Exam 4

Multiple Choice

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

1. 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. 10,000 N  
   b. 100,000 N  
   c. 1000 N  
   d. 1,000,000 N

2. This figure shows a pipe with water flowing through it. The height at point 1 is $y_1$=1 m, and the height at point 2 is $y_2$=2 m. The pressure at point 1 is $P_1$=1,000 Pa, and the pressure at point 2 is 750 Pa. The area at point 1 is $A_1$=0.1 m$^2$, and the area at point 2 is $A_2$=0.5 m$^2$. If the velocity at point 1 is $v_1$=1 m/s, what is the velocity at point 2 ($v_2$)? (The density of water is 1000 kg/m$^3$)

   a. 3 m/s  
   b. 0.2 m/s  
   c. 0.05 m/s  
   d. 1 m/s
3. A tendon in your arm, without any pressure on it, has a length of 0.10 m. The cross sectional area is 0.75 cm² (=7.5×10⁻⁵ m²) By how much does it stretch (in cm) when a force of 100 N is applied to it? (The Young’s modulus for a tendon is 2×10⁷ Pa)

a. 0.4 cm  
b. 0.7 cm  
c. 7.5 cm  
d. 1.3 cm

4. While swimming near the bottom of a pool, you let out a small bubble of air. What happens to the diameter of the bubble as it rises?

a. not enough information  
b. it decreases  
c. it increases  
d. it stays the same

5. These three containers are filled to different heights of water, as shown by the lines; however, each container has the same volume of water. Container A has the base with the largest area, B has the next largest, and C has the smallest base. Which container exerts the largest pressure on the table?

a. A  
b. B  
c. C  
d. not enough information

6. Thermometers often use mercury or alcohol in a thin glass tube. Barometers never use alcohol. Why?

a. alcohol is more toxic than mercury  
b. alcohol is more flammable than mercury  
c. alcohol is less dense than mercury  
d. alcohol is more difficult to see than mercury
7. A 10 kg mass of wood floats fully submerged in a tank of water. What is the volume of the wooden block? (The density of water is 1000 kg/m\(^3\). The density of this wood is 900 kg/m\(^3\).)

- a. 0.1 m\(^3\)
- b. 10 m\(^3\)
- c. 0.01 m\(^3\)
- d. 0.001 m\(^3\)
- e. 1 m\(^3\)

8. This figure shows a barometer. If the barometer is filled with water (\(\rho=1000\) kg/m\(^3\)), what is the height when the pressure \(P_0=0.2\) atmosphere? (1 atm=1\(\times\)10\(^5\) N/m\(^2\))

- a. 17 m
- b. 10 m
- c. 760 mm
- d. 2.0 m

9. Two drinking glasses are stuck one inside the other. How could you get them unstuck?
- a. Put cold water in the inner glass
- b. Run cold water over both glasses
- c. Put hot water in the inner glass
- d. Run hot water over both glasses

10. A steel tape measure is marked such that it gives accurate measurements at very hot temperatures, so that it can be used in extreme laboratory environments. If the tape measure is used at room temperature, how will its length measurements be affected?

- a. measured lengths will be too large
- b. measured lengths will be accurate
- c. measured lengths will be too small
- d. not enough information
11. Invar is an iron-nickel alloy that has a very low coefficient of thermal expansion. As such, it is often used in precision measurement devices. One such device is the Shortt master clock, which uses a pendulum to keep time. If the period of the pendulum is 1 s at room temperature (20.00°C), the length of the rod is 0.2500 m; the period of a pendulum is \( T = 2\pi \sqrt{\frac{L}{g}} \). What is the period of this invar pendulum when it is at 320.0°C? (The coefficient of linear expansion for invar is \( 0.9 \times 10^{-6} \, ^{\circ}\text{C}^{-1} \).)

a. 0.996 s  

b. 0.01 s  

c. 1.01 s  

d. 1.004 s

12. You want to take apart a couple of steel parts held together by bronze screws, but have become stuck. What should you do? (The coefficient of linear expansion for steel is \( 11 \times 10^{-6} \, ^{\circ}\text{C}^{-1} \). The coefficient of linear expansion for brass is \( 19 \times 10^{-6} \, ^{\circ}\text{C}^{-1} \).)

a. cool it down  

b. heat it up  

c. none of these will work  

d. heat only the screws

13. The temperature of absolute zero has what value on the Celsius scale?

a. -512°C  

b. -3243°C  

c. 0°C  

d. -273°C

14. Two identical cylinders at the same pressure contain the same type of gas. If container A has 4 times the amount of gas as container B, which has the higher temperature?

a. A  

b. B  

c. both the same  

d. not enough information

15. A balloon rises high into the atmosphere, where the atmospheric pressure decreases with altitude. Assume the temperature of the balloon remains constant. What happens to the volume of the balloon?

a. increases  

b. decreases  

c. stays the same  

d. not enough information
16. A rigid container has a volume of 0.5 m$^3$ and holds 30 moles of gas. If the gas is at room temperature (20ºC), what is the pressure of the gas? (The ideal gas constant is 8.314 J/(mol K).)

a. 30 Pa  
   b. 1000 Pa  
   c. 1.5 atm  
   d. 0.01 atm

17. Which has a greater number of atoms, a mole of nitrogen gas or a mole of oxygen gas? (the molar mass of nitrogen is 14.007; the molar mass of oxygen is 15.999)

a. nitrogen  
   b. oxygen  
   c. both the same  
   d. not enough information

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

a. from ocean to beach  
   b. either way, depends only on the weather  
   c. from beach to ocean  
   d. none of these

19. A 1 kg block of beryllium at 100ºC is placed in 1 kg of mercury at 0ºC. What is the resultant equilibrium temperature? (The specific heat of beryllium is 1820 J/(kg ºC). The specific heat of mercury is 138 J/(kg ºC)).

a. 50ºC  
   b. 100ºC  
   c. between 50ºC and 100ºC  
   d. between 0ºC and 50 ºC

20. You put 500 g of copper at 0ºC in 1000 g of water at 100 ºC. What is the final equilibrium temperature? (The specific heat of water is 4186 cal/(g ºC). The specific heat of copper is 0.0924 cal/(g ºC). The latent heat of vaporization for water is 540 cal/g.)

a. 96 ºC  
   b. 84 ºC  
   c. 43 ºC  
   d. 25 ºC
21. At some point our Sun will become a red giant and increase in size. If its radius increases by a factor of 2, by what amount will the power it emits change? Assume the temperature remains the same.

a. increase by a factor of 2  
b. increase by a factor of 4  
c. decrease by a factor of 4  
d. increase by a factor of 16

22. You drop a 1 kg silicon ball, at a temperature of 10°C, from a height of 100 m. By what temperature does it increase if all of the potential energy (PE=mgh) is converted to heat in the ball? (The specific heat of silicon is 703 J/(kg ºC).)

a. 12°C  
b. 0.1°C  
c. 1.4°C  
d. 3°C

23. Which of these is not a mode of energy transfer?

a. radiation  
b. convection  
c. conduction  
d. convection

24. What trait of water causes us to feel cooler in Phoenix (where the air is dry) than in Houma (where the air is humid)?

a. a high latent heat of fusion  
b. a high density  
c. a high latent heat of vaporization  
d. a high specific heat

25. Which mode of energy transfer is most commonly used in heating or cooling our homes?

a. convection  
b. conduction  
c. radiation

26. The correct answer to this question is A. Bubble A.

a. A  
b. B  
c. C  
d. D
Exam 4
Answer Section

MULTIPLE CHOICE

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