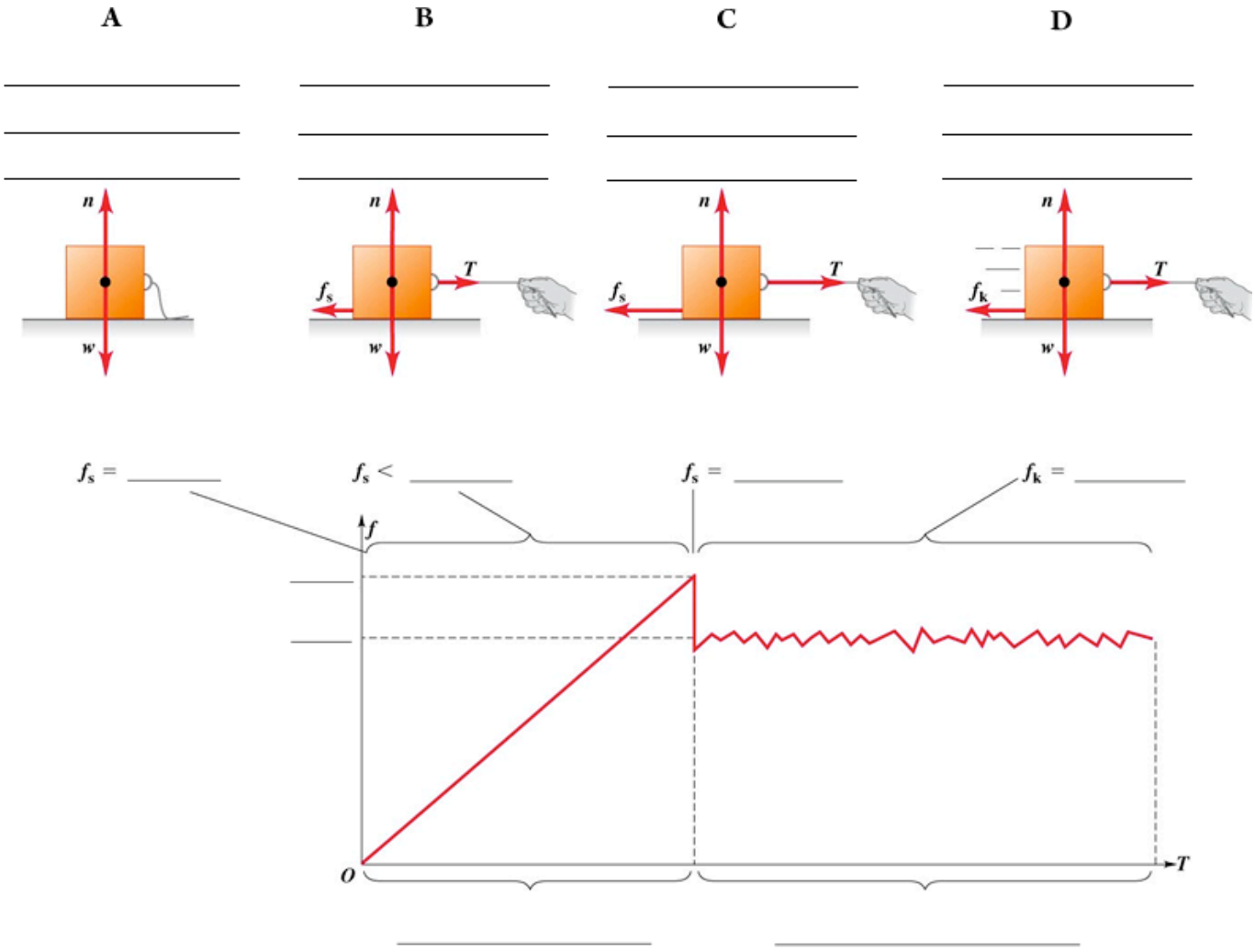
Physics 180A
Test 2 - 120 Points

Name _____

1) Describe each situation and fill in the blanks to the diagram below. There are 4 situations and 8 blanks. (12 pts)



2) A crate slides up an inclined ramp and then slides down the ramp after momentarily stopping near the top. This crate is acted upon by friction on the ramp and accelerates both ways. Which statement about this crate's acceleration is correct? (5 pts)

a. The acceleration is the same in both directions.
b. The acceleration going down the ramp is greater than the acceleration going up.
c. The acceleration going up the ramp is greater than the acceleration going down.

3) You find that if you hang a 1.90 kg weight from a vertical spring, it stretches 4 cm. What is the force constant of this spring in N/m? How much mass should you hang from the spring so it will stretch by 9.85 cm from its original, unstretched length? (6 pts)

