

Practice Exam III

1. A fan is turned off, and its angular speed decreases from 10.0 rad/s to 6.3 rad/s in 5.0 s. What is the magnitude of the angular acceleration of the fan?

- A) 0.86 rad/s²
- B) 0.74 rad/s²
- C) 0.37 rad/s²
- D) 11.6 rad/s²
- E) 1.16 rad/s²

2. A disk ($I_{\text{disk}} = \frac{1}{2}MR^2$) and a hoop ($I_{\text{hoop}} = MR^2$) of the same mass and radius are released at the same time at the top of an inclined plane. Which object reaches the bottom of the incline first?

- A) The hoop
- B) The disk
- C) Both reach the bottom at the same time.
- D) It depends on the angle of inclination.
- E) It depends on the length of the inclined surface.

3. A child is riding a merry-go-round which completes one revolution every 8.36 s. The child is standing 4.65 m from the center of the merry-go-round. What is the tangential speed of the child?

- A) 5.64 m/s
- B) 3.49 m/s
- C) 0.556 m/s
- D) 1.75 m/s
- E) 1.80 m/s

4. An object is made up of three masses connected by massless rods of fixed length. Mass A is located at (30.0 cm, 0 cm) and has a mass of 250 grams, mass B is located at (0 cm, 30.0 cm) and has a mass of 350 grams, mass C is located at (-30.0 cm, 0 cm) and has a mass of 450 grams. What is the moment of inertia of this object about an axis perpendicular to the x - y plane and passing through the origin?

- A) 0.0945 kg m²
- B) 0.315 kg m²
- C) 0.185 kg m²
- D) 0.0135 kg m²
- E) 0.0450 kg m²

5. A 3.00-m-long ladder, weighing 200 N, rests against a smooth vertical wall with its base on a horizontal rough floor, a distance of 1.00 m away from the wall. If the center of mass of the ladder is 1.20 m from its base, what frictional force must the floor exert on the base of the ladder in order for the ladder to be in static equilibrium?

- A) 93.3 N
- B) 130 N
- C) 28.3 N
- D) 102 N
- E) 150 N

6. An apparatus for measuring the mechanical equivalent of heat uses a crank to turn a small aluminum cylinder, which is being retarded by a belt. Friction with the belt heats up the cylinder, and the work done is then set equal to the heat gained by the cylinder. In one such experiment, the radius of the cylinder is 3.00 cm, the tension on one side of the belt is 50.0 N and on the other it is zero N. How much work is done turning the crank 212 times?

- A) 2000 J
- B) 4000 J
- C) 19600 J
- D) 637 J
- E) 9800 J

7. What is the period of a satellite circling Mars 100 km above the planet's surface? The mass of Mars is 6.42×10^{23} kg, its radius is 3.40×10^6 m, and $G = 6.67 \times 10^{-11}$ N·m²/kg²

- A) 1.75 hours
- B) 1.25 hours
- C) 1.15 hours
- D) 1.00 hours
- E) 1.45 hours

8. Neptune has a radius of 2.48×10^7 m and an escape velocity of 23,300 m/s. What is the mass of Neptune? $G = 6.67 \times 10^{-11}$ N·m²/kg².

- A) 1.01×10^{26} kg
- B) 2.02×10^{26} kg
- C) 3.03×10^{26} kg
- D) 4.04×10^{26} kg
- E) 5.05×10^{26} kg

9. At their closest approach, Venus and Earth are 4.20×10^{10} m apart. The mass of Venus is 4.87×10^{24} kg, the mass of Earth is 5.97×10^{24} kg, and $G = 6.67 \times 10^{-11}$ N·m²/kg². What is the force exerted by Venus on Earth at that point?

- A) 1.10×10^{18} N
- B) 4.62×10^{28} N
- C) 5.43×10^{26} N
- D) 6.30×10^{20} N
- E) 1.72×10^{19} N

10. If the frequency of the motion of a simple harmonic oscillator is doubled, by what factor does the maximum acceleration of the oscillator change?

- A) 2
- B) 4
- C) 1
- D) 1/2
- E) 1/4

11. On a planet A, the acceleration of gravity is $g/6$. If a pendulum has a period T on Earth, what will its period be on that planet?

- A) $T\sqrt{6}$
- B) $T/\sqrt{6}$
- C) $T/6$
- D) $6T$
- E) $T/3$

12. A mass is oscillating on a spring with a period of 4.60 s. At $t = 0$ s the mass has zero speed and is at $x = 8.30$ cm. What is its acceleration at $t = 2.50$ s?

- A) 1.33 cm/s^2
- B) 0.784 cm/s^2
- C) 11.5 cm/s^2
- D) 14.9 cm/s^2
- E) 0 cm/s^2

13. A mass of 0.150 kg is attached to a spring with a force constant of 3.58 N/m and undergoes simple harmonic oscillations with an amplitude of 7.50 cm. What is the total mechanical energy of the system?

- A) 0.0201 J
- B) 0.0101 J
- C) 0.269 J
- D) 0.134 J
- E) 0 J

Solutions: 1.B; 2.B; 3.B; 4.A; 5.C; 6.A; 7.A; 8.A; 9.A; 10.B; 11.A;12.D; 13.B;