Exam 3--Fall 2009--PHYS 101

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

_____  1. A 100 kg merry-go-round of radius 1.00 m is started from rest by a constant horizontal force of 50.0 N applied tangentially to the merry-go-round. Find the angular speed of the merry-go-round after 3.00 s.

   a. 3 rad/s      c. 1.5 rad/s
   b. 1 rad/s      d. 10 rad/s

_____  2. What happens when a spinning figure ice skater moves her arms out away from her body?

   a. her moment of inertia increases      c. her moment of inertia decreases
   b. her angular velocity increases      d. her angular position remains the same

_____  3. A thin hoop, with a mass of 0.50 kg and radius 1.0 m, is spinning at a rate of 10.0 rad/s. What is the energy of the hoop?

   a. 13 J      c. 5.0 J
   b. 10 J      d. 25 J
4. These 1-kg masses are connected by light, inflexible rods. They are rotating about the axis as shown. What is the moment of inertia for this system?

   a. 1.0 kg m²  
   b. 2.4 kg m²  
   c. 0.75 kg m²  
   d. 3.0 kg m²

5. Buckets are spinning horizontally on frictionless bearings. Suddenly, it starts raining. Which of these statements is true:

   a. the buckets’ angular speed will decrease because their moment of inertia is increasing  
   b. the buckets will spin at the same angular speed because there is no torque acting on this  
   c. the buckets’ moment of inertia will increase, causing the buckets angular momentum to increase  
   d. None of these are true
6. This figure shows the essential parts of a hydraulic brake system. The area of the piston in the master cylinder is 2.1 cm$^2$, and that of the piston in the brake cylinder is 6.3 cm$^2$. If the driver applies a force to the master cylinder, via his brake pedal, of 12 N. How much force is applied to the brake shoe?

![Hydraulic Brake System Diagram]

- a. 36 N
- b. 0.25 N
- c. 160 N
- d. 4 N

7. When an artery becomes clogged, which of these statements describes the flow of blood through the clogged artery?

- a. the velocity decreases, the pressure decreases
- b. the velocity decreases, the pressure increases
- c. the velocity increases, the pressure decreases
- d. the velocity increases, the pressure increases

8. This figure shows a barometer in which the pressure at the top of the tube is zero; the barometer is filled with water. If the pressure acting on the outside of the fluid is 2.0 atmospheres, what is the height of the column of water?

![Barometer Diagram]

- a. 0.1 m
- b. 20 m
- c. 2 m
- d. 10 m
9. Two beakers are filled to the brim with water. A steel block is placed in the second beaker so it sinks to the bottom. (Some of the water will overflow the beaker.) Both beakers are then weighed. Which scale reads a larger weight?

- a. beaker 1
- b. beaker 2
- c. both the same

10. A boat has a volume of 1.0 m$^3$. If the boat has a mass of 500 kg, what fraction of the boat is submerged in the water?

- a. the boat is halfway submerged
- b. the boat is three-quarter submerged
- c. the boat is one-quarter submerged
- d. the boat is fully submerged

11. A metal has a density of 1200 kg/m$^3$. What is the mass of a block that has a volume of 4 m$^3$?

- a. 4800 kg
- b. 0.003 kg
- c. 1200 kg
- d. 300 kg

12. 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
13. An ideal fluid flows through this pipe, which narrows in the middle. Because of the conservation of matter, $v_2$ is larger than $v_1$. Two standpipes extend from the top of the pipe, as shown in the figure. The fluid rises to a certain height in the standpipes. In which standpipe is the level of the fluid the highest?

![Diagram of pipe and standpipes]

a. A  
   b. B  
   c. both the same

14. A cylindrical brass sleeve is to be shrink-fitted over a brass shaft whose diameter is 2.172 cm at 0°C. The diameter of the sleeve is 2.154 cm at 0°C. To what temperature must the sleeve be heated before it will slip over the shaft? (The coefficient for linear expansion for brass is $19 \times 10^{-6} \text{°C}^{-1}$.)

a. 320°C  
   b. 100°C  
   c. 273°C  
   d. 440°C

15. An ideal gas occupies a volume of 1.0 m$^3$ at 10°C and atmospheric pressure. Determine the number of molecules of gas in the container.