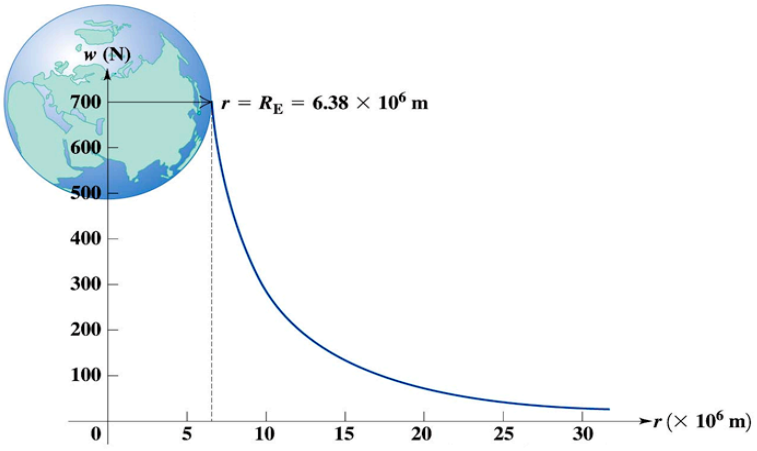
4) At night while it is dark, a driver inadvertently parks his car on a drawbridge. Some time later, the bridge must be raised to allow a boat to pass through. The coefficients of friction between the bridge and the car's tires are μ_s = 0.75 and μ_k = 0.55. At what angle will the car just start to slide? If the bridge attendant sees the car suddenly start to slide and immediately turns off the bridge's motor, what will be the car's acceleration after it has begun to move? Draw a diagram, draw a freebody diagram, sum the forces, and solve the problem. (15 pts)

5) How did the Physicists find the density of the earth using Newton's Universal Law of Gravitation? What is the density of the Earth? (6 pts)

6) Derive Kepler's Third Law from Newton's Universal Law of Gravitation. (6 pts)

7) Using Kepler's Third Law. what is the mass of the Sun using the Earth's parameters. (6 pts)

8) Using the diagram, what is the mass of a person on the surface of the earth? Use the diagram to estimate the mass of a person three times the distance from the center of the earth? (5 pts)



9) A bowling ball weighing 71.2 N is attached to the ceiling by a 4.00 m rope. The ball is pulled to one side and released; it then swings back and forth like a pendulum. As the rope swings through its lowest point, the speed of the bowling ball is measured at 4.10 m/s. At that instant, find the magnitude and direction of the acceleration of the bowling ball and find the tension in the rope. (6 pts)

10) The Cosmoclock 21 Ferris wheel in Yokohama City, Japan, has a diameter of 100 m. Its name comes from its 60 arms, each of which can function as a second hand (so that it makes one revolution every 60 s). Find the speed of the passengers when the Ferris wheel is rotating at this rate. A passenger weighs 812 N at the weight-guessing booth on the ground. What is his apparent weight at the **highest point** on the Ferris wheel? What is his apparent weight at the **lowest point** on the Ferris wheel? What would be the time for one revolution if the passenger's apparent weight at the highest point were zero? What then would be the passenger's apparent weight at the lowest point? Draw a freebody diagram for the top and bottom positions, sum the forces and solve. (15 pts)

11) Two objects with different masses are launched vertically into the air by identical springs. The two springs are compressed by the same amount before launching. Which of the following statements is or are true? (More than one statement may be true.) (5 pts)

A. Both masses leave the springs with the same speed.
B. Both masses leave the springs with the same kinetic energy.
C. Both masses reach the same maximum height.
D. Both masses leave the springs with the same energy.
E. The lighter mass will gain more gravitational potential energy than the heavier mass.

12) From the top edge of a horizontal plateau, a 250 N bag of mountain-climbing gear is launched horizontally by pressing it against a spring of force constant 395 N/cm Just before the launch, the spring is compressed 9.00 cm from its equilibrium position. Once the bag is free of the spring, it goes over a vertical cliff 5.50 m high and lands in the snow below. How far from the foot of the cliff does the bag land? How fast is it moving when it land? **Do not solve this problem.** Draw a diagram of this situation. Include the energy at important locations. (7 pts)

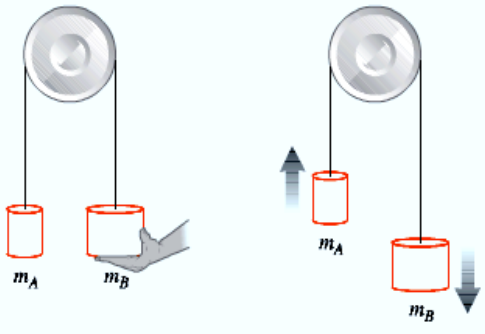
13) (5 pts)

Conceptual Analysis 7.4

Mass-and-pulley system

Two unequal masses are connected by a massless cord passing over a frictionless pulley as shown in Figure 7.27. Considering the two masses as a system, which of the following statements is true about the gravitational potential energy U_{grav} and kinetic energy K after the masses are released from rest?

A. U_{grav} increases and K increases.
B. U_{grav} decreases and K increases.
C. Both U_{grav} and K remain constant.



▲ FIGURE 7.27

14) A factory worker moves a 31.5 kg crate a distance of 4.5 m along a level floor at constant velocity by pushing horizontally on it. The coefficient of kinetic friction between the crate and the floor is 0.260. What magnitude of force must the worker apply? How much work is done on the crate by the worker's push, by friction, by the normal force and by gravity? What is the net work done on the crate? (6 pts)

15) A 475 kg roller coaster starts from rest at point A and slides down the frictionless loop-the-loop shown in the accompanying figure. How fast is this roller coaster moving at point B? How hard does it press against the track at point B? Use the diagram. Show the energy at each location. Use energy methods. (15 pts)