GASES – PRACTICE TEST QUESTIONS & ANSWERS

1) A hydrocarbon contains 85.7% by mass carbon.
   a) Calculate the empirical formula.
   b) Determine the molar mass if 1.56g of this hydrocarbon occupies 1.00L at 50.0°C and 99.7kPa.
   c) 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	$\frac{14.3g}{1.008gmol}$ = 14.186	$\frac{85.7g}{12.01gmol}$ = 7.1357
Divide by smallest	$\frac{14.186}{7.1357}$	$\frac{7.1357}{7.1357}$

Empirical Formula = CH_2

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

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

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

Molecular Formula: $3(CH_2)$ = C_3H_6

2) $NH_4NO_3 \rightarrow N_{2\,(g)} + 2H_{2\,(g)} + ½O_{2\,(g)}$

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_4NO_3 decomposes.

Answer:

Number of moles NH_4NO_3 = $\frac{mass}{molar\ mass}$ = $\frac{12.0g}{80.0gmol^{-1}}$ = 0.15mol

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

$P_2 = \frac{P_1V_1T_2}{V_2T_1} = \frac{(102.0kPa)(50.0L)(273K)}{(75L)(298K)}$ = 62.3 kPa

4) Calculate the density of $Cl_{2\,(g)}$ at 1000 kPa and 100 °C.

Answer:

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

5) A ... d the volume at STP.

Answer:

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

V = $nVm = (2.5048)(22.4L) = 56.1L$

6) A su ... uired to completely oxidize the sugar via respiration?

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$$

Answer:

Number of moles $C_6H_{12}O_6$ = $\frac{mass}{molar\ mass} = \frac{2.0g}{180\ g mol^{-1}}$ = 0.0111015

mol: mol

$C_6H_{12}O_6$: O_2

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

x = 0.066609

V = $nVm = (0.066609)(22.4L) = 1.5L$

7) W

Answer:

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

8) Cl_2 is produced electrochemically from seawater and collected in a sealed container. If a 15.0 L container holds 0.580 kg of Cl_2 at 200 °C, calculate the pressure.

Answer:

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

P = $\frac{nRT}{V} = \frac{(8.1921)(8.314)(473K)}{15.0L}$ = 2148 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 $1.71x10^5$ g of oxygen at 25 °C and 101.3 kPa?

Answer:

Number of moles = $\frac{mass}{molar\ mass}$ = $\frac{1.71x10^5 g}{31.99 g\ mol^{-1}}$ = 5343.95

V = $\frac{nRT}{P}$ = $\frac{(5343.95)(8.314)(298K)}{101.3kPa}$ = $1.3x10^5$ L

10) Th

$$2C_8H_{18\ (l)} + 25O_{2\ (g)} \rightarrow 16CO_{2\ (g)} + 18H_2O_{\ (l)}$$

What volume of gasoline C_8H_{18} (Density = 0.70g/mol) must be burned in air (assume complete combustion) to produce 20 L of carbon dioxide at 25°C and 101.3kPa?

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 mols

2. Do a mol to mol ratio with carbon dioxide to gasoline:
x/2= 0.8173/16
x= 0.1021 mols

3. Use PV=nRT to calculate the volume:
PV=nRT
(101.3)V=(0.1021)(8.314)(25+273.15)
V= 2.498 L
Therefore, the volume of gasoline required is 2.5 liters.