Physics 218
Exam 1
Fall 2003

Fill in the OPSCAN Sheet:

1) Name
2) Student identification number
3) Exam number as 01
4) Sign the OPSCAN sheet

Important: This test consists of 14 multiple-choice problems. Check that you have all of them in your copy. You are taking the red exam. Be sure your answer key is red.

Instructions: For each problem, choose the one answer that is correct or most nearly correct. Make a small mark, for your eyes only, near the letter of your choice. After you finish and check all the multiple-choice problems, transfer your answers to the OPSCAN sheet, with a #2 pencil. Then, until you hand in the OPSCAN sheet, turn the sheet over and leave it face down. You may keep your copy of the exam.

The correct answers will be displayed on the course web page soon after the exam, and you can find your score for this exam on CHIP in one or two days.

This is a closed book exam, but an equation sheet is provided. You may also use a numerical calculator.

Any form of cheating will result in severe penalties, which will include a score of zero for this exam and may result in a grade of F for the course and referral to the Dean of Students.

All wireless devices must be securely put out of sight and may not be touched during the exam.

Equation sheet

Forces

$$\Sigma\vec{\mathbf{F}} = m\vec{\mathbf{a}}$$

$$\Sigma F_x = ma_x$$

$$\Sigma F_y = ma_y$$

$$\vec{\mathbf{F}}_{AB} = \vec{\mathbf{F}}_{BA}$$

$$f_s \le \mu_s N$$

$$f_k = \mu_k N$$

Linear variables

$$\vec{\mathbf{v}} \equiv \frac{\Delta\vec{\mathbf{r}}}{\Delta t}$$

$$\vec{\mathbf{a}} \equiv \frac{\Delta\vec{\mathbf{v}}}{\Delta t}$$

$$x = x_0 + v_0 t + \frac{1}{2}at^2$$

$$v = v_0 + at$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

$$\vec{\mathbf{v}}_{AB} + \vec{\mathbf{v}}_{BC} = \vec{\mathbf{v}}_{AC}$$

$$a = \sqrt{a_t^2 + a_c^2}$$

Circular variables

$$\omega_{av} \equiv \frac{\Delta\theta}{\Delta t}$$

$$\alpha_{av} \equiv \frac{\Delta\omega}{\Delta t}$$

$$\omega^2 = \omega_0^2 + 2\alpha(\theta + \theta_0)$$

$$\omega = \omega_0 + \alpha t$$

$$\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$$

$$v = r\omega$$

$$a_t = r\alpha$$

$$a_c = \frac{v^2}{r} = \omega^2 r$$

Work and energy

$$W = F\Delta r\cos\theta$$

$$W = \Delta K$$

$$K = \frac{1}{2}mv^2$$

$$U = -\frac{Gm_1m_2}{r}$$

$$E = K + U$$

$$E_i = E_f$$

$$\Delta E = \Delta K + \Delta U = 0$$

Constants

g = 9.8 m/s^2

1) The turntable of a record player reaches its rated frequency of rotation, 33.3 revolutions per minute, in 3.07 s, starting from rest. Assuming the angular acceleration is constant, what is its magnitude?

A. 1.54 rad/s^2
B. 1.14 rad/s^2
C. 0.582 rad/s^2
D. 0.826 rad/s^2
E. 2.036 rad/s^2

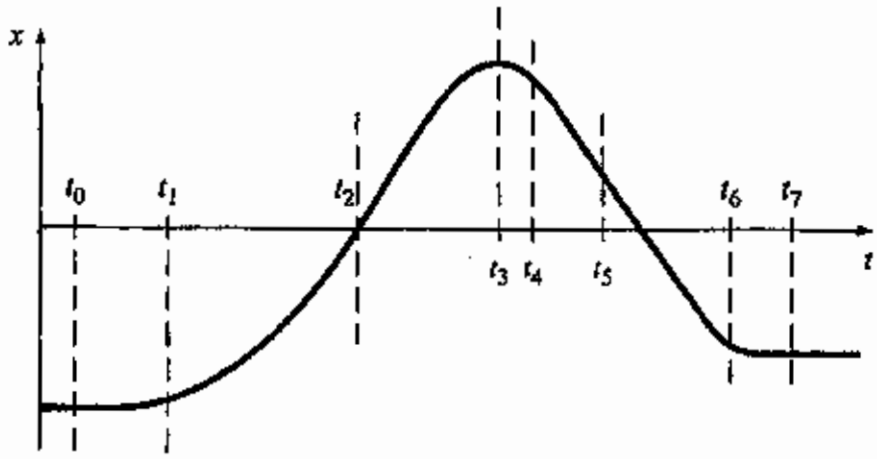
2) You are pushing a wooden crate across the floor at constant speed. You decide to turn the crate on end, reducing by half the surface area in contact with the floor. In the new orientation, to push the same crate across the same floor with the same speed, the force that you apply must be about

A. Twice as great
B. Equally great
C. Half as great

as the force required before you changed the crate's orientation.

