

Physics 218  
Exam 2  
SPRING 2004

**Fill in the OPSCAN Sheet:**

- 1) Name
- 2) Student identification number
- 3) Exam number as 02
- 4) Sign the OPSCAN sheet

**Important:** This test consists of 10 multiple-choice problems. Check that you have all of them in your copy. You are taking the green exam. Be sure your answer key is green.

**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 the day 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 single handwritten sheet of notes and 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.

## Translation

$$m$$

$$x$$

$$v_{av} = \frac{\Delta x}{\Delta t}$$

$$a_{av} = \frac{\Delta v}{\Delta t}$$

$$v = v_0 + at$$

$$x - x_0 = \frac{1}{2}(v + v_0)t$$

$$x - x_0 = v_0t + \frac{1}{2}at^2$$

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

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

$$\vec{p} = m\vec{v}$$

$$\Sigma \vec{F}_{av} = \frac{\Delta \vec{p}}{\Delta t}$$

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

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

$$U = mgy + \frac{1}{2}kx^2$$

$$P = Fv \cos \theta$$

$$f = \mu N$$

$$F = kx$$

## Translation ↔ Rotation Conversion

$$v = r\omega \quad a_r = \frac{v^2}{r} = \omega^2 r$$

$$a_t = r\alpha \quad \tau = r_{\perp} F = rF_{\perp} = rF \sin \theta$$

## Rotation

$$I = \Sigma m_i r_i^2$$

$$\theta$$

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

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

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

$$\theta - \theta_0 = \frac{1}{2}(\omega + \omega_0)t$$

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

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

$$\Sigma \tau = I\alpha$$

$$L = I\omega$$

$$\Sigma \tau_{av} = \frac{\Delta L}{\Delta t}$$

$$W = \tau\theta$$

$$K = \frac{1}{2}I\omega^2$$

$$P = \tau\omega$$

$$I_{\parallel} = I_{cm} + Mh^2$$

## Gravitational Force

$$F = \frac{Gm_1 m_2}{r^2}$$

## Constants

$$g = 9.8 \text{ m/s}^2$$

$$G = 6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2 / \text{kg}^2$$

$$M_E = 5.98 \times 10^{24} \text{ kg}$$

$$R_E = 6.37 \times 10^6 \text{ m}$$

$$\rho_{\text{water}} = 1000 \text{ kg/m}^3$$

1) In any collision,

a) Total momentum is not conserved.

b) Total kinetic energy is conserved.

c) Total momentum is conserved.

d) Total momentum is not conserved but total kinetic energy is conserved.

e) Total momentum and total kinetic energy are conserved and the masses are equal.

2) A 200 N box is pushed, at constant speed, up an incline. It moves a total distance of 5.0 m along the incline so that its final height is 1.0 m above its initial height. If the incline is frictionless, then the work done by the pushing force is,

a) 336 J

b) 305 J

c) 275 J

d) 200 J

e) 157 J

3) A 2.0 kg pendulum bob on a string 1.5 m long is released from rest when the support string makes an angle of 30 degrees with the vertical. What is the velocity of the bob at the bottom of the swing?

- a) 3.05 m/s
- b) 2.66 m/s
- c) 2.37 m/s
- d) 1.99 m/s
- e) 1.68 m/s

4) A spring-powered dart gun is un-stretched and has a spring constant 12.0 N/m. The spring is compressed by 8.0 cm and a 5.0 gram projectile is placed in the gun. The velocity of the projectile when it is shot from the gun is,

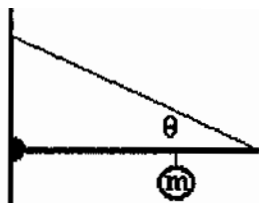
- a) 1.52 m/s
- b) 2.54 m/s
- c) 3.92 m/s
- d) 4.24 m/s
- e) 5.02 m/s

5) A 100 kg mass, initially at rest, is blown apart into a 90 kg piece and a 10 kg piece. The velocity of the 10 kg mass after the explosion is 90 m/s. The total kinetic energy of the two masses after the explosion is,

- a) 63,200 J
- b) 45,000 J
- c) 30,400 J
- d) 23,400 J
- e) 14,500 J

6) A grinding wheel has a mass of 250 kg and moment of inertia of  $500 \text{ kg m}^2$ . A torque of 100 Nm is applied to the grinding wheel. If the wheel starts from rest, what is the angular momentum of the wheel after 5.0 seconds?

- a)  $650 \text{ kg m}^2/\text{s}$
- b)  $500 \text{ kg m}^2/\text{s}$
- c)  $450 \text{ kg m}^2/\text{s}$
- d)  $300 \text{ kg m}^2/\text{s}$
- e)  $250 \text{ kg m}^2/\text{s}$

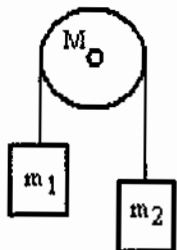


7) A 2.0 m long horizontal uniform beam of mass 20 kg is supported by a wire as shown in the figure. The wire makes an angle of 20 degrees with the beam. Attached to the beam 1.4 m from the wall is a ball with a mass of 40 kg. What is the tension in the string?

- a) 1,000 N
- b) 1,090 N
- c) 2,100 N
- d) 2,250 N
- e) 2,680 N

8) Jim and Mary are carrying Bob on a horizontal stretcher. The uniform stretcher is 2.0 m long and weighs 80 N. Bob weighs 600 N. Bob's center of gravity is 80 cm from Mary. Jim and Mary are at the ends of the stretcher. The force that Jim is exerting to support the stretcher with Bob on it, is

- a) 280 N
- b) 320 N
- c) 380 N
- d) 400 N
- e) 520 N



9) A mass  $m_1$  is connected by a light string that passes over a pulley of mass  $M$  to a mass  $m_2$  as shown in the figure. Both masses move vertically and there is no slippage between the string and the pulley. The pulley has a radius of 20 cm and a rotational inertia ( $I$ ) of  $\frac{1}{2} MR^2$ . If  $m_1$  is 3.0 kg,  $m_2$  is 6.0 kg and  $M$  is 4.0 kg, then what is the acceleration of the masses?

- a)  $5.05 \text{ m/s}^2$
- b)  $4.75 \text{ m/s}^2$
- c)  $4.05 \text{ m/s}^2$
- d)  $3.44 \text{ m/s}^2$
- e)  $2.67 \text{ m/s}^2$

10) A 1200 kg car travels at 25 m/s and collides in a perfectly inelastic collision with a stationary 2400 kg truck. The kinetic energy lost in the collision is,

- a) 330,000 J
- b) 250,000 J
- c) 125,000 J
- d) 95,000 J
- e) 75,000 J

## EXAM 2

### RED KEY

1.c

2.d

3.d

4.b

5.c

6.b

7.e

8.a

9.b

10.b

### GREEN KEY

1.c

2.d

3.d

4.c

5.b

6.b

7.b

8.a

9.e

10.b