Gas Laws Practice Problems, Numero Dos

1. Perform the following conversions of pressure units:
   1.6×10^5 torr = _____ atm

   [A] 2.1×10^2 [B] 3.2×10^2 [C] 2.1×10^3 [D] 3.2×10^3 [E] 4.6×10^2

2. A gas has a volume of 5.0 L at a certain pressure. How must the pressure be changed to double the volume of the gas at constant temperature?

   [A] There is not enough information to decide.

   [B] The pressure must be quadrupled. [C] The pressure must be doubled.

   [D] The pressure must be halved. [E] none of these

3. A 6.5-L sample of nitrogen at 25°C and 1.5 atm is allowed to expand to 13.0 L. The temperature remains constant. What is the final pressure?

   [A] 3.0 atm [B] 0.063 atm [C] 0.75 atm [D] 0.12 atm [E] 0.38 atm

4. A gas sample is held at constant pressure. The gas occupies 3.62 L of volume when the temperature is 21.6°C. Determine the temperature at which the volume of the gas is 3.45 L.

   [A] 294 K [B] 309 K [C] 20.6 K [D] 326 K [E] 281 K

5. A sample of a gas in a container fitted with a piston has a temperature above 0°C. The Celsius temperature is doubled. What is true about the ratio of final volume to initial volume for the gas?

   [A] It is greater than 2:1. [B] It is 1:1. [C] It is less than 2:1.

   [D] It is 1:2. [E] It is 2:1.

6. If the temperature of an ideal gas is raised from 100°C to 200°C, while the pressure remains constant, the volume

   [A] increases by a factor of 100 [B] remains the same [C] doubles

   [D] goes to 1/2 the original volume [E] none of these

7. A gas originally occupying 10.1 L at 0.925 atm and 25°C is changed to 12.2 L at 625 torr. What is the new temperature?

8. A specified quantity of an unknown gas has the volume of 14.3 mL at 22°C and 659 torr. Calculate the volume at STP.

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9. A gas occupies 15.0 L at STP. What volume will it occupy at 735 torr and 57°C?

   [A] 6.7 L [B] 1.2 L [C] 19 L [D] 4.6 L [E] 9.7 L

10. A 25.0-L sample of gas at STP is heated to 55°C at 605 torr. What is the new volume?

    [A] 56 L [B] 76 L [C] 38 L [D] 17 L [E] 3.5 L

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[1] [A]

[2] [D]

[3] [C]

[4] [E]

[5] [C]

[6] [E]

[7] 47°C

[8] 11.5 mL

[9] [C]

[10] [C]

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(1) 1.65×10^5 torr $\times \frac{1 \text{ atm}}{760 \text{ torr}} = 219 \text{ atm} = 2.1 \times 10^2 \text{ atm}$ (A)

(2) If the V increases by 2, then the P decrease by a factor 2. Pressure is cut in half.

(3) $V_1 = 6.5 L$ $V_2 = 13.0 L$ (C)
$P_1 = 1.5$ atm $P_2 = ?$

$$\frac{P_1 V_1}{V_2} = \frac{P_2 \cancel{V_2}}{\cancel{V_2}} \Rightarrow \frac{P_1 V_1}{V_2} = P_2 = \frac{(1.5 \text{ atm})(6.5 L)}{13.0 L} = 0.75 \text{ atm}$$

(4) $V_1 = 3.62 L$ $V_2 = 3.45 L$
$T_1 = 21.6°C + 273$ $T_2 = ?$
$= 294.6 K$ (E)

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow \frac{3.62 L}{294.6 K} = \frac{3.45 L}{T_2}$$

$$\frac{(T_2)(\cancel{3.62 L})}{\cancel{3.62 L}} = \frac{(294.6 K)(3.45 L)}{3.62 L}$$

$$T_2 = 281 K$$

(5) PICK A NUMBER ABOVE 0 .... How about 20°C?
20°C × 2 = 40°C. Is 40°C twice as hot at 20°C? No!

40°C + 273 = 313K
20°C + 273 = 293K

$\frac{313}{293} = 1.068 \times$ as hot. Thus the effect on Volume would be the same: a 1.068 × increase.

(C)

(6) E same reasoning as #5

(7) $V_1 = 10.1\,L$
$P_1 = 0.925\,atm$
$T_1 = 25°C + 273 = 298\,K$

$V_2 = 12.2\,L$
$P_2 = 625\,torr$
$T_2 = ?$

$$P_2 = 625\,\cancel{torr} \times \frac{1\,atm}{760\,\cancel{torr}} = \underline{0.822\,atm}$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$ cross multiply

$$\frac{T_2 \cancel{P_1 V_1}}{\cancel{P_1 V_1}} = \frac{T_1 P_2 V_2}{P_1 V_1} = \frac{(298\,K)(0.822\,\cancel{atm})(12.2\,\cancel{L})}{(10.1\,\cancel{L})(0.925\,\cancel{atm})}$$

$$= 320.\,K$$

$$= 3.20 \times 10^2\,K$$ (3 sig figs)

(8) $P_1 = 659\,torr$
$V_1 = 14.3\,ml$
$T_1 = 22 + 273 = 295\,K$

P_2 = standard pressure = 760.0 torr
$V_2 = ?$
T_2 = std temp = 273 K

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \xrightarrow{\text{cross multiply}} \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{\cancel{T_1} \cancel{P_2} V_2}{\cancel{T_1} \cancel{P_2}} = \frac{(659\,torr)(14.3\,ml)(273\,K)}{(295\,K)(760\,torr)}$$

$$= 11.5\,ml$$

(9) $P_1 = 760$ torr $\quad P_2 = 735$ torr

$V_1 = 15.0\,L \quad V_2 = ?$

$T_1 = 273K \quad T_2 = 330K$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \Rightarrow \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{\cancel{T_1} \cancel{P_2} V_2}{\cancel{T_1} \cancel{P_2}}$$

$$\frac{(760 \text{ torr})(15.0L)(330K)}{(273K)(735 \text{ torr})} = V_2 = 18.7\,L$$

(10) $P_1 = 760$ torr $\quad P_2 = 605$ torr

$V_1 = 25.0\,L \quad V_2 = ?$

$T_1 = 273K \quad T_2 = 55 + 273 = 328K$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \Rightarrow \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{\cancel{T_1} \cancel{P_2} V_2}{\cancel{T_1} \cancel{P_2}}$$

$$V_2 = \frac{(760 \text{ torr})(25.0L)(328K)}{(273K)(605 \text{ torr})} = 37.7\,L$$