Name: _____ **Class:** _____ **Date:** _____ **ID: A**

AP B webreview ch 10 Thermal Physics

Multiple Choice

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

____ 1. If it is given that 546 K equals 273°C, then it follows that 400 K equals:
a. 127°C.
b. 150°C.
c. 473°C.
d. 1 200°C.
e. 1 390°C.

____ 2. Which best describes a system made up of ice, water and steam existing together?
a. absolute zero
b. triple point
c. ice point
d. steam point

____ 3. A substance is heated from 15°C to 35°C. What would the same incremental change be when registered in kelvins?
a. 20
b. 40
c. 36
d. 313
e. 421

____ 4. 88°F is how many degrees Celsius?
a. 31
b. 49
c. 56
d. 158
e. 195

____ 5. At what temperature is the same numerical value obtained in Celsius and Fahrenheit?
a. −40°
b. 0°
c. 40°
d. −72°
e. 72°

____ 6. A brass cube, 10 cm on a side, is raised in temperature by 200°C. The coefficient of volume expansion of brass is $57 \times 10^{-6}/C°$. By what percentage is any one of the 10-cm edges increased in length?
a. 4%
b. 2.8%
c. 0.38%
d. 0.29%
e. 0.17%

____ 7. What happens to a volume of water when its temperature is reduced from 8°C to 4°C?
a. density increases
b. density decreases
c. density remains constant
d. vaporizes
e. freezes

____ 8. The thermal expansion of a solid is caused by:
a. the breaking of bonds between atoms.
b. increasing the amplitude of the atoms vibration.
c. increasing the distance between equilibrium positions for the vibrating atoms.
d. all of the above.
e. none of the above

____ 9. A long steel beam has a length of twenty-five meters on a cold day when the temperature is 0°C. What is the length of the beam on a hot day when $T = 40°C$? ($\alpha_{steel} = 1.1 \times 10^{-5}/C°$)
a. 25.000 44 m
b. 25.004 4 m
c. 25.011 m
d. 25.044 m
e. 25.11 m

____ 10. Suppose the ends of a 20-m-long steel beam are rigidly clamped at 0°C to prevent expansion. The rail has a cross-sectional area of 30 cm^2. What force does the beam exert when it is heated to 40°C? ($\alpha_{steel} = 1.1 \times 10^{-5}/C°$, $Y_{steel} = 2.0 \times 10^{11}$ N/m^2).
a. 2.6×10^5 N
b. 5.6×10^4 N
c. 1.3×10^3 N
d. 6.5×10^2 N
e. 2.5×10^2 N

____ 11. At 20°C an aluminum ring has an inner diameter of 5.000 cm, and a brass rod has a diameter of 5.050 cm. Keeping the brass rod at 20°C, which of the following temperatures of the ring will allow the ring to just slip over the brass rod?
($\alpha_{Al} = 2.4 \times 10^{-5}$ /C°, $\alpha_{brass} = 1.9 \times 10^{-5}/C°$)
a. 111°C
b. 236°C
c. 384°C
d. 437°C
e. 525°C

____ 12. As a copper wire is heated, its length increases by 0.100%. What is the change of the temperature of the wire? ($\alpha_{Cu} = 16.6 \times 10^{-6}/C°$)
a. 120.4°C
b. 60.2°C
c. 30.1°C
d. 6.0°C
e. 4.5°C

____ 13. At room temperature, the coefficient of linear expansion for Pyrex glass is ____ that for ordinary glass.
a. the same as
b. more than
c. less than
d. stronger than

____ 14. A pipe of length 10.0 m increases in length by 1.5 cm when its temperature is increased by 90°F. What is its coefficient of linear expansion?
a. 30×10^{-6}/°C
b. 17×10^{-6}/°C
c. 13×10^{-6}/°C
d. 23×10^{-6}/°C
e. 32×10^{-6}/°C

____ 15. What happens to its moment of inertia when a steel disk is heated?
a. It increases.
b. It decreases.
c. It stays the same.
d. It increases for half the temperature increase and then decreases for the rest of the temperature increase.
e. It increases for two thirds the temperature increase and then decreases for the rest of the temperature increase.

____ 16. An ideal gas is confined to a container with adjustable volume. The number of moles and temperature are constant. By what factor will the volume change if pressure triples?
a. 1/9
b. 1/3
c. 3.0
d. 9.0
e. 12

____ 17. A 2.00-L container holds half a mole of an ideal gas at a pressure of 12.5 atm. What is the gas temperature? (R = 0.082 1 L·atm/mol·K)
a. 1 980 K
b. 1 190 K
c. 965 K
d. 609 K
e. 578 K

____ 18. With volume and molar quantity held constant, by what factor does the absolute temperature change for an ideal gas when the pressure is five times bigger?
a. 0.2
b. 1.0
c. 5.0
d. 25.0
e. 34.0

____ 19. Two moles of nitrogen gas are contained in an enclosed cylinder with a movable piston. If the molecular mass of nitrogen is 28, how many grams of nitrogen are present?
a. 0.14
b. 56
c. 42
d. 112
e. 124

____ 20. Two moles of an ideal gas at 3.0 atm and 10°C are heated up to 150°C. If the volume is held constant during this heating, what is the final pressure?
a. 4.5 atm
b. 1.8 atm
c. 0.14 atm
d. 1.0 atm
e. 3.4 atm

____ 21. A helium-filled weather balloon has a 0.90 m radius at liftoff where air pressure is 1.0 atm and the temperature is 298 K. When airborne, the temperature is 210 K, and its radius expands to 3.0 m. What is the pressure at the airborne location?
a. 0.50 atm
b. 0.013 atm
c. 0.019 atm
d. 0.38 atm
e. 0.15 atm