3) The graph in the figure below shows the position x of a switch engine in a rail yard as a function of time t. At which of the labeled times t_0 to t_7 is $a_x > 0$?

A. t3, t4, and t5
B. t1, t6
C. t0, t1, t6, and t7
D. only t3
E. only t1



4) A ball is thrown up into the air at an angle and follows a parabolic trajectory. At the highest point in the trajectory.

A. Neither the acceleration nor the velocity is zero.
B. Both the velocity and the acceleration are zero.
C. The velocity is zero, but the acceleration is not zero.
D. The acceleration is zero, but the velocity is not zero

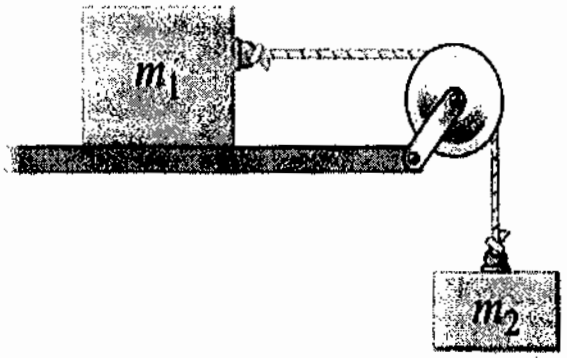
5) A 1.36 kg block sits at rest on an inclined plane that has an angle with the horizontal of 12.3 degrees. What is the force of static friction?

A. 0.532 N
B. 3.67 N
C. 2.25 N
D. 2.84 N
E. 1.67 N

6) A crate of oranges weighing 182 N rests on a flatbed truck 2.83 m from the back of the truck. The coefficients of friction between the crate and the bed are $\mu_S = 0.306$ and $\mu_K = 0.283$. The truck drives on a straight level highway at a constant 8.72 m/s. What is the maximum acceleration the truck can have without the crate starting to slide?

A. 5.16 m/s^2
B. 4.62 m/s^2
C. 7.25 m/s^2
D. 9.64 m/s^2
E. 3.00 m/s^2

7) Two blocks are connected by a light string passing over a pulley (as shown in the figure). The block with mass m_1 slides on a frictionless horizontal surface, while the block with mass m_2 hangs vertically ($m_1 > m_2$). The tension in the string is:



A. Equal to m_2g
B. Greater than m_2g but less than m_1g
C. Less than m_2g
D. Equal to m_1g
E. Greater than m_1g

8) A trolley car in New Orleans starts from rest at the St. Charles Street stop and accelerates uniformly at 1.22 m/s^2 for 12.7 s. How far has the train traveled at the end of the 12.7 s?

A. 106 m
B. 72.3 m
C. 91.5 m
D. 98.4 m
E. 126 m

9) A spider sits on a turntable that is rotating at a constant 33.3 rpm. The acceleration a of the spider is

A. Greater the closer the spider is to the central axis.
B. Greater the farther the spider is from the central axis.
C. Nonzero and independent of the location of the spider on the turntable.
D. Zero.

10) Consider a car at rest. We can conclude that the downward gravitational pull of Earth on the car and the upward contact force of Earth on it are equal and opposite because:

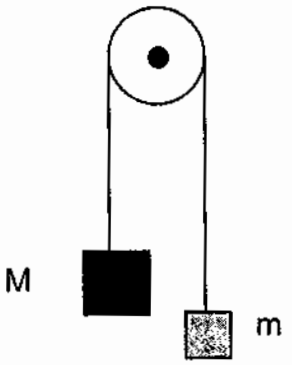
A. The two forces form an interaction (3^{rd} law) pair.
B. The net force on the car is zero (2^{nd} law).
C. Neither of the above

11) Which of the following situations are possible according to Newton's laws?

A. A body accelerates without exerting forces on any other bodies.
B. A school bus drives along a straight road at constant speed under the action of a non-zero net force.
C. In a collision between a large truck and a small car, the force of the truck on the car is larger than the force of the car on the truck.
D. When a car turns to the left, a centrifugal force in the inertial frame is what pushes you to the right in your seat.
E. None of the above are possible.

12) Two masses M and m are connected to a light string that passes over a pulley as shown. The masses are M=0.563 kg and m=0.532 kg. What is the magnitude of the acceleration of the masses?

A. 0.277 m/s^2
B. 1.35 m/s^2
C. 0.136 m/s^2
D. 1.05 m/s^2
E. 0.926 m/s^2



13) A ball is thrown from a point 1.35 m above the ground. The initial velocity is 19.6 m/s at an angle of 32.5° above the horizontal. Find the maximum height of the ball above the ground.

A. 5.16 m
B. 2.35 m
C. 7.01 m
D. 8.42 m
E. 9.52 m

14) A roller coaster car travels at 23.1 m/s along a straight horizontal track. What would be its speed after climbing a 15.8 m-high hill if friction is ignored?

A. 9.62 m/s
B. 15.0 m/s
C. 11.5 m/s
D. 13.2 m/s
E. 14.5 m/s