Name: _____ Date: _____

1. Constant-volume gas thermometers using different gases all indicate nearly the same temperature when in contact with the same object if:

   A) the volumes are all extremely large
   B) the volumes are all the same
   C) the pressures are all extremely large
   D) the pressures are the same
   E) the particle concentrations are all extremely small

2. Suppose object C is in thermal equilibrium with object A and with object B. The zeroth law of thermodynamics states:

   A) that C will always be in thermal equilibrium with both A and B
   B) that C must transfer energy to both A and B
   C) that A is in thermal equilibrium with B
   D) that A cannot be in thermal equilibrium with B
   E) nothing about the relationship between A and B

3. To help keep buildings cool in the summer, dark colored window shades have been replaced by light colored shades. This is because light colored shades:

   A) are more pleasing to the eye
   B) absorb more sunlight
   C) reflect more sunlight
   D) transmit more sunlight
   E) have a lower thermal conductivity

4. Inside a room at a uniform comfortable temperature, metallic objects generally feel cooler to the touch than wooden objects do. This is because:

   A) a given mass of wood contains more thermal energy than the same mass of metal
   B) metal conducts energy better than wood
   C) energy tends to flow from metal to wood
   D) the equilibrium temperature of metal in the room is lower than that of wood
   E) the human body, being organic, resembles wood more closely than it resembles metal

Write the letter for the correct answer on the answer sheet. Write clearly.

5. Possible units for the coefficient of volume expansion are:

A) mm/C°
B) mm³/C°
C) (C°)³
D) 1/(C°)³
E) 1/C°

6. Room temperature is about 20 degrees on the:

A) Kelvin scale
B) Celsius scale
C) Fahrenheit scale
D) absolute scale
E) C major scale

7. When two gases separated by a thermally conducting wall are in thermal equilibrium with each other:

A) only their pressures must be the same
B) only their volumes must be the same
C) they must have the same number of particles
D) they must have the same pressure and the same volume
E) only their temperatures must be the same

8. In an adiabatic process:

A) the thermal energy absorbed equals the work done by the system on its environment
B) the thermal energy equals the work done by the environment on the system
C) the thermal energy absorbed equals the change in internal energy
D) the work done by the environment on the system equals the change in internal energy
E) the work done by the system on its environment equals to the change in internal energy

Write the letter for the correct answer on the answer sheet. Write clearly.

9. A Kelvin thermometer and a Fahrenheit thermometer both give the same reading for a certain sample. The corresponding Celsius temperature is:

A) 574° C
B) 232° C
C) 301° C
D) 614° C
E) 276° C

10. Which of the following statements pertaining to a vacuum flask (Thermos) is NOT correct?

A) Silvering reduces radiation loss
B) Vacuum reduces conduction loss
C) Vacuum reduces convection loss
D) Vacuum reduces radiation loss
E) Glass walls reduce conduction loss

11. For constant-volume processes the heat capacity of gas A is greater than the heat capacity of gas B. We conclude that when they both absorb the same thermal energy at constant volume:

A) the temperature of A increases more than the temperature of B
B) the temperature of B increases more than the temperature of A
C) the internal energy of A increases more than the internal energy of B
D) the internal energy of B increases more than the internal energy of A
E) A does more positive work than B

12. The heat capacity of an object is:

A) the amount of thermal energy that raises its temperature by 1° C
B) the amount of thermal energy that changes its state without changing its temperature
C) the amount of thermal energy per kilogram that raises its temperature by 1° C
D) the ratio of its specific heat to that of water
E) the change in its temperature caused by adding 1 J of thermal energy

13. The coefficient of linear expansion of iron is 1.0×10^{-5} per $C°$. The surface area of an iron cube, with an edge length of 5.0 cm, will increase by what amount if it is heated from $10°$ C to $60°$ C?

