

This exam is based on Ch 3-8 of Giambattista et al.

Fall 2006 – Final Exam

1. Jim and Mary are carrying Bob on a horizontal stretcher. The uniform stretcher is 2.00 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 Mary is exerting to support the stretcher with Bob on it is:

- A. 300 N.
- B. 550 N.
- C. 280 N.
- D. 200 N.
- E. 400 N.

2. An airplane has a mass of 8,000 kg and is flying at 150 m/s in level flight. The airplane drops 1,000 kg of water on a fire below. The velocity of the airplane after dropping the water is:

- A. 75 m/s.
- B. 50 m/s.
- C. 100 m/s.
- D. 60 m/s.
- E. 150 m/s.

3. A merry-go-round (radius $R=2\text{m}$, Rotation inertia $I_0=200\text{ kg}\cdot\text{m}^2$) spins with negligible friction. Its initial angular velocity is 2 rad/s. A child of mass $m=25\text{ Kg}$ on the merry-go-round moves from the center out to the rim. Calculate the angular velocity after the child moves out to the rim.

- A. 1.3 rad/s
- B. 2.3 rad/s
- C. 1.0 rad/s
- D. 0.5 rad/s
- E. 2.0 rad/s

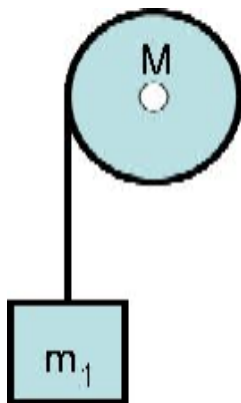
4. A stone thrown horizontally from a cliff with an initial speed of 10 m/s hits the bottom of the cliff in 4.3 s. What is the height of the cliff?

- A. 43 m
- B. 69 m
- C. 91 m
- D. 9.8 m
- E. 22 m

5. A 4.00 kg object is moving at 5.00 m/s NORTH. It strikes a 6.00 kg object that is moving EAST at 2.00 m/s. The objects have a completely inelastic (stick together) collision. The velocity of the combined system after the collision is:

- A. 2.00 m/s at an angle of 59.0 degrees NORTH of EAST.
- B. 2.00 m/s at an angle of 45.0 degrees NORTH of EAST.
- C. 2.33 m/s at an angle of 45.0 degrees NORTH of EAST.
- D. 2.33 m/s at an angle of 35.0 degrees NORTH of EAST.
- E. 2.33 m/s at an angle of 59.0 degrees NORTH of EAST.

6. A mass m_1 of 3.00 kg is connected by a light string which is wrapped around a pulley of mass (M) as shown in the figure. The pulley has a radius of 20.0 cm, a mass M of 4.00 kg, and a moment of inertia of $\frac{1}{2} MR^2$. Initially the mass m_1 is kept at rest by a breaking system. What is the acceleration of the mass m_1 once the break is removed and the string unwinds? Assume that the mass m_1 moves vertically and there is no slippage between the string and the pulley.



- A. 5.9 m/s²
- B. 48 m/s²
- C. 9.8 m/s²
- D. 2.0 m/s²
- E. 3.9 m/s²

7. A 30.00 kg mass falls from a height of 4.000 m. The momentum of the mass just before it hits the ground is:

- A. 265.6 kg•m/s.
- B. 144.2 kg•m/s.
- C. 442.4 kg•m/s.
- D. 502.1 kg•m/s.
- E. 320.0 kg•m/s.

8. A 3.00 kg mass is located at $x = 2.0$ cm and $y = -4.0$ cm. A 3.00 kg mass is located at $x = -5.0$ cm and $y = 2.0$ cm. A 4.00 kg mass is located at $x = -3.0$ cm and $y = -3.0$ cm. Where is the location of the center of mass (x, y)?

- A. (-2.1 cm, -1.8 cm)
- B. (+ 2.1 cm, -1.8 cm)
- C. (-2.1 cm, + 1.8 cm)
- D. (+ 1.1 cm, -2.0 cm)
- E. (-0.10 cm, -0.50 cm)

9. A 120 N horizontal force is applied to a 4.00 kg box. The box moves a horizontal distance of 8.00 meters. The change in the kinetic energy of the box is:

- A. 480 J.
- B. 765 J.
- C. 875 J.
- D. 633 J.
- E. 960 J.

10. An astronaut in a space suit is motionless in outer space. The propulsion unit strapped to her back ejects some gas with a velocity of 50 m/s. The astronaut recoils with a velocity of 1.0 m/s. If the mass of the astronaut and space suit after the gas is ejected is 120 kg, the mass of the gas ejected is:

- A. 1.9 kg.
- B. 3.6 kg.
- C. 1.0 kg.
- D. 3.00 kg.
- E. 2.4 kg.

11. A car starting from rest travels a distance of 20.0 m with a constant acceleration of 2.0 m/s^2 . What is the velocity of the car?

- A. 10 m/s
- B. 20 m/s
- C. 8.94 m/s
- D. 4.47 m/s
- E. 40 /s

12. A 100 kg mass is blown apart into a 50.0 kg piece and a 50.0 kg piece. After the blast, the two masses are moving apart with a relative velocity of 100 m/s. The total kinetic energy after the explosion is:

- A. $8.42 \times 10^4 \text{ J}$.
- B. $3.62 \times 10^5 \text{ J}$.
- C. $1.24 \times 10^6 \text{ J}$.
- D. $6.50 \times 10^5 \text{ J}$.
- E. $1.25 \times 10^5 \text{ J}$.

13. A $M=2.00 \text{ kg}$ hollow sphere ($I=2MR^2/3$) of radius $R=6.00 \text{ cm}$ starts from rest and rolls without slipping down a 10.0 degree incline. If the length of the incline is 50.0 cm , then the velocity of the center of mass of the hollow sphere at the bottom of the incline is:

- A. 1.22 m/s.
- B. 1.95 m/s.
- C. 1.47 m/s.
- D. 1.51 m/s.
- E. 1.01 m/s.

14. A 35.0 kg child swings on a rope with a length of 6.50 m that is hanging from a tree. At the bottom of the swing the child is moving at a speed of 4.20 m/s. What is the tension in the rope?

- A. 343 N
- B. 227.5 N
- C. 438 N
- D. 147 N
- E. 346 N

15. A 200 N box is pushed up an incline that is 5.00 m long and rises 1.00 m. If the incline is frictionless, then the work done by the pushing force is:

- A. 336 J.
- B. 200 J.
- C. 305 J.
- D. 275 J.
- E. 157 J.

16. An 8.0 kg object has a moment of inertia of $1.00 \text{ kg}\cdot\text{m}^2$. What torque is needed to give the object an angular acceleration of 1.5 rad/s^2 ?

- A. $1.0 \text{ N}\cdot\text{m}$
- B. $2.0 \text{ N}\cdot\text{m}$
- C. $2.5 \text{ N}\cdot\text{m}$
- D. $3.0 \text{ N}\cdot\text{m}$
- E. $1.5 \text{ N}\cdot\text{m}$

Final 149 Blue Key

1 E

2 E

3 A

4 C

5 E

6 A

7 A

8 A

9 E

10 E

11 C

12 E

13 E

14 C

15 B

16 E