Key

AP Chem Gas Laws Worksheet No. 1

1. If 1.00 mol of an ideal gas occupies 1.00 m^3 at 1.00 kPa what must be the Kelvin temperature? The ideal gas constant is 8.314 J $mol^{-1}K^{-1}$.
   a) 0.120 K
   b) 120 K
   c) 273 K
   d) 8,314 K
   e) 120,000 K

2. Helium is the second most abundant element in the universe, but it is rare on Earth. This is because
   a) helium is more dense than hydrogen
   b) helium nuclei have fused to form heavier elements on Earth
   c) helium remains trapped underground
   d) radioactive decay occurs slowly on Earth
   e) helium readily escapes Earth's gravitational pull

3. A weather balloon contains 12 L of hydrogen at 740 mm Hg pressure. At what pressure in mm Hg will the volume become 20 L (temperature is constant)?
   a) 370
   b) 444
   c) 760
   d) 1230
   e) 1480

4. A container holds one mole of gaseous argon at a known temperature and pressure. A second, identical container holds gaseous krypton at twice the pressure and three times the absolute temperature. Approximately how many moles of krypton are in the second container?
   a) 0.67 mol
   b) 1.0 mol
   c) 1.5 mol
   d) 2.0 mol
   e) 3.0 mol

5. When a sample of oxygen gas in a closed container of constant volume is heated until its absolute temperature is doubled, which of the following is also doubled?
   a) the density of the gas
   b) the pressure of the gas
   c) the average velocity of the gas molecules
   d) the number of molecules per cm^3
   e) the potential energy of the molecules

6. Two flexible containers for gases are at the same temperature and pressure. One holds 0.50 grams of hydrogen and the other holds 8.0 grams of oxygen. Which one of the following statements regarding these gas samples is **false** ? (The relative atomic mass of oxygen is 16.0 and that of hydrogen is 1.0)

a) the volume of the hydrogen container is the same as the volume of the oxygen container
b) the number of molecules in the hydrogen container is the same as the number of molecules in the oxygen container
c) the density of the hydrogen sample is less than that of the oxygen sample
d) the average kinetic energy of the hydrogen molecules is the same as the average kinetic energy of the oxygen molecules
e) the average speed of the hydrogen molecules is the same as the average speed of the oxygen molecules

7. Oxygen condenses at -183°C and freezes at -223°C. According to the kinetic molecular theory, the kinetic energy of oxygen molecules is zero at

a) -183°C b) -273°C c) -373°C d) -223°C e) 0°C

8. An automobile cylinder has a volume of 450 cc. The engine takes in air at a pressure of 1.00 atm and a temperature of 27°C, and compresses it to a volume of 50.0 cc at 77°C. What is the final pressure of air in the cylinder?

a) 1.17 atm b) 7.7 atm c) 9.0 atm d) 25.7 atm e) 10.5 atm

9. A tire is filled in summer at 27°C until the pressure guage reads ~~22 kPa (29 psi)~~ 200 kPa. In effect the guage shows the excess over atmospheric pressure; in this case the time pressure is 200 kPa over atmospheric pressure which is 100 kPa on that day. The pressure of the same tire is measured in January at -23°C when the atmospheric pressure is again 100kPa. What pressure will the guage show if there are no leaks and the volume is unchanged?

a) 167 kPa b) 170 kPa c) 150 kPa d) 250 kPa e) 240 kPa

10. Helium filled balloons are lighter than air. How many balloons can be inflated to a volume of 6 L by filling them with helium from a cylinder of 20 L at a pressure of 1900 kPa? Suppose that the pressure inside the balloons is 120 kPa. The atmospheric pressure is 101 kPa and the temperature is 28.0°C.

a) 58 b) 15 c) 52 d) 62 e) 4

11. A closed vessel contains 80 g of O_2, 14 g of N_2 and 44 g of CO_2. The total pressure in the vessel is 200 kPa. What is the pertial pressure (in kPa) exerted by the oxygen in the mixture?

a) 79 b) 121 c) 125 d) 150 e) 200

12. A rigid balloon with a volume of 50.0 cm^3 is kept at 18°C and contains air at a pressure of 101.3 kPa initially. If 0.223 g of krypton is now introduced, what will be the pressure of krypton inside the balloon?

a) 128.8 kPa b) 64.4 kPa c) 27.5 kPa d) 230.1 kPa e) 7.97 kPa

13. Air is a mixture whose principal components are N_2 and O_2. According to the kinetic molecular theory of gases, at what temperature is the average speed of N_2 molecules equal to the average speed of O_2 molecules at 0°C?
a) +39°C b) +84°C c) +19°C d) -18°C e) -34°C

14. A plastic bottle contains 0.60 g of nitrogen, N_2. Another bottle of the same size if filled at the same temperature and pressure with an unknown gas. If the mass of the second gas is 1.52 g, this gas can be:
a) air b) Cl_2 c) O_2 d) CH_4 e) CO_2

15. A balloon probe is filled with 150 L of helium at ground level where the atmospheric pressure is 102 kPa and the temperature is 30°C. The balloon bursts at an altitude where the temperature is -5°C and the pressure is 50 kPa. What is the volume of the balloon just before it bursts?
a) 270 L b) 346 L c) 51 L d) 65 L e) 83 L

16. When most coal is mined it is contaminated with sulphur containing compounds; when the coal is burned, the sulphur compounds are converted into sulphur dioxide, SO_2, gas. Coal from one mine is analyzed as containing 2.12 % S, by mass. When 3.5×10^5 kg of this coal is burned, what volume of SO_2 gas, measured at 25°C and 738 mm Hg, would be produced?
a) 58 L
b) 9.7×10^3 L
c) 2.8×10^5 L
d) 5.8×10^6 L
e) 8.9×10^8 L

17. Which one of the following gases will behave the **least** ideally (i.e.: deviate the most from the Ideal Gas Law) at a pressure of 101.3 kPa and a temperature of 298 K?
a) He b) H_2 c) CH_4 d) NH_3 e) N_2

18. In order for a gas filled balloon to rise in air, the density of the gas in the balloon must be less that that of air. To what height would a balloon filled with dinitrogen oxide, N_2O, at 25°C and 101.3 kPa pressure rise in air at 25.o°C? (You may assume that air has a molar mass of 28.96 g mol^{-1})
a) 1.00 m
b) 2.00 m
c) 10.0 m
d) the balloon will not rise in the air.
e) insufficient information is given to determine the height.

19. A mixture of gases is prepared for underwater divers; the gaseous mixture is 79% He and 21% O_2, by volume. What is the density of the mixture at 25°C and 645 mmHg?
a) 3.38×10^{-3} g L^{-1}
b) 2.23×10^{-3} g L^{-1}
c) 0.343 g L^{-1}
d) 1.25 g L^{-1}
e) none of the values in a) to d) is correct

20. A 1.240 g sample of a gaseous hydrocarbon (C_xH_y) burned in air to produce 3.891 g of CO_2 and 1.593 g of H_2O. A sample of this gas was found to effuse from a porous container at a rate of 116 mL in 5.00 minutes. Sulphur dioxide gas was found to effuse from the same container under the same conditions at a rate of 94 mL in 5.00 minutes. Determine the molecular formula of the gaseous hydrocarbon.

C_3H_6