 points.**) A roller coaster of mass $m = 300.0\,\text{kg}$ moves on the curve described in Figure 2. Assume frictionless surface. It starts with velocity $v_A = 5.0\,\text{m/s}$ at point A height $h_A = 50.0\,\text{m}$. Determine the velocity of the mass at points C, when its height is $h_C = 40.0\,\text{m}$,

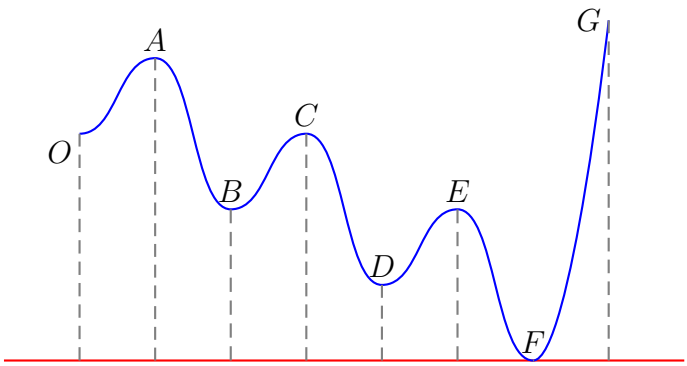

Figure 2: Problem 4.

5. (**10 points.**) A railroad car of mass m is moving with a speed of 4.00 m/s. It collides and couples with three other coupled railroad cars at rest, each of the same mass as the single car. What is the speed of the four cars after the collision?

6. (**10 points.**) A car of mass 2000.0 kg is moving at speed 20.0 m/s towards East. A truck of mass 6000.0 kg is moving at speed 10.0 m/s towards North. They collide at an intersection and get entangled. What is the magnitude and direction of the final velocity of the entangled automobiles?

7. (**10 points.**) A person is riding a bicycle, the wheels of a bicycle have an angular velocity of $+20.0\,\text{rad/s}$. Then, the brakes are applied. In coming to rest, each wheel makes an angular displacement of $+12.0$ revolutions. The radius of the wheels of the bicycle are $30.0\,\text{cm}$ each. Determine the linear acceleration of the bicycle while it came to stop.