

HOMEWORK!

The Ideal Gas Law

Chemistry: <http://genest.weebly.com>

Stop in for help every day at lunch and Tues, Weds., & Thurs after school!

After-hours question? Email me at home: aggenesi@medison.k12.wi.us

GAS

ANSWERS

1. What pressure is exerted by 0.693 moles of oxygen in a 7.55 L vessel at 18°C?

This is a "now" problem.

$$PV = nRT$$

$$P = \frac{nRT}{V}$$

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$$P = \frac{(0.693 \text{ mol}) (0.0821 \text{ L}\cdot\text{atm/mol}\cdot\text{K}) (291 \text{ K})}{(7.55 \text{ L})}$$

$$P = 2.19 \text{ atm}$$

2. Carbon monoxide, a poisonous gas, has a formula of CO. How many moles of carbon monoxide occupies a volume of 0.445 L at 333 kelvins and 1.5 atm?

This is a now problem.

$$PV = nRT$$

$$\frac{PV}{RT} = n$$

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$$\frac{(1.5 \text{ atm})(0.445 \text{ L})}{(0.0821 \text{ L}\cdot\text{atm/mol}\cdot\text{K})(333 \text{ K})} = n$$

$$0.024 \text{ mol} = n$$

3. A gas filled weather balloon with a volume of 80.0 L is released at sea level at 102.0 kPa pressure and 27.0°C. The balloon expands to final volume of 835.0 L at maximum altitude, where the temperature is 0.00°C. What will be the pressure at this time?

(This is before + after)

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

Fix the units

$$27.0^\circ\text{C} + 273 = 300 \text{ K}$$

$$0^\circ\text{C} + 273 = 273 \text{ K}$$

$$\text{Fix the units}$$

$$102 \text{ kPa} \times \left(\frac{1 \text{ atm}}{101 \text{ kPa}}\right) = 1.0099 \text{ atm}$$

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

(#3 cont'd)

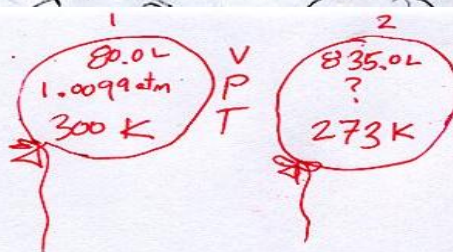
$$\frac{T_2 P_1 V_1}{V_2 T_1} = \frac{P_2 V_2}{V_2} \cdot \frac{T_2}{V_2}$$

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

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

$$\frac{(273 \text{ K})(1.0099 \text{ atm})(80.0 \text{ L})}{(835.0 \text{ L})(300 \text{ K})} = P_2$$

$$0.0880 \text{ atm} = P_2$$



4. A gas filled weather balloon contains 33.0 L of air at 10.0°C at a pressure of 745 Torr.
How many moles of gas are in the balloon? (Useful converter: 760 torr = 1.00 atm)

Fix the units

$$10.0^{\circ}\text{C} + 273 = 283\text{K}$$

and also:

$$745\text{ torr} \times \frac{1\text{ atm}}{760\text{ torr}} = 0.980\text{ atm}$$

This is the "Now" formula:

$$PV = nRT$$

rearrange:

$$\frac{PV}{RT} = n$$

$$\frac{(0.980\text{ atm})(33.0\text{ L})}{(0.0821\frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}})(283\text{ K})} = n$$

$$1.39\text{ mol} = n$$

$$125.0 \text{ kPa} \times \frac{1 \text{ atm}}{101 \text{ kPa}} = 1.2376 \text{ atm}$$

5. At what temperature would you need to have He to have 5.75 moles occupy a volume of 45.0L at a pressure of 125.0kPa?

formula

$$PV = nRT$$

$$\frac{PV}{nR} = T$$

$$\frac{(1.2376 \text{ atm})(45.0 \text{ L})}{(5.75 \text{ mol})(0.0821 \frac{\text{L atm}}{\text{mol K}})} = T$$

$$118 \text{ K} = T$$

6. Carbon monoxide, a poisonous gas, has a formula of CO. How many moles of carbon monoxide occupies a volume of 0.445 L at STP?

$$PV = nRT$$

Rearranges to

$$\frac{PV}{RT} = n$$

$$\frac{(1.00 \text{ atm})(0.445 \text{ L})}{(0.0821 \frac{\text{L atm}}{\text{mol K}})(273 \text{ K})} = n$$

$$0.0198 \text{ mol} = n$$

recall that Standard Temperature & Pressure is 0°C and 1 atm

7. What is the pressure of 25.00 moles of methane at 50.0°C if it occupies a volume of 60.0L?

$$PV = nRT$$

$$P = \frac{nRT}{V}$$

$$P = \frac{(25.00 \text{ mol})(0.0821 \frac{\text{atm L}}{\text{mol K}})(323 \text{ K})}{(60.0 \text{ L})}$$

$$P = 11.0 \text{ atm}$$

$$50^\circ \text{C} + 273 = 323 \text{ K}$$