

## Questions

MathonGo

## Q1 - 25 July - Shift 1

The pressure of a moist gas at  $27^{\circ}\text{C}$  is 4 atm. The volume of the container is doubled at the same temperature. The new pressure of the moist gas is  $\dots \times 10^{-1}$  atm. (Nearest integer)  
(Given : The vapour pressure of water at  $27^{\circ}\text{C}$  is 0.4 atm)

*Space for your notes:*

## Q2 - 25 July - Shift 2

A sealed flask with a capacity of  $2 \text{ dm}^3$  contains 11 g of propane gas. The flask is so weak that it will burst if the pressure becomes 2 MPa. The minimum temperature at which the flask will burst is \_\_\_\_\_  $^{\circ}\text{C}$ . [Nearest integer]  
(Given:  $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$ . Atomic masses of C and H are 12u and 1u respectively.) (Assume that propane behaves as an ideal gas.)

*Space for your notes:*

## Q3 - 25 July - Shift 2

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A sample of 4.5 mg of an unknown monohydric alcohol, R-OH was added to methylmagnesium iodide. A gas is evolved and is collected and its volume measured to be 3.1 mL. The molecular weight of the unknown alcohol is \_\_\_\_\_ g/mol.

[Nearest integer]

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**Q4 - 26 July - Shift 1**

A mixture of hydrogen and oxygen contains 40% hydrogen by mass when the pressure is 2.2 bar. The partial pressure of hydrogen is bar.

(Nearest Integer)

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**Q5 - 26 July - Shift 2**

A 10 g mixture of hydrogen and helium is contained in a vessel of capacity  $0.0125 \text{ m}^3$  at 6 bar and  $27^\circ\text{C}$ . The mass of helium in the mixture is \_\_\_\_\_ g. (nearest integer)

Given :  $R = 8.3 \text{ JK}^{-1}\text{mol}^{-1}$  (Atomic masses of H and He are 1u and 4u, respectively)

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**Q6 - 27 July - Shift 1**

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## Questions

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Given below are two statements. One is labelled as **Assertion A** and the other is labelled as **Reason R**.

**Assertion A** : Activated charcoal adsorbs  $\text{SO}_2$  more efficiently than  $\text{CH}_4$ .

**Reason R** : Gases with lower critical temperatures are readily adsorbed by activated charcoal.

In the light of the above statements, choose the correct answer from the options given below.

(A) Both **A** and **R** are correct and **R** is the correct explanation of **A**.

(B) Both **A** and **R** are correct but **R** is NOT the correct explanation of **A**.

(C) **A** is correct but **R** is not correct.

(D) **A** is not correct but **R** is correct.

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**Q7 - 27 July - Shift 2**

for a real gas at  $25^\circ\text{C}$  temperature and high pressure (99 bar) the value of compressibility factor is 2, so the value of Vander Waal's constant

'b' should be \_\_\_\_\_  $\times 10^{-2}$  L mol $^{-1}$  (Nearest integer) (Given  $R = 0.083$  L bar K $^{-1}$  mol $^{-1}$ )

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### Answer Key

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Q1 (22)

Q2 (1655)

Q3 (33)

Q4 (2)

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Q5 (8)

Q6 (C)

Q7 (25)

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Q1 (22)

$$[P_{\text{gas}}]_0 + \text{V.P.} = 4$$

$$[P_{\text{gas}}]_0 = 4 - 0.4 = 3.6$$

As volume is doubled,  $[P_{\text{gas}}]_{\text{new}} = 1.8 \text{ atm}$

New Total Pressure =  $1.8 + 0.4 = 2.2 \text{ atm}$

Q2 (1655)

$$\text{Moles of } C_3H_8 = \frac{11}{44} = 0.25 \text{ moles}$$

$$PV = nRT$$

$$\Rightarrow 2 \times 10^6 \times 2 \times 10^{-3} = 0.25 \times 8.3 \times T$$

$$\Rightarrow T = 1927.710 \text{ K} = 1654.56^\circ\text{C}$$

Q3 (33)



moles of  $\text{CH}_4 = \text{moles of ROH}$

$$\Rightarrow \frac{V}{22400} = \frac{m}{\text{M.M}} \quad (\text{Assuming NTP Condition})$$

$$\Rightarrow \frac{3.1}{22400} = \frac{4.5 \times 10^{-3}}{\text{M.M}}$$

$$\Rightarrow \text{MM} = 32.51$$

Nearest Integer = 33

Q4 (2)

$$\text{Let } W_{\text{H}_2} = 40 \text{ g} \Rightarrow n_{\text{H}_2} = \frac{40}{2} = 20$$

$$W_{\text{O}_2} = 60 \text{ g} \Rightarrow n_{\text{O}_2} = \frac{60}{32} = \frac{15}{8}$$

$$P_{\text{H}_2} = \left( \frac{20}{20 + \frac{15}{8}} \right) \times 2.2$$

$$= \frac{20}{20 + 1.875} \times 2.2$$

$$= \frac{20}{21.875} \times 2.2$$

$$= 2.0114$$

$$\approx 2.01 \text{ bar}$$

Q5 (8)

$$PV = n_{\text{mix}}RT$$

$$n_{\text{mix}} = \frac{6 \times 12.5}{0.083 \times 300} \approx 3$$

Let mole of He = x

Mole of H<sub>2</sub> = 3 - x

$$4x + 2(3 - x) = 10$$

$$x = 2\text{mol}$$

Mass of He = 8g

**Q6 (C)**  
SO<sub>2</sub> is absorbed to a greater extent than CH<sub>4</sub> on activated charcoal under same conditions.

Gases with **higher critical temperature** are readily absorbed by activated charcoal.

**Q7 (25)**

For real gas under high pressure

$$Z = 1 + \frac{Pb}{RT} \Rightarrow b = \frac{RT}{P}$$

$$= \frac{0.083 \times 298}{99}$$

$$= 0.25 \times 10^{-2} \text{ L mol}^{-1}$$

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