

Name \_\_\_\_\_ ID # \_\_\_\_\_

Section # \_\_\_\_\_ TA Name \_\_\_\_\_

Fill in your name, student ID # (not your social security #), and section # (under ABC of special codes) on the Scantron sheet. Fill in the letters given for the first 5 questions on the Scantron sheet. These letters determine which version of the test you took, and it is very important to get this right. Make sure your exam has questions 6–25.

1. A
2. C
3. B
4. E
5. D
6. An object **A** has a Young's modulus that is greater than that of object **B**. This indicates object **A**:
  - a. is made of different material from object **B**.
  - b. is longer than object **B**.
  - c. has a greater cross-sectional area than object **B**.
  - d. has a smaller cross-sectional area than object **B**.
  - e. has a greater elastic limit than object **B**.
7. A solid rock, suspended in air by a spring scale, has a measured mass of 9.00 kg. When the rock is submerged in water, the scale reads 3.30 kg. What is the density of the rock?
  - a.  $3500 \text{ kg/m}^3$
  - b.  $4550 \text{ kg/m}^3$
  - c.  $1200 \text{ kg/m}^3$
  - d.  $5700 \text{ kg/m}^3$
  - e.  $1580 \text{ kg/m}^3$

8. As ice floats in water, about 10% of the ice floats above the surface of the water. If we float some ice in a glass of water, what will happen to the water level as the ice melts (ignore evaporation of the water)?
- The water level will rise less than 10% of the volume of ice that melts.
  - The water level will rise 10% of the volume of ice that melts.
  - The water level will remain unchanged.
  - The water level will rise more than 10% of the volume of ice that melts.
  - The water level will become lower.
9. Water flows at 15 m/s through a pipe with radius 0.040 m. The pipe goes up to the second floor of the building, 3.0 m higher, and the pressure remains unchanged. What is the speed of the water flow in the pipe on the second floor?
- 12 m/s
  - 13 m/s
  - 14 m/s
  - 15 m/s
  - 16 m/s
10. Which one of the following is true for an ideal liquid flowing through a horizontal pipe whose diameter decreases along the direction of the flow?
- The liquid flows at the same speed as the pipe narrows.
  - The pressure increases when the pipe narrows.
  - The liquid flows faster when the pipe narrows.
  - The pressure remains the same when the pipe narrows.
  - Less liquid exits the narrow end than enters the wide end per unit time.
11. An ideal gas at 1.00 atm and 25.0°C is compressed to one tenth of its original volume, reaching a pressure of 40.0 atm. What is its final temperature?
- 919 K
  - 1500 K
  - 919°C
  - 1500°C
  - 1192°C

12. Evaporation cools the liquid that is left behind because the molecules that leave the liquid during evaporation:
- have kinetic energy.
  - have broken the bonds that held them in the liquid.
  - create vapor pressure.
  - occupy a greater volume.
  - have greater than average speed.
13. A rectangular steel plate with dimensions of  $30\text{ cm} \times 25\text{ cm}$  is heated from  $20^\circ\text{C}$  to  $220^\circ\text{C}$ . What is its change in area? (The coefficient of linear expansion for steel is  $11 \times 10^{-6}/^\circ\text{C}$ .)
- $3.3\text{ cm}^2$
  - $0.82\text{ cm}^2$
  - $1.65\text{ cm}^2$
  - $6.6\text{ cm}^2$
  - $2.72\text{ cm}^2$
14. An interval of one Celsius degree is equivalent to an interval of
- one Fahrenheit degree.
  - one Kelvin.
  - $5/9$  Fahrenheit degree.
  - $5/9$  Kelvin.
  - 273 Kelvin
15. The sulfur hexafluoride molecule consists of one sulfur atom and six fluorine atoms. The atomic masses of sulfur and fluorine are 32.0 u and 19.0 u respectively. One mole of this very heavy gas has what mass?
- 32 g
  - 51 g
  - 608 g
  - 146 g
  - 211 g

16. In a greenhouse, electromagnetic energy in the form of visible light enters through the glass panes and is absorbed and then reradiated. What happens to this reradiated electromagnetic radiation from within the greenhouse?

- a. 100% returns to the atmosphere.
- b. It mostly radiates into outer space.
- c. It is transformed into ultraviolet upon striking the glass.
- d. It is reflected as visible light upon striking the glass.
- e. It is blocked by the glass.

17. A swimming pool heater has to be able to raise the temperature of the 40 000 gallons of water in the pool by  $10.0\text{ }^{\circ}\text{C}$ . How many kilowatt-hours of energy are required? (One gallon of water has a mass of approximately 3.8 kg.)

- a. 1770 kWh
- b. 1960 kWh
- c. 330 kWh
- d. 216 kWh
- e. 177 kWh

18. Heat flow occurs between two bodies in thermal contact when they differ in what property?

- a. mass
- b. specific heat
- c. density
- d. temperature
- e. heat capacity

19. Iced tea is made by adding ice to 1.8 kg of hot tea, initially at  $80^{\circ}\text{C}$ . How many kg of ice, initially at  $0^{\circ}\text{C}$ , are required to bring the mixture to  $10^{\circ}\text{C}$ ? ( $L_f = 80\text{ cal/g}$ )

- a. 1.8 kg
- b. 1.4 kg
- c. 1.6 kg
- d. 1.2 kg
- e. 1.0 kg

20. If you are cooking using an aluminum pan over an electric burner, which one of the following will make the food cook more slowly?
- a. increase the pan bottom thickness
  - b. increase the pan bottom area
  - c. increase the burner temperature
  - d. decrease the height of the sides of the pan
  - e. put a lid on the pan
21. When gasoline is burned, it gives off 46 kJ/g of heat energy. If an automobile uses 13.0 kg of gasoline per hour with an efficiency of 21%, what is the average horsepower output of the engine? (1 hp = 746 W)
- a. 110 hp
  - b. 47 hp
  - c. 67 hp
  - d. 34 hp
  - e. 168 hp
22. If an ideal gas does positive work on its surroundings, which one of the following must occur:
- a. the temperature increases
  - b. the pressure increases
  - c. the internal energy decreases
  - d. the volume increases
  - e. the internal energy increases
23. What is the maximum efficiency of a gasoline engine whose fuel burns at a temperature of 180°C if the outside temperature is 25°C?
- a. 66%
  - b. 14%
  - c. 34%
  - d. 86%
  - e. 31%

24. A thermodynamic process that happens very quickly tends to be

- a. adiabatic.
- b. isobaric.
- c. isothermal.
- d. isovolumetric.
- e. isometric.

25. What is the change in entropy when 500 g of ice at  $0^{\circ}\text{C}$  melts? (The heat of fusion of water is 80 cal/g.)

- a. 147 J/K
- b. 35 J/K
- c. 613 J/K
- d. 26 J/K
- e. 40 J/K