Physical Chemistry-Properties of Gases

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1st Exam-paper A

(50 degrees)

Q1: Circle the right answer for all of the following:

1: A vessel of 100 L capacity contains a certain amount of gas at 50 °C and 0.5 bar pressure. The gas is transferred to another vessel has a pressure of 5 bar at 50 °C. What should be the volume of the vessel?

<u>Answer:</u>   a) 10 bar   b) 10 dm³   c) 0.1 dm³   d) 0.1 bar

2: What is the right formula of the Graham's law of effusion?

<u>Answer:</u> a) $\frac{r_1}{t_2} = (\frac{r_2}{M_1})^{\frac{1}{2}}$ b) $\frac{r_1}{r_2} = (\frac{M_1}{M_2})^{\frac{1}{2}}$ c) $\frac{d_1}{d_2} = (\frac{M_2}{M_1})^{\frac{1}{2}}$ d) $\frac{r_1}{r_2} = (\frac{d_2}{M_1})^{\frac{1}{2}}$

3: Calculate Z for a gas if T is 22 °C, V_m is 5 dm³ mol⁻¹ and p is 3 bar.

<u>Answer:</u>   a) 0.62 °C   b) 6.2 K   c) 0.62   d) 6.2

4: Calculate the molar mass of O_2 (16 g.mol⁻¹) in a 4 L cylinder at 9 atm and 281 K.

<u>Answer:</u>   a) 32 g.mol⁻¹   b) 32 g   c) 50 g.mol⁻¹   d) 50 g

5: Calculate the $V°_m$ of a gas, if p is 1 atm and temperature is 32 °C.

<u>Answer:</u>   a) 25 K   b) 25 atm   c) 25 L mol⁻¹   d) 25 mol

6: If the attraction forces are negligible, that means the gas is?

<u>Answer:</u>   a) real   b) noble   c) perfect   d) expands

7: According to the Dalton's law the unit of the mole fraction is?

<u>Answer:</u>   a) mol   b) dm³   c) psi   d) free of units

8: What is the partial pressure of a gas in a mixture if the X_i is 0.1, and under atmospheric pressure?

<u>Answer:</u>   a) 760 mmHg   b) 10 bar   c) 0.1 atm   d) 1 bar

9: If the value of R is 0.082 then the unit of pressure is?

<u>Answer:</u>   a) Pascal   b) mmHg   c) Psi   d) bar

10: What is the right equation of one of the following?

<u>Answer:</u>   a) $p_r p_c = p$ b) $p_r p = p_c$ c) $p_r / p_c = p$ d) $p_r = p_c p$

Q2: Calculate the mass of 335 mL of sulfur dioxide (64 g mol⁻¹) measured at 37 °C and 745 mm Hg pressure.?

(25 degrees)

Q3: Calculate the volume of 0.25 g of oxygen at 25 °C and 742 mm Hg pressure.

(25 degrees)

Wed_20/01/2021   Best wishes   Dr Abduljabbar I. R. Rushdi

Q2

$V = \dfrac{335 \, ml}{1000} = 0.335 \, L$, $m.t = 64$, $T = 37 + 273 = 310 \, K$

$P = \dfrac{745}{760} = 0.988 \, atm$

$PV = nRT$

$n = \dfrac{PV}{RT} = \dfrac{0.988 * 0.335 \, L \, atm}{0.082 \, L.atm/mol.K * 310 \, K}$

$= \dfrac{0.330}{25.42 \, ?}$

$n = 0.012 \, mol \longrightarrow n = \dfrac{m}{m.t}$ $\quad \dfrac{15}{25}$ Q_2

$0.012 \; \dfrac{mol}{\cancel{}} \times \dfrac{m}{64 \; \dfrac{g}{mol}} \longrightarrow m = \boxed{0.768} \; g$

$\cancel{g*mol} \quad \cancel{g/mol}$ 0.833

$\boxed{Q_3 \, \dfrac{10}{25}}$

Q3

$PV = \dfrac{m}{m.t} RT$

$0.976 \, atm * V = \dfrac{0.25 \, g}{\boxed{16 \, g/mol} \; 32} * 0.082 * 289 \, K \quad P = \dfrac{742}{760}$
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad L.atm/mol.K \qquad = 0.976$

$0.976 * V = 0.015 * 23.698 \, ?$ $T = 25 + 273$
$\qquad\qquad\qquad 24.43 \, L \qquad\qquad = 298 \, ?$

$0.976 * V = 0.355$ $? = \text{vint}$

$V = \dfrac{0.355}{0.976} \longrightarrow V = 0.363 \, L$