

## GASES – PRACTICE TEST QUESTIONS & ANSWERS

- 1) A hydrocarbon contains 85.7% by mass carbon.
- Calculate the empirical formula.
  - Determine the molar mass if 1.56g of this hydrocarbon occupies 1.00L at 50.0°C and 99.7kPa.
  - Using part A and B calculate the correct molecular formula for the hydrocarbon.

Answer:

	H	C
Percentage	14.3%	85.7%
Mass(g)	14.3	85.7
Mass to moles	$\frac{14.3g}{1.008g/mol}$ = 14.186	$\frac{85.7g}{12.01g/mol}$ = 7.1357
Divide by smallest	$\frac{14.186}{7.1357}$	$\frac{7.1357}{7.1357}$

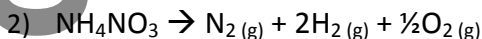
Empirical Formula = CH<sub>2</sub>

$$n = \frac{PV}{RT} = \frac{(99.7kPa)(1L)}{(8.314)(323K)} = 0.037126$$

$$\text{Molar mass} = \frac{m}{n} = \frac{1.56g}{0.037126} = 42.01 \text{ gmol}^{-1}$$

$$\text{Multiple} = \frac{\text{given}}{\text{calculated}} = \frac{42.01}{14} = 3$$

Molecular Formula: 3(CH<sub>2</sub>) = C<sub>3</sub>H<sub>6</sub>



Assuming gases behave ideally; calculate the total volume if the temperature is 300°C with a pressure of 101.3 kPa where only 12.0 g of NH<sub>4</sub>NO<sub>3</sub> decomposes.

Answer:

$$\text{Number of moles NH}_4\text{NO}_3 = \frac{\text{mass}}{\text{molar mass}} = \frac{12.0g}{80.0g/mol} = 0.15 \text{ mol}$$

$$V = \frac{nRT}{P} = \frac{(0.15)(8.314)(573K)}{101.3kPa} = 7.05 \text{ L}$$

- 3) A sample of gas is at 25°C in a 50.0 L container at 102.0 kPa. The gas is expanded to 75 L and cooled to 0°C. Calculate the new pressure.

Answer:

$$P_2 = \frac{P_1 V_1 T_2}{V_2 T_1} = \frac{(102.0kPa)(50.0L)(273K)}{(75L)(298K)} = 62.3 \text{ kPa}$$

4) Calculate the density of  $\text{Cl}_2(g)$  at 1000 kPa and 100 °C.

Answer:

$$D = \frac{P}{\frac{RT}{M}} = \frac{1000 \text{ kPa}}{\frac{(8.314)(373 \text{ K})}{(70.906 \text{ g mol}^{-1})}} = 22.9 \text{ g/L}$$

5) A

d the volume at STP.

Answer:

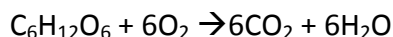
$$n = \frac{PV}{RT} = \frac{(253.3 \text{ kPa})(24.5 \text{ L})}{(8.314)(298 \text{ K})} = 2.5048$$

$$V = nV_m = (2.5048)(22.4 \text{ L}) = 56.1 \text{ L}$$

6) A su

quired to completely

oxidize the sugar via respiration?



Answer:

$$\text{Number of moles } \text{C}_6\text{H}_{12}\text{O}_6 = \frac{\text{mass}}{\text{molar mass}} = \frac{2.0 \text{ g}}{180 \text{ g mol}^{-1}} = 0.0111015$$

mol: mol

$\text{C}_6\text{H}_{12}\text{O}_6$ :  $\text{O}_2$

$$V = nV_m = (0.066609)(22.4 \text{ L}) = 1.5 \text{ L}$$

$$\frac{1}{0.0111015} : \frac{6}{x}$$

7) W

$$x = 0.066609$$

Answer:

$$P = \frac{nRT}{V} = \frac{(80)(8.314)(373 \text{ K})}{100 \text{ L}} = 2481 \text{ kPa}$$

8)  $\text{Cl}_2$  is produced electrochemically from seawater and collected in a sealed container. If a 15.0 L container holds 0.580 kg of  $\text{Cl}_2$  at 200 °C, calculate the pressure.

Answer:

$$\text{Number of moles} = \frac{\text{mass}}{\text{molar mass}} = \frac{580 \text{ g}}{70.8 \text{ g mol}^{-1}} = 8.1921$$

$$P = \frac{nRT}{V} = \frac{(8.1921)(8.314)(473 \text{ K})}{15.0 \text{ L}} = 2148 \text{ kPa}$$

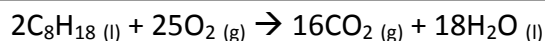
- 9) Liquid oxygen used in large rockets is prepared by cooling air at very low temperature. How many litres of oxygen are present in  $1.71 \times 10^5$  g of oxygen at  $25^\circ\text{C}$  and  $101.3\text{ kPa}$ ?

Answer:

$$\text{Number of moles} = \frac{\text{mass}}{\text{molar mass}} = \frac{1.71 \times 10^5 \text{ g}}{31.99 \text{ g mol}^{-1}} = 5343.95$$

$$V = \frac{nRT}{P} = \frac{(5343.95)(8.314)(298\text{K})}{101.3\text{kPa}} = 1.3 \times 10^5 \text{ L}$$

10) The



What volume of gasoline  $\text{C}_8\text{H}_{18}$  (Density =  $0.70\text{g/mol}$ ) must be burned in air (assume complete combustion) to produce  $20\text{ L}$  of carbon dioxide at  $25^\circ\text{C}$  and  $101.3\text{kPa}$ ?

Answer:

1. Find the number of mols of carbon dioxide using  $PV=nRT$ :

$$PV=nRT$$

$$(101.3)(20)=n(8.314)(25+273.15)$$

$$n=0.8173 \text{ mols}$$

2. Do a mol to mol ratio with carbon dioxide to gasoline:

$$x/2=0.8173/16$$

$$x=0.1021 \text{ mols}$$

3. Use  $PV=nRT$  to calculate the volume:

$$PV=nRT$$

$$(101.3)V=(0.1021)(8.314)(25+273.15)$$

$$V=2.498 \text{ L}$$

Therefore, the volume of gasoline required is  $2.5$  liters.