a. 43 molecules  
   b. $2.6 \times 10^{25}$ molecules  
   c. $7.2 \times 10^{21}$ molecules  
   d. $7.2 \times 10^{26}$ molecules
16. The SI unit for temperature, the kelvin, is based, in part, on which of these physical quantities?
   a. the freezing point of water  
   b. the temperature of the triple point of water  
   c. the pressure of water at which sublimation occurs  
   d. the temperature of water at which osmoticism occurs

17. Which of these best approximates the temperature of the air in this room?
   a. 70°C  
   b. 0°C  
   c. 293°C  
   d. 20°C

18. You want to take apart a couple of copper parts held together by brass screws, but the screws are stuck. What should you do?(The coefficient for linear expansion for copper is $17 \times 10^{-6} \, ^\circ C^{-1}$. For brass it is $19 \times 10^{-6} \, ^\circ C^{-1}$.)
   a. heat them both  
   b. cool them both  
   c. heat the screw  
   d. none of these

19. Which is the smallest unit of temperature: one degree Kelvin, Celsius, or Fahrenheit?
   a. Fahrenheit  
   b. Celsius  
   c. Kelvin & Celsius  
   d. Kelvin

20. You heat a bimetallic strip that is made of brass on one side and steel on the other side. As you heat it, the strip will bend towards which side? (The coefficient of linear expansion for steel is $11 \times 10^{-6} \, ^\circ C^{-1}$. The coefficient for brass is $19 \times 10^{-6} \, ^\circ C^{-1}$.)
   a. the steel side  
   b. the strip will not bend  
   c. the brass side  
   d. don’t know

21. Heat flow occurs between two bodies in thermal contact when they differ in what property?
   a. specific heat  
   b. density  
   c. temperature  
   d. mass

22. A waterfall is 145 m high. What is the increase in water temperature at the bottom of the falls if all the initial potential energy goes into heating the water? (The specific heat of water is 4186 J/(kg °C).)
   a. 0.34°C  
   b. 0.69°C  
   c. 0.16°C  
   d. 1.04°C
23. A 120-g block of copper is taken from a kiln and quickly placed into a beaker of negligible heat capacity containing 300 g of water. The water temperature rises from 15°C to 35°C. Given \( c_{Cu} = 0.10 \text{ cal/g} \cdot ^\circ \text{C} \), and \( c_{\text{water}} = 1.00 \text{ cal/g} \cdot ^\circ \text{C} \), what was the initial temperature of the copper, when it was in the kiln?

a. 535°C  

b. 500°C  

c. 360°C  

d. 720°C

24. Water has a higher specific heat than sand. Therefore, on the beach during midday, the breezes blow

a. from beach to ocean  

b. either way, depends only on the weather  

c. from ocean to beach  

d. none of these

25. How much energy is required to change a 0.1 kg block of ice into water at 50°C?(The specific heat of water is 4186 J/(kg \cdot ^\circ \text{C}). The latent heat of fusion for water is \(3.33 \times 10^5 \text{ J/kg} \). The latent heat of vaporization for water is \(2.26 \times 10^6 \text{ J/kg} \).)

a. 54,000 J  

b. 280,000 J  

c. 33,000 J  

d. 250,000 J  

e. 21,000 J

26. The correct answer for this question is “B.”

a. A  

b. B  

c. C  

d. D
MULTIPLE CHOICE

1. ANS: A  PTS:  1
2. ANS: A  PTS:  1
3. ANS: D  PTS:  1
4. ANS: C  PTS:  1
5. ANS: A  PTS:  1
6. ANS: A  PTS:  1
7. ANS: C  PTS:  1
8. ANS: B  PTS:  1
9. ANS: B  PTS:  1
10. ANS: A  PTS:  1
11. ANS: A  PTS:  1
12. ANS: A  PTS:  1
13. ANS: A  PTS:  1
14. ANS: D  PTS:  1
15. ANS: B  PTS:  1
16. ANS: B  PTS:  1
17. ANS: D  PTS:  1
18. ANS: B  PTS:  1
19. ANS: A  PTS:  1
20. ANS: A  PTS:  1
21. ANS: C  PTS:  1
22. ANS: A  PTS:  1
23. ANS: A  PTS:  1  DIF:  2  TOP:  11.3 Calorimetry
24. ANS: C  PTS:  1
25. ANS: A  PTS:  1
26. ANS: B  PTS:  1