Exam 3--Fall 08--PHYS 101

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. An object at rest begins to rotate with a constant angular acceleration. If this object rotates through an angle \( \theta \) in the time \( t \), through what angle did it rotate in the time \( 3t \)?
   a. \( \theta/3 \)  
   b. \( 9\theta \)  
   c. \( \theta/9 \)  
   d. \( 3\theta \)

2. A tire placed on a balancing machine in a service station starts from rest and turns through 1.59 revolutions in 1.00 s before reaching its final angular speed. Calculate its angular acceleration.
   a. 1.59 rad/s\(^2\)  
   b. 10.0 rad/s\(^2\)  
   c. 3.18 rad/s\(^2\)  
   d. 20.0 rad/s\(^2\)

3. A tire 0.50 m in diameter is placed on a balancing machine, where it is spun so that its tread is moving at a constant speed of 30.0 m/s for 10.0 seconds. A small stone is stuck in the tread of the tire. What is the acceleration of the stone as the tire is being balanced?
   a. 150 m/s\(^2\)  
   b. 60 m/s\(^2\)  
   c. 0.3 m/s\(^2\)  
   d. 1800 m/s\(^2\)
4. A certain light truck can go around a flat curve having a radius of 100.0 m. On a rainy day, the coefficient of static friction is 0.20. What is the maximum speed the truck can drive on the curve without sliding off the road?

a. 200 m/s  
   b. 4.5 m/s  
   c. 20 m/s  
   d. 14 m/s

5. If a net torque is applied to an object, that object will experience:

a. a constant moment of inertia.  
   b. an angular acceleration.  
   c. a constant angular speed.  
   d. an increasing moment of inertia.

6. This bar is rotating about the point C. What is the net torque?

a. 35 N m CCW  
   b. 70 N m CW  
   c. 42 N m CCW  
   d. 60 N m CCW  
   e. None of these
7. A solid sphere has a mass of 200 kg and a radius of 2 m. It accelerates up to an angular velocity of 1.0 revolutions/second, with an acceleration of 0.02 rev/s². What work is required to bring the work up to this speed?

a. 6300 J  
   c. 160 J  
   b. 7900 J  
   d. 0.064 J

8. This figure shows the human arm. The forearm rotates about the elbow (point O), and the biceps exerts a force on the ulna at 0.03 m from the elbow. The total length of the forearm and hand is 0.35 m. What force must the biceps exert in order for this arm to hold the bowling ball (whose weight is 30 N) steady (i.e. in equilibrium)? (Assume the bicep exerts a force that is perpendicular to the forearm.)

a. 350 N  
   c. 2.6 N  
   b. 30 N  
   d. 580 N
9. What are the units for moment of inertia?

   a. kg m²  
   b. kg m  
   c. N·m  
   d. kg m/s

10. What is the moment of inertia for this arrangement of particles?

   a. 60 kg m²  
   b. 13 kg m²  
   c. 16 kg m²  
   d. 33 kg m²  
   e. 19 kg m²

11. In a mercury barometer at atmospheric pressure, the height of the column of mercury in a glass tube is 760 mm. If another mercury barometer is used that has a tube of larger diameter, how high will the column of mercury be in this case?

   a. the same height  
   b. higher than 760 mm  
   c. lower than 760 mm  
   d. not enough information

12. In a swimming pool, assuming the density of water to be 1000 kg/m³, what happens to the buoyant force acting on your body as you descend to deeper depths?

   a. it stays the same  
   b. it depends on the volume of your body  
   c. it increases  
   d. it decreases
13. A boat is carrying a large wooden block, which has a density less than that of water. What happens to the level of the water in the lake (with respect to the shore) when the block is thrown overboard and floats outside of the boat?

- a. the level of the water rises
- b. the level of the water drops
- c. the level of the water remains the same
- d. it depends on the volume of the block

14. Air is trapped above liquid water in a rigid container, as shown in this figure. If the air pressure above the liquid is 1.0 atm, determine the pressure inside a bubble 9.0 m below-the surface of the liquid.

