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Special Online Speed Test

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ), 2023 අගෝස්තු

General Certificate Of Education (Adv. Level) Examination, August 2023

රසායන විද්‍යාව I Chemistry I	02	S/E	I

Universal gas constant $R = 8.314\ J\ K^{-1}\ mol^{-1}$ Plank's constant $h = 6.626\times10^{-34} J\ s$

Avogadro constant $N_A = 6.022\times10^{23}\ mol^{-1}$ Velocity of light $c = 3\times10^{8} m\ s^{-1}$

Gas Laws Past/term Test paper Discussion 01

1. **2011 A/L**

At a temperature of 300 K and at a pressure of 1.0×10^5 Pa, a sample of oxygen gas weighing 3.2 g exists in a rigid vessel of volume **V**. Another rigid vessel of volume **V** which has been fully evacuated is connected to this vessel, allowing the gas to spread in both vessels. The temperature of the combined vessels is then raised to 400 **K.** At the same temperature, gas **X** is then introduced into the combined vessels, until the pressure is raised to 2.0×10^5 Pa. If the mass of the gas **X** required for the purpose is 8.8 g, calculate the relative molar mass of **X**. Assume that both these gases behave ideally and that they do not react with each other. (O = 16).

(3.0 *marks*)

2. **2012 A/L**

a. At pressure P and temperature T, a mixture of O_2 (g) and O_3(g) exists at equilibrium in a closed rigid container of volume V.

(i) Express the density of the gas mixture (d), in terms of n_1, n_2, M_1, M_2 and V, where

n_1 = number of moles of O_2 n_2= number of moles of O_3

M_1 = molar mass of O_2 M_2 = molar mas of O_3

(ii) Express the above relationship in terms of X_1, X_2, M_1, M_2, V and n, where,

X_1 = mole fraction of O_2 X_2 = mole fraction of O_3

n = total number of moles of both gases

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(iii) Hence show that, $X_1 = \left(3 - \frac{dRT}{16P}\right)$

where R is the universal gas constant. (relative atomic mass of O = 16)

3. 2010 A/L

At 300 K and at 3.0×10^5 N m^{-2}, gas **A** exists in a vessel with a volume of 2.0 m^3. At 300 K and at 5.0×10^5 N m^{-2}, gas **B** exists in a vessel with a volume of 3.0 m^3. The vessels are connected allowing the two gases to mix completely. During the mixing, no chemical reactions occur. Further, the temperature and the total volume of the two gases remain unchanged. Assuming the ideal gas behaviour, calculate the following:

I. the total pressure in the connected vessels

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II. the mole fractions of gas **B** in the mixture

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III. the partial pressure of gas **B** in the connected vessels when the temperature of the gas mixture is increased to 350 K maintaining the total volume of the two vessels the same

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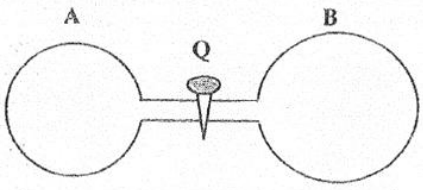
4. Devi Balika Vidyalaya – 2014 July



A and **B** in the diagram above are two rigid, closed vessels. Volume of the vessel **A** is 800 cm^3 and it contains 6.4 g of O_2 gas and 2.4 g of He gas. Vessel **B** contains 4 g of H_2 gas under 4.157×10^6 Nm^{-2} pressure.
A and **B** are connected by a narrow tube with the tap **Q** which is closed at the start. The initial temperature of the system is 27^0 c.
(O = 16, He = 4, H = 1)

(i) Calculate the mole fraction of He in vessel **A**.

(ii) What is the total pressure of the gas mixture in vessel **A** ?

(iii) Calculate the partial pressure of O_2 in vessel **A**.

(iv) Calculate the volume of vessel **B**.

(v) Tap **Q** between **A** and **B** was opened and let the gases mix with each other. If the temperature of the system is maintained at 27^0 c, what is total pressure of the gas mixture in the compound vessel ?

(vi) When the temperature of the compound vessel is increased by 100^0c, calculate the partial pressure of the He gas.

(vii) If any assumptions you made in the calculations above, state clearly.