____ 22. One mole of an ideal gas at 1.00 atm and 0.00°C occupies 22.4 L. How many molecules of an ideal gas are in one cm^3 under these conditions?
a. 28.9
b. 22 400
c. 2.69×10^{19}
d. 6.02×10^{23}
e. 5.23×10^{24}

____ 23. How many moles of air must escape from a 10-m × 8.0-m × 5.0-m room when the temperature is raised from 0°C to 20°C? Assume the pressure remains unchanged at one atmosphere while the room is heated.
a. 1.3×10^3 moles
b. 1.2×10^3 moles
c. 7.5×10^2 moles
d. 3.7×10^2 moles
e. 1.4×10^2 moles

____ 24. Estimate the volume of a helium-filled balloon at STP if it is to lift a payload of 500 kg. The density of air is 1.29 kg/m^3 and helium has a density of 0.178 kg/m^3.
a. 4 410 m^3
b. 932 m^3
c. 450 m^3
d. 225 m^3
e. 134 m^3

____ 25. Two ideal gases, X and Y, are thoroughly mixed and at thermal equilibrium in a single container. The molecular mass of X is 9 times that of Y. What is the ratio of root-mean-square velocities of the two gases, $v_{X,\,rms}/v_{Y,\,rms}$?
a. 9/1
b. 3/1
c. 1/3
d. 1/9
e. 1/1

____ 26. The absolute temperature of an ideal gas is directly proportional to which of the following properties, when taken as an average, of the molecules of that gas?
a. speed
b. momentum
c. mass
d. kinetic energy
e. total energy

____ 27. Evaporation cools the liquid that is left behind because the molecules that leave the liquid during evaporation:
a. have kinetic energy.
b. have greater than average speed.
c. have broken the bonds that held them in the liquid.
d. create vapor pressure.
e. both choices B and C are valid.

AP B webreview ch 10 Thermal Physics
Answer Section

MULTIPLE CHOICE

1. ANS: A PTS: 1 DIF: 2
   TOP: 10.1 Temperature and the Zeroth Law of Thermodynamics | 10.2 Thermometers and Temperature Scales
2. ANS: B PTS: 1 DIF: 1
   TOP: 10.1 Temperature and the Zeroth Law of Thermodynamics | 10.2 Thermometers and Temperature Scales
3. ANS: A PTS: 1 DIF: 1
   TOP: 10.1 Temperature and the Zeroth Law of Thermodynamics | 10.2 Thermometers and Temperature Scales
4. ANS: A PTS: 1 DIF: 1
   TOP: 10.1 Temperature and the Zeroth Law of Thermodynamics | 10.2 Thermometers and Temperature Scales
5. ANS: A PTS: 1 DIF: 2
   TOP: 10.1 Temperature and the Zeroth Law of Thermodynamics | 10.2 Thermometers and Temperature Scales
6. ANS: C PTS: 1 DIF: 2
   TOP: 10.3 Thermal Expansion of Solids and Liquids
7. ANS: A PTS: 1 DIF: 1
   TOP: 10.3 Thermal Expansion of Solids and Liquids
8. ANS: C PTS: 1 DIF: 1
   TOP: 10.3 Thermal Expansion of Solids and Liquids
9. ANS: C PTS: 1 DIF: 2
   TOP: 10.3 Thermal Expansion of Solids and Liquids
10. ANS: A PTS: 1 DIF: 3
    TOP: 10.3 Thermal Expansion of Solids and Liquids
11. ANS: D PTS: 1 DIF: 2
    TOP: 10.3 Thermal Expansion of Solids and Liquids
12. ANS: B PTS: 1 DIF: 2
    TOP: 10.3 Thermal Expansion of Solids and Liquids
13. ANS: C PTS: 1 DIF: 1
    TOP: 10.3 Thermal Expansion of Solids and Liquids
14. ANS: A PTS: 1 DIF: 2
    TOP: 10.3 Thermal Expansion of Solids and Liquids
15. ANS: A PTS: 1 DIF: 2
    TOP: 10.3 Thermal Expansion of Solids and Liquids
16. ANS: B PTS: 1 DIF: 1
    TOP: 10.4 Macroscopic Description of an Ideal Gas
17. ANS: D PTS: 1 DIF: 2
    TOP: 10.4 Macroscopic Description of an Ideal Gas
18. ANS: C PTS: 1 DIF: 1
    TOP: 10.4 Macroscopic Description of an Ideal Gas

19. ANS: B PTS: 1 DIF: 1
TOP: 10.4 Macroscopic Description of an Ideal Gas
20. ANS: A PTS: 1 DIF: 2
TOP: 10.4 Macroscopic Description of an Ideal Gas
21. ANS: C PTS: 1 DIF: 2
TOP: 10.4 Macroscopic Description of an Ideal Gas
22. ANS: C PTS: 1 DIF: 2
TOP: 10.4 Macroscopic Description of an Ideal Gas
23. ANS: B PTS: 1 DIF: 3
TOP: 10.4 Macroscopic Description of an Ideal Gas
24. ANS: C PTS: 1 DIF: 3
TOP: 10.4 Macroscopic Description of an Ideal Gas
25. ANS: C PTS: 1 DIF: 2
TOP: 10.5 The Kinetic Theory of Gases
26. ANS: D PTS: 1 DIF: 1
TOP: 10.5 The Kinetic Theory of Gases
27. ANS: B PTS: 1 DIF: 1
TOP: 10.5 The Kinetic Theory of Gases