- a. 1.9 atmospheres
- b. 0.9 atmospheres
- c. 3.4 atmospheres
- d. 1.4 atmospheres
15. A boat has a volume of 3.2 m$^3$. If the boat has a mass of 500 kg, what is the total mass of cargo that the boat can carry without sinking?

a. 29,400 kg  
   b. 3200 kg  
   c. 2700 kg  
   d. 600 kg

16. You squeeze the end of a garden hose to make the cross-sectional area smaller. According to Bernoulli’s principle, what happens to the pressure of the water passing through this smaller area?

a. the pressure increases  
   b. the pressure stays the same  
   c. the pressure decreases  
   d. it depends on the density of the water

17. This figure shows a hydraulic lift. The force $F_1$ has a magnitude of 100 N, and the area $A_1$ is 0.01 m$^2$. If the area $A_2$ is 1.0 m$^2$, what is the weight of the truck?

a. 1000 N  
   b. 10,000 N  
   c. 100,000 N  
   d. 1,000,000 N
18. This figure shows a barometer. If the barometer is filled with water, what is the height when the pressure $P_0=0.2$ atmosphere?

![Barometer Diagram]

a. 10 m  

b. 17 m  

c. 2.0 m  

d. 760 mm

19. A glass cylinder is stuck inside a hole in an aluminum block. Which is the best way to get the glass cylinder unstuck? (The coefficient of linear expansion for glass is $9 \times 10^{-6}$ °C$^{-1}$; the coefficient of linear expansion for aluminum is $24 \times 10^{-6}$ °C$^{-1}$.)

a. heat the glass and aluminum pieces  

b. cool the glass and aluminum  

c. unable to remove it  

d. not enough information

20. Two identical cylinders at the same pressure contain the same gas. If A contains three times as much gas as B, which cylinder has the higher temperature?

a. Container A  

b. Container B  

c. both have the same temperature

21. Which of these is the equivalent of room temperature, which is 20°C, in kelvins?

a. -273 K  

b. 70 K  

c. 273 K  

d. 293 K  

e. 0 K
22. A cylindrical brass sleeve is to be shrink-fitted over a tooth whose average diameter is 1.500 cm at 30°C. The diameter of the sleeve is 1.498 cm at 30°C. To what temperature must the sleeve be heated before it will slip over the tooth? (The coefficient of linear expansion for brass is $19 \times 10^{-6}$ °C$^{-1}$.)

(a) 293°C  
(b) 45°C  
(c) 70°C  
(d) 100°C

23. A rigid container has a volume of 0.1 m$^3$ and holds 10 moles of gas. If the gas is at a pressure of 1.5 atmospheres, what is the temperature of the gas in °C? (The ideal gas constant is 8.314 J/(mol K).)

(a) 180 °C  
(b) −93°C  
(c) −113 °C  
(d) 0.0018 °C

24. A steel tape measure is marked such that it gives accurate measurements at room temperature. If the tape measure is used at very low temperatures, how will its length measurements be affected?

(a) measured lengths will be too small  
(b) measured lengths will be too large  
(c) measured lengths will be accurate  
(d) not enough information

25. The correct answer for this question is “A”

(a) A  
(b) B  
(c) C  
(d) D
MULTIPLE CHOICE

1. ANS: B  PTS: 1
2. ANS: D  PTS: 1
3. ANS: D  PTS: 1
4. ANS: D  PTS: 1
5. ANS: B  PTS: 1  DIF: 1  TOP: 8.5 Relationship Between Torque and Angular Acceleration
6. ANS: C  PTS: 1
7. ANS: A  PTS: 1
8. ANS: A  PTS: 1
9. ANS: A  PTS: 1
10. ANS: D  PTS: 1
11. ANS: A  PTS: 1
12. ANS: A  PTS: 1
13. ANS: C  PTS: 1
14. ANS: A  PTS: 1
15. ANS: C  PTS: 1
16. ANS: C  PTS: 1
17. ANS: B  PTS: 1
18. ANS: C  PTS: 1
19. ANS: A  PTS: 1
20. ANS: B  PTS: 1
21. ANS: D  PTS: 1
22. ANS: D  PTS: 1
23. ANS: B  PTS: 1
24. ANS: B  PTS: 1
25. ANS: A  PTS: 1