   A) 0.0125 cm²
   B) 0.025 cm²
   C) 0.075 cm²
   D) 0.15 cm²
   E) 0.30 cm²

14. The figure shows a rectangular brass plate at $0°$ C in which there is cut a rectangular hole of dimensions indicated. If the temperature of the plate is raised to $150°$ C:
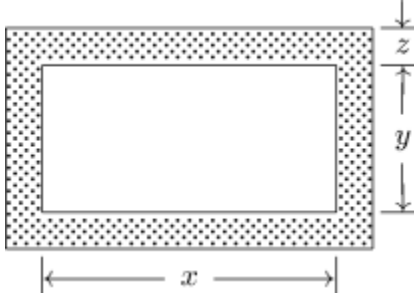
   A) x will increase and y will decrease
   B) both x and y will decrease
   C) x will decrease and y will increase
   D) both x and y will increase
   E) the changes in x and y depend on the dimension z

15. The specific heat of lead is 0.030 cal/g · $C°$. 300 g of lead shot at $100°$ C is mixed with 100 g of water at $70°$ C in an insulated container. The final temperature of the mixture is:

   A) 100° C
   B) 85.5° C
   C) 79.5° C
   D) 74.5° C
   E) 72.5° C

Write the letter for the correct answer on the answer sheet. Write clearly.

16. The mercury column in an ordinary medical thermometer doubles in length when its temperature changes from 95° F to 105° F. Choose the correct statement:

A) the coefficient of volume expansion of mercury is 0.1 per F°
B) the coefficient of volume expansion of mercury is 0.3 per F°
C) the coefficient of volume expansion of mercury is (0.1/3) per F°
D) the vacuum above the column helps to "pull up" the mercury this large amount
E) none of the above is true

17. On a very cold day, a child puts his tongue against a fence post. It is much more likely that his tongue will stick to a steel post than to a wooden post. This is because:

A) steel has a higher specific heat
B) steel is a better radiator of thermal energy
C) steel has a higher specific gravity
D) steel is a better energy conductor
E) steel is a highly magnetic material

18. Of the following which might NOT vanish over one cycle of a cyclic process?

A) the change ΔE^{int} in internal energy
B) the change ΔP in pressure
C) the work W by the substance
D) the change ΔV in the volume of the substance
E) the change ΔT in the temperature of the substance

19. The same thermal energy Q enters five different substances.
Which substance has the greatest specific heat?

A) The temperature of 3 g of substance A increases by 10 K
B) The temperature of 4 g of substance B increases by 4 K
C) The temperature of 6 g of substance C increases by 15 K
D) The temperature of 8 g of substance D increases by 6 K
E) The temperature of 10 g of substance E increases by 10 K

Write the letter for the correct answer on the answer sheet. Write clearly.

20. A constant-volume gas thermometer is used to measure the temperature of an object. When the thermometer is in contact with water at its triple point (273.16 K) the pressure in the thermometer is 8.500×10^4 Pa. When it is in contact with the object the pressure is 9.650×10^4 Pa. The temperature of the object is:

A) 37.0 K
B) 241 K
C) 310 K
D) 314 K
E) 2020 K

21. The coefficient of linear expansion of a certain steel is 0.000012 per C° . The coefficient of volume expansion, in $(C°)^{-1}$, is:

A) $(0.000012)^3$
B) $(4\pi/3)(0.000012)^3$
C) 3×0.000012
D) 0.000012
E) depends on the shape of the volume to which it will be applied

22. Two different samples have the same mass and temperature. Equal quantities of thermal energy are absorbed by each. Their final temperatures may be different because the samples have different:

A) thermal conductivities
B) coefficients of expansion
C) densities
D) volumes
E) heat capacities

23. There is a temperature at which the reading on the Kelvin scale is numerically:

A) equal to that on the Celsius scale
B) lower than that on the Celsius scale
C) equal to that on the Fahrenheit scale
D) less than zero
E) none of the above

Write the letter for the correct answer on the answer sheet. Write clearly.

24. The heat capacity of object B is twice that of object A. Initially A is at 300 K and B is at 450 K. They are placed in thermal contact and the combination is isolated. The final temperature of both objects is:

A) 200 K
B) 300 K
C) 400 K
D) 450 K
E) 600 K

25. The coefficient of linear expansion of steel is 11×10^{-6} per C° . A steel ball has a volume of exactly 100 cm³ at 0° C. When heated to 100° C, its volume becomes:

A) 100.33 cm³
B) 100.0011 cm³
C) 100.0033 cm³
D) 100.000011 cm³
E) none of these

Write the letter for the correct answer on the answer sheet. Write clearly.

Answer Key

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