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

1. A temperature change from 15°C to 35°C corresponds to what incremental change in °F?
   a. 20
   b. 40
   c. 36
   d. 313

2. Normal body temperature for humans is 37°C. What is this temperature in kelvins?
   a. 296
   b. 310
   c. 393
   d. 273

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

4. A rectangular steel plate with dimensions of 30 cm \(\times\) 25 cm is heated from 20°C to 220°C. What is its change in area? (Coefficient of linear expansion for steel is \(11 \times 10^{-6}/\degree \text{C}\).)
   a. 0.82 cm²
   b. 1.65 cm²
   c. 3.3 cm²
   d. 6.6 cm²

5. A steel sphere sits on top of an aluminum ring. The steel sphere (\(\alpha = 1.10 \times 10^{-5}/\degree \text{C}\)) has a diameter of 4.000 cm at 0°C. The aluminum ring (\(\alpha = 2.40 \times 10^{-5}/\degree \text{C}\)) has an inside diameter of 3.994 cm at 0°C. Closest to which temperature given will the sphere just fall through the ring?
   a. 462°C
   b. 208°C
   c. 116°C
   d. 57.7°C
6. The mass of a hot-air balloon and its cargo (not including the air inside) is 200 kg. The air outside is at a temperature of 10°C and a pressure of 1 atm = 10^5 N/m^2. The volume of the balloon is 400 m^3. Which temperature below of the air in the balloon will allow the balloon to just lift off? (Air density at 10°C is 1.25 kg/m^3.)
   a. 37°C
   b. 69°C
   c. 99°C
   d. 200°C

7. A spherical air bubble originating from a scuba diver at a depth of 18.0 m has a diameter of 1.0 cm. What will the bubble's diameter be when it reaches the surface? (Assume constant temperature.)
   a. 0.7 cm
   b. 1.0 cm
   c. 1.4 cm
   d. 1.7 cm

8. A tank with a volume of 0.150 m^3 contains 27.0°C helium gas at a pressure of 100 atm. How many balloons can be blown up if each filled balloon is a sphere 30.0 cm in diameter at 27.0°C and absolute pressure of 1.20 atm? Assume all the helium is transferred to the balloons.
   a. 963 balloons
   b. 884 balloons
   c. 776 balloons
   d. 598 balloons

9. How many atoms are present in a sample of pure iron with a mass of 300 g? (The atomic mass of iron = 56 and \( N_A = 6.02 \times 10^{23} \))
   a. \( 1.8 \times 10^{19} \)
   b. \( 6.7 \times 10^{22} \)
   c. \( 1.6 \times 10^{28} \)
   d. \( 3.2 \times 10^{24} \)

10. One way to heat a gas is to compress it. A gas at 1.00 atm at 25.0°C is compressed to one tenth of its original volume, and it reaches 40.0 atm pressure. What is its new temperature?
   a. 1 500 K
   b. 1 500°C
   c. 1 192°C
   d. 919°C
11. 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, \( v_{X, \text{rms}} / v_{Y, \text{rms}} \)?
   a. \( 9/1 \)
   b. \( 3/1 \)
   c. \( 1/3 \)
   d. \( 1/9 \)

12. 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

13. What is the root-mean-square speed of chlorine gas molecules at a temperature of 320 K? (\( R = 8.31 \text{ J/mol·K} \), \( N_A = 6.02 \times 10^{23} \), and the molecular mass of \( \text{Cl}_2 = 71 \))
   a. \( 1.7 \times 10^2 \text{ m/s} \)
   b. \( 3.4 \times 10^2 \text{ m/s} \)
   c. \( 0.8 \times 10^4 \text{ m/s} \)
   d. \( 1.1 \times 10^5 \text{ m/s} \)

14. For an ideal gas of a given mass, if the pressure remains the same and the volume increases:
   a. the average kinetic energy of the molecules decreases.
   b. the average kinetic energy of the molecules stays the same.
   c. the average kinetic energy of the molecules increases.
   d. Nothing can be determined about the molecular kinetic energy.

15. What is the internal energy of 50 moles of Neon gas (molecular mass = 20 u) at 27°C? (\( R = 8.31 \text{ J/mol·K} \))
   a. \( 1.9 \times 10^5 \text{ J} \)
   b. \( 1.6 \times 10^5 \text{ J} \)
   c. \( 3.8 \times 10^3 \text{ J} \)
   d. It depends on the container size, which is not given.