

PHYSICS 221

NAME:

Midterm Exam #2 (100 points)

March 8, 2007

This is a closed book, closed notes 50 minute exam. You are allowed one 3 1/2" x 5" card of formulae.

Your Score	Your Grade
	/100

Multiple Choice
/35
Section

Short Answer Section (40 points)

Write the answer **and circle it**. Or circle the letter corresponding to the best answer. It is not necessary to show any work.

1. What is the work done **on you by a spring** with $k=1000 \text{ N/m}$, as you stretch it from $x=0.03 \text{ m}$ to $x=0.05\text{m}$ (x is measured from the spring's rest length).

/5

W =

2. The bobs of two identical pendulums are released from different heights. The left one from lower than the right one. At which point is the **tension** on the string **greatest**? (circle one answer)

/5

- A. B. C. D. A & C are equal

3. Alice throws ball A horizontally at 12.0 m/s, from a 10.0 m roof top. At the same instant Bob **drops** an identical ball (ball B) from the same roof. When the balls hit the ground, how do their kinetic energies compare?

/5

- a. $K_{fA} > K_{fB}$
b. $K_{fA} < K_{fB}$
c. $K_{fA} = K_{fB}$

4. Two identical crates are stacked in the back of a truck. The truck is accelerating at $a=1.0\text{m/s}^2$, and the stacked crates do not slide. Draw free body diagrams for both crates. DO NOT include any numerical values, but be sure that forces of different magnitudes have arrows of clearly different lengths.

/5

5. A ball of mass 0.30 kg and radius $r=0.1\text{ m}$, experiences aerodynamic drag force (i.e. air resistance) $F_D=0.5D\rho Av^2$, where $D=1.00$ is the drag coefficient, $\rho=1.00\text{ kg/m}^3$ is the density of air and A is the cross sectional area. What is the terminal speed of the ball?

/5

$$v_t =$$

6. A 0.5 kg brick rests on a 20° ramp whose coefficient of static friction is $\mu_k=0.6$. What is the magnitude of the friction force of the ramp on the brick?

/5

$$|\mathbf{f}_{rb}| =$$

7. You push downward at 45° with a force of 4 N on a box. The box slides across the floor at velocity $v(t) = 0.5 \text{ (m/s}^2) t$, in the direction you push it. Find the power you are delivering to the box at the instant $t=3$ sec.

/5

$$P =$$

Open Response Questions (60 points total)

Open Response

/65

Section

Notice: In this part of the exam, it is very important that you show how you obtained your answer. A complete answer will include a diagram, if appropriate. Circle your answer. Use the back if necessary.

1. **(10 pts.)** A block of mass 0.300 kg is placed on top of a light vertical spring of force constant 2 000 N/m and pushed downward, so that the spring is compressed by 0.050 m. After the block is released from rest it travels upward and then leaves the spring. To what maximum height **above the point of release** does it rise?

/10

/20

2. **(20 pts)** A 5.00-kg object placed on a horizontal table, with kinetic friction $\mu_k=0.4$ is connected to a cable that passes over a pulley and then is fastened to a hanging 7.00-kg object, as in the figure.
- Draw free-body diagrams of both objects.
 - Find the acceleration of the two objects
 - Find the tension in the string.

/15

3. (15 pts.) A 500 g bob is hung at the end of a very light 1.5m string whose other end is fixed. The bob is struck, giving it an initial speed of 10 m/sec at the bottom. It makes a complete vertical circle.
- What is the speed of the bob when it passes the top?
 - What is the tension on the string when the bob passes the top?

6. (20 pts.) A snow boarder starts from rest atop a frictionless slope. From there he descends 3.0 m, crosses a 2.0 m long patch of poor snow ($\mu_k=0.2$) and then launches from the top of a 1.0 m high, 30° ramp, across level ground (see figure).
- Find the speed of the snowboarder at the lip of the ramp.
 - How far does the snowboarder travel across the level ground before landing?

/20