

Physics 1 - Final Exam Questions

- Which of the following has the unit $\text{kg}\cdot\text{m}^2/\text{s}$?
 - Power
 - Rotational kinetic energy
 - Moment of inertia
 - Angular momentum
 - Torque
- As shown below, different wrench lengths are applied to a bolt. Which combination of wrench length and force produces the greatest torque?
- A physical pendulum with a mass of $m = 3 \text{ kg}$ oscillates with small amplitude around an axis $h = 0.4 \text{ m}$ from the center of mass. What is the period of oscillation?
 - $\sqrt{2} \text{ s}$
 - $\sqrt{3} \text{ s}$
 - 0.4 s
 - $\sqrt{2}/2 \text{ s}$
 - 0.2 s
- If the angular amplitude of the simple pendulum is 0.2 rad , what is its maximum angular acceleration?
 - 1
 - $1/10$
 - 10
 - 100
 - $1/100$
- What is the angular acceleration of the pendulum as it passes through its equilibrium position?
 - $10\sqrt{2}$
 - $20/\sqrt{3}$
 - 0 (At equilibrium, velocity is maximum, and force and acceleration are zero.)
 - 10
 - 200
- For a mass-spring system oscillating frictionlessly, the position-time graph is shown below. Which of the following represents the position $x(t)$ as a function of time t ?
 - $x(t) = 3 \cos(\pi/4 t + \pi/2)$
 - $x(t) = 3 \cos(\pi/4 t - \pi/2)$
 - $x(t) = 3 \cos(\pi/8 t - \pi/2)$
 - $x(t) = 3 \cos(\pi/8 t + \pi/2)$
 - $x(t) = 3 \cos(\pi/8 t + \pi/4)$
- What is the velocity of the mass at $t = 2 \text{ s}$?
 - 0
 - $3\pi\sqrt{2}/8$
 - $3\pi\sqrt{2}/16$
 - $3\pi\sqrt{2}/2$
 - $3\pi\sqrt{2}/4$

8. What is the maximum acceleration of the mass?

- A) $3\pi^2/64$
- B) $3\pi^2/16$
- C) $-3\pi^2/64$
- D) $-3\pi^2/16$
- E) $-3\pi^2/8$

9. A particle of mass $m = 2 \text{ kg}$ is launched with an initial velocity $v = 10 \text{ m/s}$ at an angle $\theta = 45^\circ$ to the

- A) -20 kJ
- B) 20 kJ
- C) 0
- D) -40 kJ
- E) 40 kJ

10. At the highest point of the particle's trajectory, what is the angular momentum vector relative to point

- A) 50 kJ
- B) $25/2 \text{ kJ}$
- C) 0
- D) -50 kJ
- E) $-25\sqrt{2} \text{ kJ}$

11. Just before the particle hits the ground, what is the angular momentum vector relative to point O, in

- A) $-80\sqrt{2} \text{ kJ}$
- B) 80 kJ
- C) $-100\sqrt{2} \text{ kJ}$
- D) 100 kJ
- E) -25 kJ

12. A bullet of mass 20 g and velocity 300 m/s passes through a stationary solid disk of mass 2 kg and

- A) 2.5
- B) 2
- C) 25
- D) 5
- E) 20

13. What is the angular momentum of the disk in SI units?

14. What is the kinetic energy of the disk in SI units?

- A) 0.15
- B) 0.45
- C) 1.5
- D) 4.5
- E) 0.5

15. A pulley of mass m and radius r is wrapped with a weightless string and hangs as shown. The pulley

- A) $mg/(\sin\beta + 1)$
- B) $mg/(\sin\beta - 1)$
- C) $mg/(\cos\beta + 1)$
- D) $(mg \cdot \sin\beta)/(\cos\beta + 1)$
- E) $(mg + 1)/(\tan\beta)$

16. What is the reaction force exerted by the wall?

- A) $mg \cdot \tan\beta$
- B) $(mg \cdot \cos\beta)/(\sin\beta + 1)$
- C) $mg/\cos\beta$
- D) $(mg \cdot \sin\beta)/(\cos\beta + 1)$
- E) $mg/(\tan\beta + 1)$

17. What is the coefficient of static friction μ required for equilibrium?

- A) $\mu \leq 1/\sin\beta$
- B) $\mu \leq \tan\beta$
- C) $\mu \geq 1/\sin\beta$
- D) $\mu \geq \tan\beta$
- E) $\mu \leq \cos\beta$

18. In a spring pendulum experiment, the graph $T^2 = f(m)$ is obtained by studying the dependence of the

- A) 120
- B) 90
- C) 87
- D) 56
- E) 48

19. A pulley with a mass of 800 g and radius 40 cm is wrapped with a string of length 240 cm. If the pulley is released from rest, the angular speed of the pulley is

- A) 8
- B) 2.4
- C) 3.6
- D) 3.2
- E) 2

20. How long does it take for the pulley to reach an angular speed of 10 rad/s?

- A) 3.2 s
- B) 5 s
- C) 4 s
- D) 2.5 s
- E) 2 s